3. Project Justification and Alternatives

This section provides details of the proposed Wallarah 2 Coal Project and an assessment of the justification and alternatives of the project as described.

3.1 World Reliance on Coal

Coal has been used for centuries throughout the world and has become an important commodity in developed and developing nations. Many societies have emerged with a heavy reliance on the resource, and invested substantially in coal-dependant industries such as electricity generation, steel and cement production.

The heavy reliance on coal has developed for the following reasons:

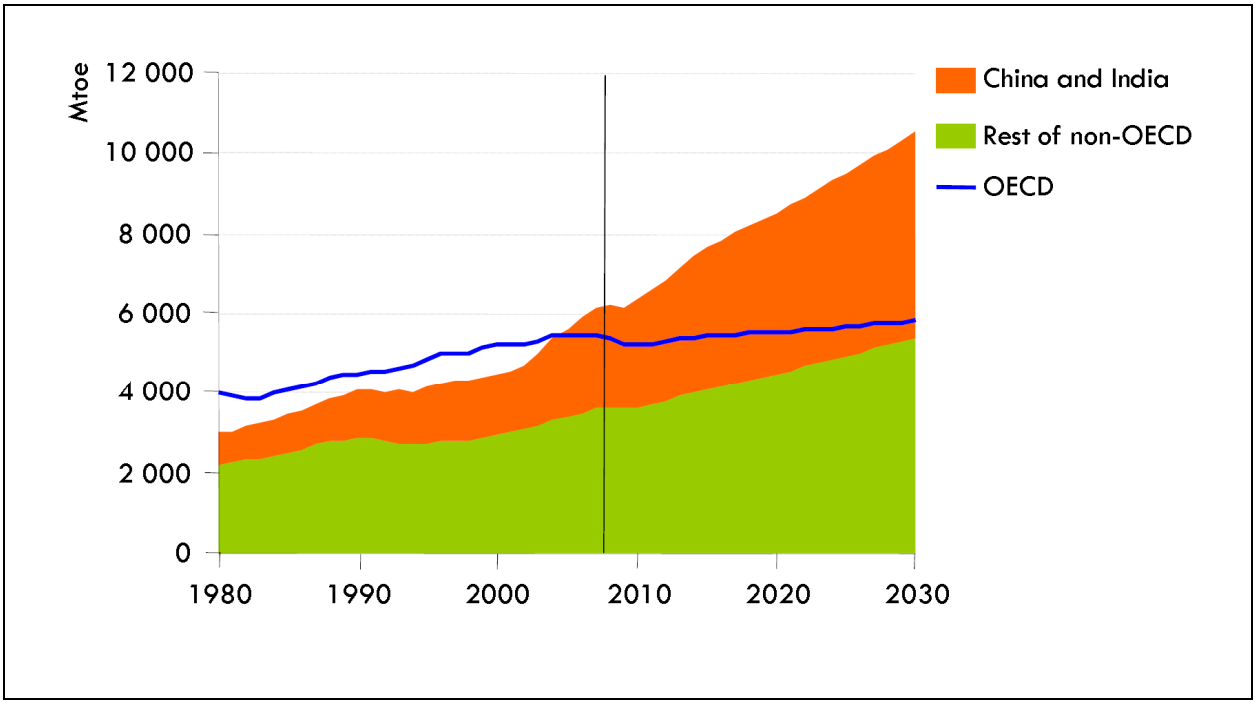
- Safety - coal is relatively stable and hence the safest fossil fuel to transport, store and use;
- Security - abundant reserves mean that coal supplies for both domestic and industrial users are guaranteed at competitive prices, allowing associated industries to rely on ongoing supply of coal resources, facilitating expenditure and investment through the economy;
- Flexibility – coal is used as a fuel for power generation, cement manufacture, a source of carbon for metallurgical applications and many organic chemicals, including tars and feedstocks for making various plastics, can be prepared from the by-products of coke; and
- Cost-effectiveness - globally, coal is the most competitive fuel for the generation of electricity.

The world today has a more diversified energy economy with each primary energy source being used where it is most suited. However, coal still contributes about 24 per cent of global primary energy demand, second only to oil (35 per cent), and is used to produce over 40% per cent of the world's electricity. Around 543 million tonnes of coking coal and pulverised coal injection (PCI) coals (14 per cent of total global hard coal production) are used to produce over 66 per cent of the steel produced in the world.

Rapid world population growth and economic development, particularly in developing countries, is resulting in phenomenal growth in energy demand throughout the world. If we are to meet the aspirations for improved living standards for many of the world's people, approximately 1.5 billion of whom currently have no access to electricity, the availability of coal will have a major influence as to whether demand can be met for at least the foreseeable future.

Access to energy remains a critical development need, particularly for the one-third of the world’s population without electricity. Given the projected strong growth in global demand and the importance of supply security, coal will continue to be an essential part of the world’s energy and industrial materials in the foreseeable future.

Figure 3.1 shows the rapid increase in world primary energy use is predicted by the International Energy Agency (IEA) to continue to at least 2030. In recent years, Non-OECD countries (typically developing countries) have overtaken the OECD countries in terms of total energy use. Non-OECD countries will account for 93% of the increase in global demand between 2007 and 2030, driven largely by China and India.



Source: IEA World Energy Outlook 2009 *(Mtoe = million tonnes oil equivalent)*

Figure 3.1 World Primary Energy Demand (Reference Case)

IEA's World Energy Outlook 2009 predicts that by 2030, in the reference scenario which assumes similar energy policies among governments as currently exists, the world energy demand will be 47% higher than in 2007.

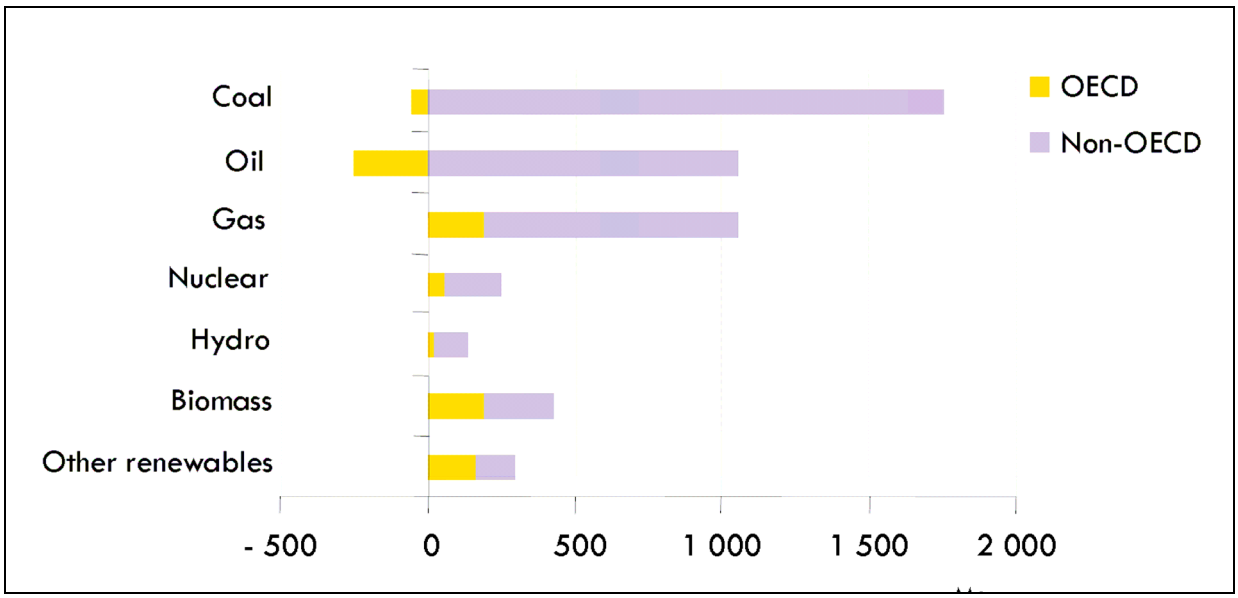
IEA expects that electricity demand will grow by an even greater amount. It predicts a rise in electricity demand to 2030 by 77% over 2007 levels, requiring 4,800 Gigawatts (GW) of capacity additions which is around 100 times the entire grid-connected electricity generating capacity currently in Australia (48.5 GW). This equates to adding Australia's entire electricity system less than every four months for over thirty years.

Coal will remain the dominant fuel of the power sector, its share of global power generation mix rising by 2 percentage points to 44% in 2030. Higher fossil fuel prices, as well as increasing concerns over energy security and climate change, will boost the share of renewables-based electricity generation from 18% to 22% in 2030.

Even with this increased energy production, about 1.3 billion people will still lack access to electricity in 2030 compared to 1.5 billion now, largely due to ever-increasing world population, especially in Africa.

Figure 3.2 shows which fuels are predicted by the IEA to be used in meeting energy demands in OECD and Non-OECD countries in the period to 2030. This

confirms the increased role of coal in future energy scenarios, particularly in developing countries. Under the Reference Scenario, coal and other fossil fuels will account for 77% of the increase in world primary energy demand in the period 2007 – 2030.



Source: IEA World Energy Outlook 2009 *(Reference Case)*

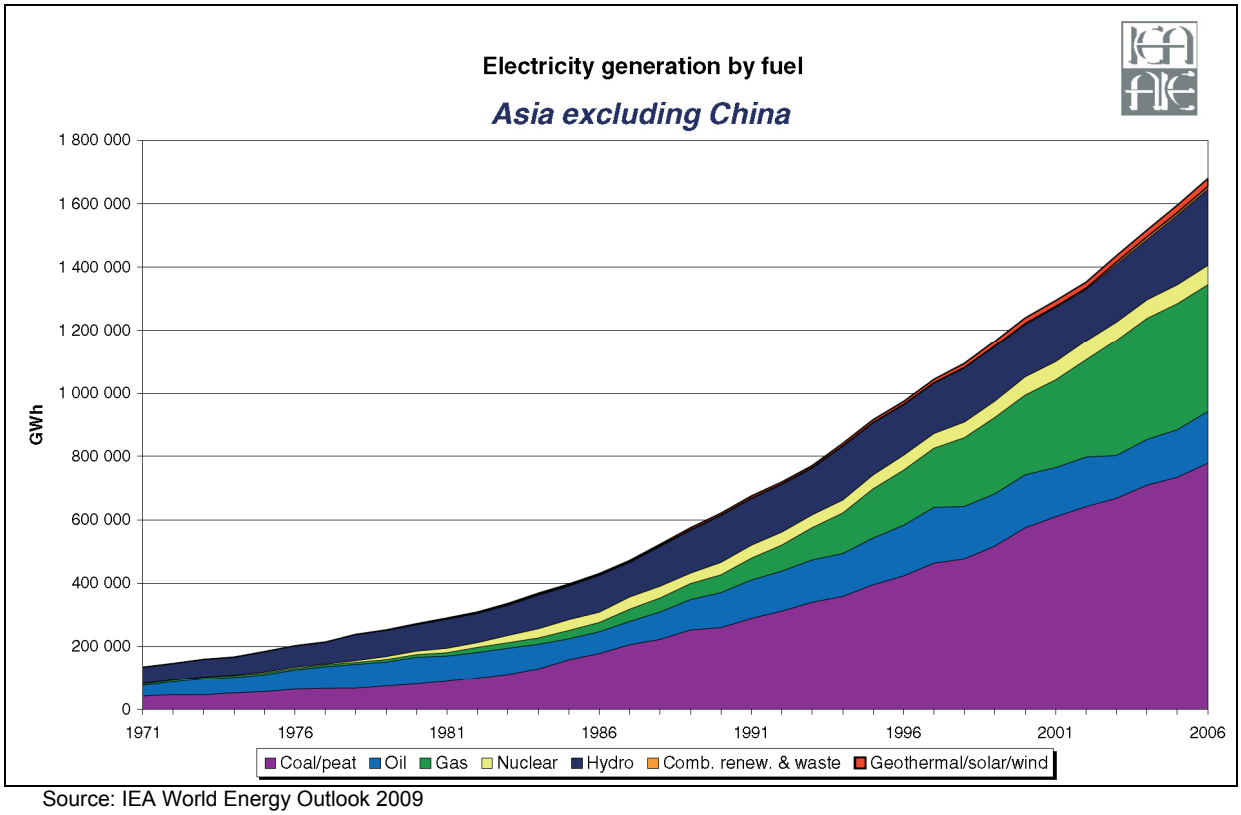
Figure 3.2 Change in Primary Energy Demand 2007 – 2030

3.2 Coal Use for Energy in Asia

Over the last two decades, Asian energy demand has increased on average by 4.5 per cent per annum compared with 1 per cent growth in North America and Europe. The increase in the consumption of coal in Asia has been even more rapid, averaging in excess of 5 per cent per annum over the past 10 years.

Figure 3.3 indicates that, even without China, the growth of electricity generation in Asia and coal use in particular has been dramatic in recent decades.

Coal is the most readily available indigenous fossil fuel in the region. There is no practicable alternative to coal for the generation of the additional electricity required by most developing countries for economic growth and an increased standard of living, in the foreseeable future. As described above, major international energy authorities agree that coal will continue to be a major part of the world's energy mix for decades to come. It will be used as fuel in existing power stations and in future ultra-supercritical (USC) and integrated gasification combined cycle (IGCC) power stations.



Source: IEA World Energy Outlook 2009

Figure 3.3 Electricity Generation in Asia 1971–2006 (excluding China)

High levels of energy, electricity and coal consumption growth in Asia are predicted to continue according to the IEA in its 2009 World Energy Outlook released in November 2009.

China is the world's largest coal producer (more than 10 times greater than Australia's entire coal exports) and it will continue to expand its massive domestic coal production for both energy and steel-making purposes. China, like other countries in Asia, will continue to diversity its energy mix. However, China has been only a minor coal importer to date.

The four largest net coal importers in the world are (2008 IEA data):

- Japan – 186 Mt;
- Korea – 100 Mt;
- Chinese Taipei (Taiwan) – 66 Mt; and
- India – 58 Mt.

Following these, in order, were European countries: Germany (46 Mt), United Kingdom (43 Mt), Italy (25 Mt) and France (21 Mt).

Australia provides substantial exports to the abovementioned countries for meeting both their electricity generation and steel-making requirements, with exports to Korea increasing significantly over the past two decades. In recent years, Korea imports around 27 million tonnes of coal from Australia every year, and 17 m tonnes from Indonesia. It already has made significant investment in coal mining operations and communities in Australia as part of establishing long term trade links for energy supply.

3.3 Australian Coal Industry

While coal is widely recognised within Australia for providing consumers with an affordable and efficient means of generating electricity (when compared to other forms of generating electricity such as solar, wind etc), coal underpins the international competitiveness and performance of the entire Australian economy.

Mining of black coal is one of Australia's most important industries, creating significant employment in regional Australia, fuel for low-cost electricity generation, cement manufacture and steel-making as well as significant export income.

Australia has large reserves of coal and produces some of the best quality coal in the world in an efficient and environmentally sound manner. Australia has exported coal since 1798.

While Australia is the largest exporter of coal in the world and the world's fourth largest producer, Australia produces only 5.5% of the world's black coal and its exports are equivalent to less than 4.3% of the world's production.

In national terms, coal is Australia's most important commodity for domestic use and international trade. Black coal is Australia's largest merchandise export and in 2008 - 2009 coal delivered around A$55 billion in export revenues and an estimated A$4 billion in state royalties and taxes. The outstanding trade value for coal in that year comprised 125 Mt of coking coal valued at A$36.7 billion and 136 Mt of thermal coal valued at A$17.9 billion.

The 2008 - 2009 coal trade values were well above the trend as shown by 2007 - 2008 figures which saw 252 million tonnes exported that were worth over $A24 billion. ABARE has forecast that in 2009 - 2010 the level of exports will remain about the same, but with a value returning to more like the 2007-08 level at $28.4 billion.

The New South Wales coal industry produced 170.3 million tonnes in 2006-07 which provided a value of coal production of $A8.1 billion, with $A6.2 billion worth of coal (91.5 million tonnes) being exported, mainly through the port of Newcastle.

Coal was exported to 37 countries from Australia in 2008. Main destinations (and share of exports) were:

- Japan (45%);
- Korea (15%);
- European Union (11%);
- Taiwan (10%);
- India (9%);and
- South America (5%).

According to a multi-disciplinary study released by the University of Queensland in November 2009 and entitled *Coal and the Commonwealth*, coal has shaped Australia's history and is essential to its prosperity, creating around 20 per cent of the nation's mineral wealth, 81 per cent of its electricity nationally (around 95% in NSW) and the largest coal export platform in the world. The study analysed the historical, social and economic contribution of Australia's coal and outlines the importance of Australia's leadership in advancing carbon technologies.

The Australian coal industry employs over 32,000 people and indirectly creates an additional 126,000 jobs in Queensland and New South Wales. As a result of coal production in 2008-2009, household disposable income grew by nearly 7 per cent in Queensland and 6 per cent in New South Wales.

In 2007 coal's contribution to Australia's net Greenhouse Gas Emissions was 37%, or around half of the emissions from the Energy and Industrial Processes sectors. Oil, natural gas and other fuels together also contributed 37%. Other sectors contributions were: Agriculture 15% (70 % livestock related), Land Use, Land Use Change and Forestry 7 %, and Waste 3 %.

Coal's contribution to net Greenhouse Gas Emissions across all sectors comprised:

- Electricity Generation – 30.2%;
- Fugitive emissions from coal mining – 4.5 %; and
- Manufacturing, Transport and other – 2.2 %.

In 2009, Australia led the creation of the Global Carbon Capture and Storage Institute which has a mandate to facilitate development of 20 integrated, industrial-scale carbon capture and storage demonstration projects worldwide by 2020. The Australian Government is hosting the Institute and is providing A$100 million annually to fund the effort while other countries are also major contributors such as Korea.

The Institute has received strong international support with 16 national governments, five Australian States and more than 40 major companies in the coal, oil and gas, electricity, technology, finance and research sectors signing on as foundation members and collaborating participants.

In addition to Australia, national government members include: Abu Dhabi, Canada, the European Commission, France, Germany, Indonesia, Italy, Japan, Mexico, Netherlands, New Zealand, Norway, Papua New Guinea, South Africa, Korea, the United Kingdom and the United States. The government of China is a collaborating participant.

Carbon capture and storage (CCS) is globally recognised as an essential technology for meeting low emission coal targets. Australia is a global leader in developing clean coal technologies and is advancing solutions to address concerns about climate. Investments in research recently surpassed A$250 million, while 12 CCS demonstration programs in the country are valued in excess of A$1 billion.

One world-class research trial by Delta Electricity is located in the Wyong Shire at Munmorah Power Station which is undertaking drilling and investigations for its pilot program of carbon capture and storage.

The world will continue to rely on coal for electricity generation, with coal forecast to continue to fuel a significant portion of the world's power generation, as described above. China and India will lead this growth. Provided that appropriate policy settings are in place, Australia will be well placed to competitively supply coal products to meet the demands for electricity generation in the Asian region.

3.4 The Wyong Coal Resource

The location of the W2CP is primarily defined by the location of the Wyong coal resource. The suitability of the site is also consistent with the importance placed on resource extraction in the 2008 Central Coast Regional Strategy.

The W2CP coal is an attractive coal to overseas and domestic power station operators and has the following features:

- low moisture;
- high energy;
- low sulphur;
- medium to high volatile matter;
- low nitrogen; and
- benign ash chemistry.

Major features of the coal compared to other coals from the Newcastle and Hunter coalfields are the low moisture, low sulphur and low nitrogen contents.

The coal resource in the western area is in excess of 700 million tonnes with over 1.2 billion tonnes of coal resources identified within the entire Exploration Licences held by the Wyong Areas Coal Joint Venture. The resource was originally drilled by the then Department of Mineral Resources and was recognised by the NSW State Government as a major state resource since the early 1970's. This recognition culminated in the NSW State Government releasing a tender for the right to explore the deposit in 1995.

3.5 Coal Alternatives – Other Energy Sources

Each of Australia's states and territories, together with developed nations overseas such as Korea, rely very heavily on coal fired power generation to service an electricity dependent society.

For the foreseeable future, there will be a need to maintain production from existing coal mines and ensure the development of new mines such as W2CP to feed the future growth in electricity demand. While alternative sources of energy and electricity generation will be developed in addition to coal-fuelled types, these will form part of an orderly portfolio approach to meet future energy needs. However, if an alternative energy fuel source was highly viable and able to contribute dramatically to the portfolio of future energy systems, it could potentially be able to gradually reduce the need for new mines and eventually replace existing coal fired power stations. However, according to national and international expert agencies such as IEA, this is currently not the case.

Other potential fuel sources are discussed in the following sections. This discussion is relevant to any thermal coal development both in Australia and overseas. Since a proportion of the coal from W2CP is likely to be used in local power stations on the Central Coast, the discussion of alternatives is relevant. The discussion centres on steaming coal rather than alternatives for steel and cement manufacture which utilise different types of coal.

3.5.1 Solar Energy

Photovoltaic - Australian researchers are world leaders in several aspects of solar energy research and development. However, at present, electricity

generation using photovoltaic cells would cost at least five times as much as electricity supplied from coal fired power stations. A solar plant of sufficient size and with adequate backup facilities to meet the needs of society would be very costly, both in terms of materials and land requirements, and would not be without greenhouse, environmental and social impacts.

The conversion of solar energy to electrical energy is only possible during the daytime and under fine conditions. High electricity demand in the State occurs during winter evenings when there is no sunlight for solar plant to convert to electricity. Thus if a photovoltaic installation were to be established, another electricity supply augmentation, such as coal fired power stations, would still be required to ensure that an adequate supply of electricity could be maintained during periods when the solar generation was not available.

It is possible, due to further technological advance and cost reductions, that local photovoltaic generation will begin to be employed to reduce daytime loads within ten years. However, this will not remove the need for traditional coal fired power stations, particularly for base load generation.

Solar Thermal - As well as the conversion of solar energy into electrical energy, the technology of conversion from solar to heat energy is well advanced, particularly for specific applications such as solar hot water heating, heating and cooling of buildings and some low temperature industrial applications. Similarly to the above, solar thermal, being dependent on the sun, cannot currently alleviate existing supply limitations without costly backup systems.

Advances have been recently made in the storage of solar thermal energy in various media such as molten salt, rock, steam or oil. These systems allow the storage of energy, although at only modest efficiencies, for up to several days enabling the generation of electricity in peak demand periods. This research provides for many future opportunities both in Australia and overseas countries.

3.5.2 Wind Energy

The generation of electricity by wind is dependent on prevailing weather conditions and is generally restricted to locations of high and frequent winds. Although wind can contribute to the total available generation on a National Grid, as for solar power an alternative supply system would still be necessary to cover periods when generation from local wind sources was not adequate. A large number of wind generators would be required to adequately meet power consumption requirements even in a small region.

They would cover a substantial area of high exposed ground in order to capture sufficient wind energy and are currently costly to build and maintain. Accordingly, whilst this potential fuel source may reduce the consumption of fossil fuel elsewhere, the disadvantages of wind power generation are the significant capital costs, different environmental impacts, visual impacts, limited operating parameters, and logistical difficulties in relation to positioning of the generators.

Much of the growth in wind energy is in European countries such as Holland, Denmark, the United Kingdom, Spain and Germany. Denmark, for example, currently obtains about 20 per cent of its electricity from wind turbines and aims to increase this to 35 per cent by 2015. This is related to specific domestic energy policies and energy pricing circumstances. Interest in wind power is also growing in countries such as Korea, India and China, and Australia is paying increasing attention to the concept.

3.5.3 Combustion Turbines

Combustion turbines are suited to support the system for emergency conditions during interruptions to transmitted supply.

It is possible to install local gas or diesel fired combustion turbines at any environmentally acceptable location to support the voltage and/or meet regular peak loads. While the capital cost of such installations is modest compared to the capital cost of coal fired generation, the cost of their operation is high because of the high cost of natural gas or distillate fuel compared with coal. They are not an economical means of meeting the normal daily load although they do have a place in meeting peak and shoulder loads.

3.5.4 Biomass

Biomass is matter derived from biological sources such as - plants and animals and the wastes that result from their growth, processing or disposal. These wastes are then used as fuel for the generation of electricity. A typical example of potentially viable biomass-based power generation is the use of bagasse (a sugar industry waste product) for electricity and steam production combined with the use of gas produced from waste disposal sites. With the right combination of factors, which include close proximity to a site generating biomass (paper mill, forest plantation, sugar mill, central city waste depot), this form of electricity generation can provide useful source of electricity. The main advantage of this form of generation is that it is available 24 hours per day 7 days per week and it not directly reliant on other climatic factors such as wind or solar radiation.

There may be some potential to generate this form of electricity at the Buttonderry Waste Disposal facility owned by Wyong Shire Council, however that facility is planning to focus on utilising waste landfill gas as a potential fuel source for greenhouse management and potential small scale electricity generation on site. The W2CP has held preliminary discussion with Council regarding the potential to explore the opportunity for co-ordination of its and the W2CP's methane gas management programs.

Even if local small scale electricity generation from these waste gas resources was developed in the future to provide a useful addition to the local supply grid, it would not effectively replace generating capacity at any of the local coal-fired power stations.

Similarly, it would not obviate or otherwise replace the power requirements of any location outside the region.

3.5.5 Nuclear Power

In NSW, government authorities are currently prohibited from developing nuclear generated power supplies under the *Uranium Mining and Nuclear (Prohibition) Act,* 1986 (page 2, Section 9). Nuclear Power remains a highly controversial option that is met with fierce community opposition, far greater than that faced by coal mining developments such as the proposed W2CP.

Many overseas countries are developing nuclear power stations and some see this as the only real alternative to coal, oil or gas fired power stations. Korea became a member of the International Atomic Energy Agency in 1957 with the first nuclear power plant being commissioned in 1977. A further eight were constructed in the 1980's with the current number of nuclear reactors in operation

at 20. A further eight are planned in the next 10 years. Korea plans to satisfy about 60% of electricity demands from nuclear by 2035. Fuel for these nuclear power stations primarily comes from Australia and Canada.

The combination of nuclear power generation and using high quality steaming coal such as found at Wyong forms the basis for Korea's commitments to reduce greenhouse gas emissions. Korea is a signatory to the Kyoto Protocol. The Kyoto Protocol is a legally binding agreement under which industrialised countries who have signed the protocol will reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990 (but note that, compared to the emissions levels that would be expected by 2010 without the Protocol, this target represents a 29% cut).

Without W2CP product, Korea will still need to source an alternative coal supply, probably of an environmentally inferior grade which would impair the ability to meet Kyoto targets.

3.5.6 Conclusion

There is increasing potential for alternative energy sources to make an increasing contribution in future years both in Australia and overseas, but at present the only viable alternative is nuclear, which Australia has currently rejected. Therefore there are no baseload alternatives to coal which is expected to continue to meet or substantially supplement the power demands of developed nations. Coal will continue to be the major player in a portfolio of diverse energy sources.

3.6 Project Design Alternatives

There have been a significant number of alternatives developed for each aspect of the W2CP since the grant of the Exploration Licences. In broad terms these alternatives have included:

- Mine plans – change in panel orientation, location and extent, changes to roadway locations, pillar dimensions and distance to panel start and finish points;
- Longwall panel width and extraction height. These have varied throughout the mine plan;
- Location of surface facilities. Two previous locations were assessed but relocated to the current location following the outcome of strategic planning studies, engineering assessments and advice from Wyong Shire Council;
- Despite several variations to the surface facilities layout however, some aspects remained fixed such as the drift entry and the desired pit bottom location (that is, where the drift enters the coal seam). The alterations adopted were based on minimising noise emissions from the site and exploring alternative construction methods; and
- Minor variations were made to the Buttonderry site infrastructure, mainly the fan arrangements in order to provide a balance between air and noise emissions.

The consideration of project alternatives and the selection of the proposed mine plan, in terms of project location, mining constraints and mining method are detailed in Section 2.3 to 2.5 of this EA.

The iterative process between engineering and environmental issues has resulted in the formulation of the proposed development. The development as proposed provides the optimal balance between environmental impacts and efficient and effective resource utilisation. Thus the W2CP proposal is considered to best meet the reasonable balance for economic, environmental and social factors as required by sustainable development principles, as described below.

3.7 Principles of Ecologically Sustainable Development

Ecologically sustainable development (ESD) may be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It calls for a balance between conservation and development and requires resources to be used in a manner that provides quality of life, equity, biodiversity and maintenance of ecological processes.

Sustainability is essentially about developing a system which is not self-destructive and does not take from the world's future, but which takes account of social, environmental and economic factors in the decision making process. By integrating conservation practices and principles into the development process, a sustainable balance can be achieved between environmental and economic objectives.

The Federal Government released the *National Strategy for Ecologically Sustainable Development* in December 1993 (NESD). The NESD defines ESD, and provides a goal and core objectives relating to ESD.

The Definition of ESD

- Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.

The Goal

- Development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

The Core Objectives

- To enhance individual and community well being and welfare by following a path of economic development that safeguards the welfare of future generations.

- To provide for equity within and between generations.

- To protect biological diversity and maintain essential ecological processes and life-support systems.

The well being of our current world population is often associated with the ability to generate electricity, which is essential to many facets of human life and well being. The application of these principles in the development of the W2CP to extract coal, a resource essential to current and future generations is discussed below.

The relevant definition of ESD is contained in Section 6(2) of the *Protection of the Environment Administration Act 1991* (NSW) (PEA Act), being the definition adopted by the EP&A Act.

This definition of ESD provides as follows:

For the purposes of subsection (1)(a), ecologically sustainable development requires the effective integration of economic and environmental consideration in decision-making processes. Ecologically sustainable development can be achieved through the implementation of the following principles and programs:

(a) The precautionary principle – namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environment degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

(b) Inter-generational equity – namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) Conservation of biological diversity and ecological integrity – namely that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) Improved valuation, pricing and incentive mechanisms – namely, that environmental factors should be included in the valuation of assets and services, such as:

(i) polluter pays – that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best

placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

3.7.1 Precautionary Principle

The precautionary principle, as defined by the PEA Act, dictates:

.....that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(ii) an assessment of the risk-weighted consequences of various options,

The precautionary principle is based on the premise that many of the potential benefits of the natural environment may be unknown and it is prudent and ethical to keep options open for current and future generations (DUAP, 1997).

The WACJV has taken risk into account, and has conducted an environmental risk assessment of the potential environmental impacts of the Project (Chapter 5 and Attachment 3 of this EA), including long-term risks. Further, WACJV has commissioned a human health risk assessment (Chapter 10 and Appendix M of this EA), and has also undertaken a risk screening of potential hazards (Appendix P).

WACJV has integrated the precautionary principle in the W2CP along with adopting mitigation measures to minimise the potential for serious and/or irreversible damage to the environment. The primary mitigation strategy has been to:

- limit the degree and scale of the development and its potential impacts for example by reducing coal production levels;
- sterilising significant coal reserves within the mining area by reducing coal extraction height and longwall panel widths in order to reduce subsidence impacts;
- avoiding the need for a coal washery that would generate wastes requiring disposal and consume significant quantities of water;
- locate the surface facilities away from planned residential and industrial development but also to maximise utilisation of available rail transport systems;
- locate surface infrastructure within the carefully selected sites so as to minimise the amount of land clearing required;
- in recognition of fact that some residual impacts will result, the project has developed a social and environmental offset package, referred to as a Community Enhancement Program.

The studies undertaken prior to and during the preparation of this EA in relation to subsidence, flora, fauna, noise, transport, soils, hydrology and flooding, Aboriginal and European heritage, and social and economic values have not indicated that there are threats of serious or significant irreversible environmental damage. However, where risk of potential degradation has been identified, mitigation measures have been developed to ensure that substantial adverse impacts do not occur. Consistent with the requirements of the precautionary principle, it has been assumed that threatened species may be present at appropriate habitats, although not all may have been observed, and a comprehensive set of mitigation measures, summarised in Chapter 13, forms an integral component of the project.

3.7.2 Intergenerational Equity

Under the EP&A Regulation, the principle of intergenerational equity requires:

...that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

In 1992, the United Nations conference on Environment and Development produced Agenda 21 which adopted the principle that:

...the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

The principle of intergenerational equity identifies a need to ensure that the requirements of the present generation can be met without precluding options for future generations. The proposed W2CP will assist in meeting existing demands for coal through mining methods that provide an appropriate level of resource utilisation. Although the proposal allows for some sterilisation of coal in the interests of environmental protection, the mine plan adopted provides for long term production without making alternative energy sources unavailable to future generations. With over 40 years of coal reserves within the target area, the project will be able to meet demand for coal until anticipated replacement energy sources become available. This therefore represents a responsible utilisation of an existing high quality resource.

If coal utilisation is to be phased out or phased down in the next 40 years or so, it is prudent to make preferred use of environmentally superior, less harmful coal deposits, such as W2CP, until alternatives are developed.

Measures to protect and maintain items of historical or Aboriginal heritage value are also required under the principle of intergenerational equity. Although no sites have been identified to date, liaison the local Indigenous community will continue during construction in order to protect Aboriginal relics should they be uncovered during construction. Further archaeological surveys will also be undertaken during the Subsidence Management Plan process and should any sites be identified, appropriate level of protection will be implemented.

Mitigation measures to ensure that the environmental impacts associated with the mine are minimised are also required under the principle of intergenerational equity. Mitigation measures to protect the soils, water, flora and fauna of the area will contribute to meeting the requirements of intergenerational equity, protecting the quality of the environment for both the existing and future

generations. These measures are discussed in each relevant section of this EA and have been summarised in Chapter 16.

3.7.3 Conservation of Biological Diversity and Ecological Integrity

It is a principle of ESD that:

> *Conservation of biological diversity and ecological integrity [is] a fundamental consideration,*

There is a need to maintain the biological diversity and ecological integrity of the flora and fauna of NSW, which includes terrestrial, marine and other aquatic ecosystems, diversity within and between species, and diversity of ecosystems. Conservation of ecological integrity requires that natural processes continue to function.

The proposal for the W2CP includes measures to minimise clearing of native vegetation and degradation of soil and water resources. The application of erosion and sediment control techniques will assist in minimising impacts on the soil and aquatic environments. These and other measures discussed in the EA will assist in conservation of ecological integrity.

3.7.4 Improved Valuation and Pricing of Environmental Resources

The goal of improved valuation of natural capital has been included in Agenda 21 of Australia's Intergovernmental Agreement on the Environment. The principle of improved valuation and pricing refers to the need to determine proper values of services provided by the natural environment. In particular, scarce environmental resources will increase in value and this should be taken into account.

Although benefits of the project will be derived from economic activity there are often residual impacts on the local community. The W2CP has incorporated a comprehensive Community Enhancement Program, which forms a key plank in the Statement of Commitments, found in Chapter 16. This program recognises both real and perceived implications and sets out a program and mechanism to offset these impacts on a local and regional level. A high value has been placed on local environmental values which in turn feature in the Community Enhancement Program.

3.7.5 Consistency of the W2CP with the objects of the EP&A Act

The objects of the EP&A Act are set out in section 5 of the EP&A Act:

The objects of this Act are:

(a) to encourage:

> *(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment,*
>
> *(ii) the promotion and co-ordination of the orderly and economic use and development of land,*

(iii) the protection, provision and co-ordination of communication and utility services,

(iv) the provision of land for public purposes,

(v) the provision and co-ordination of community services and facilities, and

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats, and

(vii) ecologically sustainable development, and

(viii) the provision and maintenance of affordable housing, and

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State, and

(c) to provide increased opportunity for public involvement and participation in environmental planning and assessment.

The W2CP is consistent with the objects of the EP&A Act, as follows:

(a)(i) The WACJV will develop the underground coal mine to utilise the coal resource, while at the same time, provide for the management of agricultural land owned by the WACJ on the surface and the development of the ecological offset areas to conserve forests and natural systems. The project has committed to protecting the regions water supply, and through additional employment generated by the mine, will assist in sustaining the viability of the towns and the Central Coast Region as a whole. All of these elements of the W2CP will promote the social and economic welfare of the community, while protecting and providing some areas of benefit to the environment.

(a)(ii) The planning of the W2CP has taken into consideration the protection of valuable land on the surface, by ensuring that subsidence is limited to an acceptable limit that will not result in the degradation of the land, or prevent land uses from continuing.

(a)(iii) The Tooheys Road site is located in an areas zoned as industrial land. Currently the provision of services such as roads, water, power and telecommunications to this location is low. The development of this site by the W2CP will include the provision of these and other services. As the W2CP will be underwriting the initial cost of these services, the subsequent provision of these services to firms who locate near the mine will be reduced.

(a)(iv) The W2CP has committed to providing land for conservation purposes, that is a benefit to the general public.

(a)(v) The W2CP proposes to establish a Community Enhancement Program that will invest in the local community through implementing economic, social and environmental projects for the local community. W2CP will work with the local Council and relevant educational institutions to implement training and education programs for the project as well as to facilitate local employment opportunities within the Wyong Shire.

(a)(vi) The Ecological Offset Program proposed for the project will assist in conserving the regions native flora and fauna, habitats, and encourage the protection of rare or threatened species, populations and ecological communities.

(a)(vii) Details of how the W2CP meets the objectives of ESD are provided in Section 3.7.

(a)(viii) The W2CP will assist in making housing affordable for the region through secure employment and economic stimulus to the region.

(b) The power to approve the W2CP rests with the Minister for the Department of Planning. However, consultation with all key stakeholders has been undertaken for the project to ensure that their requirements are considered.

(c) Community consultation has been undertaken for the W2CP (refer to Section 10.7) to allow their input into the project and how it will impact the local community.

3.8 Benefit Cost Analysis

Planning NSW (James and Gillespie, 2002) draft *Guideline for Economic Effects and Evaluation in EIA* identifies economic efficiency as the key consideration of economic analysis. Benefit Cost Analysis (BCA) is the method used to consider the economic efficiency of proposals. The above guideline identifies BCA as essential to undertaking a proper economic evaluation of proposed developments that are likely to have significant environmental impacts.

Gillespie Economics were engaged to prepare a BCA for the W2CP. The report is contained in **Appendix H**, and has been prepared in response to the Direcotr-General's EARs for the project:

" conclusion justifying the project, taking into consideration: the economic..... impacts of the project as a whole..."

"comprehensive assessment of the potential economic and social impacts and benefits of the project that demonstrates that the project as a whole has would result in a net benefit to the community.....including consideration of the economic implications of the Commonwealth's proposed Carbon Pollution Reduction Scheme".

From an economic perspective there are two important aspects of the W2CP that can be considered:

- The economic efficiency of the proposal (i.e. consideration of the economic costs and benefits); and
- The economic impacts of the proposal (i.e. the economic stimulus that the proposal will provide to the regional or State economy).

For the W2CP to be economically desirable it must be economically efficient. Technically, a proposal is economically efficient and desirable on economic grounds if the benefits to society exceed the costs (James and Gillespie, 2002). For mining projects, the main economic benefit is the producer surplus generated by the mine and the employment benefits it provides, while the main economic costs relate to environmental and cultural impacts.

3.8.1 Identification of Benefits and Costs of the W2CP

In order to identify the costs and benefits of the W2CP, it is necessary to compare the project (as detailed in this EA document) to the alternative of not proceeding with the W2CP (ie the 'base case' or 'do nothing' scenario). Under the base case, realisation of the value of land and capital assets accumulated in anticipation of the W2CP is considered.

Relative to the identified base case, the W2CP may have the potential incremental economic benefits and costs shown in Table 3.1.

It should be noted that the potential external costs, listed in Table 3.1, are only economic costs to the extent that they affect individual and community wellbeing through direct use of resources by individuals or non-use. If the potential impacts are mitigated to the extent where community wellbeing is insignificantly affected, then no external economic costs arise.

Table 3.1 Economic Benefits and Costs of the W2CP

Category	Costs	Benefits
Production	• Opportunity cost of land (including land for biodiversity offsets) • Opportunity cost of capital • Capital costs including surface infrastructure, sustaining capital, land acquisitions • Operating costs, including administration, mining, processing and transportation (ex royalties) • Decommissioning and rehabilitation costs of surface facilities	• Sale value of coal • Residual value of capital and land at the cessation of the proposal
Externalities	• Local water supply impacts • Subsidence impacts • Waterways, creeks and riparian area impacts • Groundwater impacts • Flooding impacts • Air quality impacts • Noise impacts • Ecology and biodiversity impacts • Aboriginal and European heritage impacts • Traffic and transport impacts • Visual amenity impacts • Greenhouse gas impacts	• Economic and social benefits of employment

3.8.2 Economic Costs of the W2CP

Opportunity Cost of Land
There is an opportunity cost associated with using land already owned by WACJV for the W2CP, instead of using the land for some other use. This opportunity cost therefore si the market value of the land, currently estimated at around $50 M.

Opportunity Cost of Plant
An opportunity cost of plant would refer to a situation where the mining company already owned plant and machinery, and was able to utilise the equipment for a new project proposal. In the case of the W2CP, there is no plant or equipment already purchased, and therefore the opportunity cost of plant for the W2CP is zero.

Capital Cost of the W2CP
Capital costs of the W2CP are associated with development of a coal handling plant, construction of a rail loop and loading infrastructure, development of surface infrastructure for employees, development of underground longwalls, sustaining capital and land acquisitions for impacted properties. These capital costs over the life of the proposal are estimated at approximately $1.4 billion(B). These costs are included in the economic analysis in the years that they are expected to occur.

Annual Operating Costs of the Mine
The annual operating costs of the W2CP include those associated with underground mining, coal handling, rail transport, port costs, demurrage, marketing and commissions, corporate costs and environmental management. Average annual operating costs of the W2CP (excluding royalties) are estimated at $161 million (M).

While royalties are a cost to WACJV they are part of the overall producer surplus benefit of mining that is redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the W2CP. Nevertheless, it should be noted that the Project would generate total royalties of $638 M.

Decommissioning and Rehabilitation Costs of the W2CP
Once mining of the W2CP is complete, it will be necessary to decommission and rehabilitate the surface infrastructure sites. However, it is anticipated that in the case of the W2CP, the sale of land and residual capital would be in excess of the costs for decommissioning and rehabilitation, therefore this is not considered to be a net cost of the project.

3.8.3 Economic Benefits of the W2CP

Sale Value of Coal
W2CP coal will be sold to both export and domestic markets. However, in the first 10 years of mining it is anticipated that the majority of coal will be sold on the export market.

An average value of AUD$98/tonne has been assumed for the analysis.

Residual Value of Land and Capital at End of the Project
Advice from WACJV is that the residual value of land and capital at the end of the Project life would more than offset closure costs. Conservatively, in this analysis it is assumed that they would exactly offset closure costs.

3.8.4 External Costs and Benefits

External to the basic economics of the project are the impacts on the environment and the community, which may also be valued in a real sense.

Local Water Supply Scheme
The overall impact of the W2CP on water supplies (both surface and groundwater) are discussed in detail in Chapters 7 and 8 respectively. While the impacts are considered to be negligible, the value of water to the community is high. For this reason, the WACJV proposes an enhancement scheme designed to assist in improving overall water quality in the catchment, which will result in an overall positive effect on the regions water supply. The enhancement scheme will obviously be a cost to the WACJV, that should be considered in the BCA.

Subsidence Impacts
The predicted subsidence impacts from the W2CP are detailed in Chapter 6 of this EA document. The resource to be mined by the W2CP is covered by two Mine Subsidence Districts (MSD). Houses built in accordance with the Mine Subsidence District criteria should have appropriate levels of structural protection to mitigate the impacts of subsidence. Any damage to houses or surface infrastructure is an economic cost that will be remedied by the Mine Subsidence Board should any impacts arise.

The cost of mine subsidence related damage is ultimately a cost to the W2CP, as the mine must pay contributions to the Mine Subsidence Board, which funds the repair of damage caused by subsidence.

Waterways, Creeks and Riparian Areas
The mine plan for the W2CP has been modified over time to ensure the stability of the confluence of Jilliby Creek and Little Jilliby Creek during all flows. Where required for these or other streams affected by subsidence, riparian protection works will be undertaken. There is sufficient allowance in the capital cost estimated to accommodate such works.

Groundwater
Groundwater modelling and assessment included as Chapter 8 of this document has determined that effects on alluvial groundwater systems will be minor and transient, and hence there will be negligible effects on stream flows or groundwater users. As a result, no economic implications associated with groundwater have been identified.

Flooding
The impacts of subsidence on potential flood levels from the W2CP have been detailed in Chapter 9 of this document. The Mine Subsidence Board will be responsible for developing mitigation measures to rectify, reduce or otherwise compensate landholders for increased risk of flood inundation for properties affected by mine subsidence. As discussed previously, payments made by the W2CP to the Mine Subsidence Board are used to fund such repair works.

Air Quality
A detailed assessment of the impact of the W2CP on air quality has been provided in Chapter 12 of this document. All air quality goals are expected to be met by the project, and there are no health related impacts anticipated. No economic implications associated with air quality have therefore been identified.

Noise
A detailed noise assessment has been provided in Chapter 11 of this document. Noise modelling has indicated that with appropriate controls, the Buttonderry site will meet all relevant noise assessment goals. However, some marginal noise exceedences may occur under certain meteorological conditions at two properties to the south of the Tooheys Road site. Consequently, a Noise Management Plan will be implemented which provides for further noise monitoring, restricting site activities when prevailing north east winds occur and specific noise mitigations measures or compensation. Outright purchase of these properties may be offered by WACJV if negotiation of suitable compensation or other mitigation strategies fail to achieve acceptable outcomes to the owners during operations.

The noise environmental of properties to the northwest of the Tooheys Road site is dominated by the F3 Freeway and while technically the Project will result in no noise exceedences at these properties, in the absence of the F3 Freeway background noise it would. WACJV therefore proposes to offer the same mitigation and management strategy for affected properties as it will for properties to the south of the Tooheys Road site.

An allowance for these actions is included in capital and operating cost estimates above. In this way any noise externalities of the Project are internalised into the costs of the W2CP.

Ecology and Biodiversity
The impacts of the W2CP on ecology and biodiversity have been assessed in detail, as described in Chapter 13 of this document. In order to offset the impacts of the required vegetation clearing (and associated loss of habitat) the WACJV has proposed an Ecological Offset Strategy, which has inherent costs involved. The cost of providing offsets is included in the opportunity cost of land estimate above, as existing project-owned land would be involved.

Aboriginal and European Heritage
There are no significant Aboriginal or European heritage features directly impacted by the Project surface infrastructure (refer to Chapter 14 for further details). European heritage features above the underground workings will be considered in subsidence management planning with appropriate management plans prepared. No economic implications associated with heritage have therefore been identified.

Transport and Traffic
The Project surface facilities will be well serviced by road, with coal to be transported offsite by a dedicated rail loop. Implications of the W2CP for transport and traffic are therefore likely to be negligible. No economic implications associated with transport and traffic have been identified.

Visual Amenity
The surface facilities will be located on industrially zoned lands adjoining other industrial and light industrial land uses. Any potential visual impact from the F3 will be ameliorated by mounding and landscaping. No economic implications associated with visual amenity have therefore been identified.

Greenhouse Gas Emissions
Over the life of the project (and assuming no methane mitigation measures are undertaken), the W2CP will generate in the order of 51 million tonnes (Mt) of greenhouse gas emissions from mining and transport of product coal by rail to the port. To place an economic value on carbon dioxide equivalent (CO_2-e) emissions, a shadow price of carbon is required that reflects its social costs. The social cost of carbon is the present value of additional economic damages now and in the future caused by an additional tonne of carbon emissions. There is great uncertainty around the social cost of carbon with a wide range of estimated damage costs reported in the literature. An alternative method to trying to estimate the damage costs of carbon dioxide is to examine the price of carbon credits. Again, however, there is a wide range of permit prices. For this analysis a shadow price of carbon of AUD$30/t CO_2-e was used, with sensitivity testing from AUD$8/t CO_2-e to AUD$40/t CO_2-e.

Social and Economic Value of Employment
It is estimated that the value of employment generated by the W2CP, based on other existing mining operations, would be in the order of $712 M over 23 years of the project.

3.8.5 Benefit Cost Analysis

The main decision criterion for assessing the economic desirability of a proposal to society is its Net Present Value (NPV). NPV is the present value of benefits less the present value of costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the W2CP, because the community as a whole would obtain net benefits.

Table 3.2 summarises the predicted present value benefits and costs of the W2CP. The Project will result in net production benefits of $1,519 M, which would be distributed amongst a range of stakeholders including:

- WACJV shareholders;
- the NSW Government via royalties;
- the Commonwealth Government in the form of Company tax; and
- the local community via the proposed Community Enhancement Program.

The NSW Government receives additional benefits in the form of payroll tax and local councils may also benefit through community infrastructure contributions required under the EP&A Act (if applicable).

The W2CP also has a range of external economic costs and benefits. Most of these e.g. those related to subsidence, flooding and noise would be paid for by the WACJV either directly or indirectly (via the Mine Subsidence Board) and therefore have already been included in the estimation of net production benefits. External costs associated with greenhouse gas generation have been estimated at $388 M. These may initially be borne by the community, however, would ultimately be internalised into the production costs of WACJV through the

purchase of required carbon pollution permits (once the Commonwealth Government's proposed Carbon Pollution Reduction Scheme is implemented). Alternatively, WACJV may reduce the carbon liability associated with the Project through methane mitigation actions and potential onsite electricity generation. However, this latter action would only make economic sense if the carbon permit savings and value of electricity generated are greater than the costs of taking the actions. This is the subject of ongoing investigations.

There would also be externality costs associated with the clearing of native vegetation. However, these are assumed to be counterbalanced by the offset actions proposed by WACJV. External benefits associated with employment have been estimated at $665 M.

Table 3.2 Benefit Cost Analysis Results of the W2CP (Present Values)

	Costs	$M	Benefits	$M
Production	Opportunity cost of land	$47	Sale value of coal	$3,727
	Opportunity cost of capital	$0		
	Capital costs	$686		
	Operating costs ex royalties and carbon tax	$1,752		
	Rehabilitation and decommissioning costs	Offset by residual value of land and capital	Residual value of land and capital	Offset by rehabilitation and decommissioning costs
	Production Sub-total	***$2,484***		***$3,727***
	Net Production Benefit	**$0**		**$1,242**
Externalities	Local water supply	Negligible		
	Subsidence impacts	Accounted for through Mine Subsidence Board Levy	Social and economic value of employment	$665
	Waterways, creeks and riparian areas	Some capital work costs included above		
	Groundwater	Negligible		
	Flooding	Accounted for through Mine Subsidence Board Levy		
	Air quality	Negligible		
	Noise	Costs of mitigation included in capital and operating costs		
	Ecology and biodiversity	Some loss of values but offset. Cost of offset included in opportunity cost of land and operating costs		
	Aboriginal and European heritage	Negligible		
	Traffic and transport	Negligible		
	Visual amenity	Negligible		
	Greenhouse gas	$388		
	Externality sub-total	***$388***		***$665***
	Net externality benefit			**$277**
Net Community Benefits				**$1,519**

3.8.6 BCA Justification for the W2CP

Overall the W2CP is estimated to have net benefits to the community of $1,519 M and hence is desirable and justified from an economic efficiency perspective.

3.9 Project Justification

The domestic and global need for ongoing and economical supplies of coal has been clearly established. While scientific research and development continues to advance renewable energy sources, these alternative systems will not be capable of meeting Australia or the world's demand for electricity in the foreseeable future. Until such time as these technologies are further advanced, the world will continue to rely on coal as a major input to electricity generation.

Australia, and New South Wales and Queensland in particular, contain large deposits of coal. Under current coal demand conditions, it is inevitable that new coal resources will be required and developed.

3.9.1 Project Viability

The W2CP has incorporated extensive exploration work, detailed mine planning and economic modelling to verify that the project is in fact economically viable. However, while the ability to economically extract the coal and secure a market has been verified, the ability to carry out the project with an acceptable and manageable level of environmental and social impact is also of extreme importance.

The era of extracting a resource purely for economic benefit has passed, and consideration of the environmental consequences is now recognised as being of utmost importance. Detailed environmental studies have been undertaken to assess the level of anticipated impact, and it is firmly believed that the W2CP can be developed with an acceptable level of impact, making the project viable on economic, social and environmental grounds:

Economic Impact
The economic assessment undertaken for the project (Chapter 10 and Appendix I) has estimated that the total potential expenditure in the Central Coast economy from the three years of the mine's construction is expected to be approximately $600 million. This will create a total stimulus to the Central Coast economy of over $1 billion during the construction phase. On top of this will be significant ongoing direct expenditure and flow-on effects to the local economy in the order of $200 million per annum. Total revenue to Governments over the life of the project will be over $1 billion.

Social Impact
In addition to the expenditure and economic stimulus that will be generated by the W2CP, the construction of the mine will provide direct employment for over 300 people and indirect employment for a further 2989. In the mine's first year of operation it is expected to generate an additional 428 jobs in the Central Coast economy which will rise to 726 jobs at full production. A further 336 jobs in the Hunter Region will be sustained by the project during operations.

Environmental Impact
The environmental impacts are described in detail in Chapters 6 – 15. It is acknowledge that it is impossible to remove coal from the ground without some

form of impact, however with the mitigation measures described in this EA and committed to in the Statement of Commitments (Chapter 16) and the careful design of the mine plan having regard to surface features, the net impact on the environment is acceptable.

W2CP will develop a modern and well-planned underground mine to produce up to 5 million tonnes per year of low-sulphur, export quality coal. It will be a stable, efficient and environmentally responsible coal producer of fuel for international and domestic electricity generation and it will substantially contribute to the local, State and national economies.

3.9.2 Consequences of Not Proceeding with the Development

Given the high value of the State owned coal reserves within proposed Exploration Licence areas it is considered unlikely that the resource would not be extracted at some time in the future. Should this particular proposal not proceed, the economic benefits to the State and local region will at best be delayed but potentially will be lost even if the Exploration Licences were transferred rather than extinguished. The power to approve the transfer of mining titles rests solely with the Minister for Mineral Resources.

However, the viability of future coal extraction is based on considerations other than simply the coal resource itself. It relies, among other things, on the ability to extract, process, stockpile and transport the product. In doing so, a viable project must develop the surface infrastructure to serve the mine and to ensure suitable land areas that are well-sited for construction and operation of these long term facilities. The WACJV, the current owners of the W2CP, has painstakingly assembled a large portfolio of freehold land which is essential for rational project development. If the current W2CP development proposal did not proceed, it would likely result in the sale and breakup of a significant property bank that has been compiled to provide the appropriately sited current and future surface facilities and buffer areas required for well-planned surface infrastructure. Once disintegrated and/or sold, it would be extremely unlikely to ever re-establish such a land bank that supports the optimal development potential of the local coal resource.

Failure to develop the W2CP will not prevent existing international and domestic coal markets from continuing to grow, and consumers will be forced to source the coal from other regions. The demand for coal of this quality will not be extinguished by not proceeding with the W2CP.

The W2CP has been developed over the past fourteen years and has been able to incorporate specific control systems to safeguard the key mining constraints such as the water supply catchment, residents and community infrastructure.