Submission No 138

SUSTAINABILITY OF ENERGY SUPPLY AND RESOURCES IN NSW

Organisation: Australasian Institute of Mining and Metallurgy

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NEW SOUTH WALES HOUSE OF REPRESENTATIVES

ENVIRONMENT AND PLANNING COMMITTEE

SUSTAINABILITY OF ENERGY SUPPLY AND RESOURCES IN NSW

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About the AusIMM

The Australasian Institute of Mining and Metallurgy (the AusIMM) was formed in 1893 and is the leading organisation representing the 65,000 resources sector professionals in the Australasian region, across industry, government and academia.

Our members include professionals from traditional disciplines such as mining engineers, geoscientists and metallurgists, as well as from disciplines such as business management, finance, health and safety, social and environmental science.

With a focus on enhancing professional excellence, the AusIMM provides members with an ongoing program of professional development opportunities to ensure our members are supported throughout their careers to provide high quality professional input to industry and the community.

Over 16 percent of AusIMM Australian members reside in New South Wales and this submission has been written in consultation with them, particularly the Hunter Region Branch of the AusIMM including Geoffrey Pitkin, Nicole Brook, Kim Wright, Rob McLaughlin and Brian Baumhammer.

Submission

This submission by the Australasian Institute of Mining and Metallurgy (AusIMM) is in response to the NSW Legislative Assembly inquiry into the Sustainability of Energy Supply and Resources in NSW. The terms of reference of this inquiry include:

1. The capacity and economic opportunities of renewable energy.
2. Emerging trends in energy supply and exports, including investment and other financial arrangements.
3. The status of and forecasts for energy and resource markets.
4. Effects on regional communities, water security, the environment and public health.
5. Opportunities to support sustainable economic development in regional and other communities likely to be affected by changing energy and resource markets, including the role of government policies.
6. Any other related matters

This submission relates to points 2 through 5 of the terms above.

Summary

Metallurgical Coal

Coal is used primarily as metallurgical coal in steelmaking or as thermal coal for power generation and other industrial uses such as cement manufacture. High quality metallurgical coal is produced in the Illawarra region, but only relatively small quantities are exported from Port Kembla. Lower quality metallurgical coal is exported through

Newcastle. The quantities exported depend on the relative price differential between metallurgical and thermal coal.

Queensland Bowen Basin coal is the predominant source of metallurgical coal for the export market.

Thermal Coal

Renewables (photovoltaic, wind and biomass) and gas are predicted to rapidly expand their share of the world energy market over the coming twenty years. Electricity generation will increase significantly as the third world develops. The result is a net zero growth in coal fired power generation worldwide over the coming twenty years. This is not consistent across all regions, with an increase in coal usage in India and Asia (excluding China).

Seaborne traded coal will increase as a result. Australia is predicted to take market share from Indonesia as its domestic requirements increase. Australia's thermal coal exports are predicted to expand by over 50% over the next twenty years.

Approximately 70% of Australia's thermal coal exports come from Newcastle. Additional new supply can come from Queensland's Surat and Galilee basins.

The principal impediment to maintaining or expanding coal exports through Newcastle is the NSW government approvals process. Without timely approvals for extensions and expansions for new and existing mines coal supply will switch to Queensland or internationally.

Community and Environment

Coal is NSW's largest export earner and is a major source of employment in regional areas. In some regional towns coal mining is responsible for over 50% of employment. Only an intensive, export-oriented industry can provide similar employment opportunities.

The mining industry continues to offer some of the most challenging and rewarding careers for new graduates in Australia. It is incumbent on government and industry to maintain positive messaging and support for our major export industries.

Dust levels at most mine sites are monitored and kept to below standards set under the National Environment Protection Measure. Reducing dust and noise impacts is a process of continuous improvement. New mining operations offer an opportunity to implement improved technologies to reduce environmental impacts.

Mining land use is very minimal in NSW. Mine rehabilitation has objectives that are agreed upon by the community and government, and lays out the post-mining use of the land. Modern rehabilitation using geomorphic techniques are a vast improvement on the engineered landform designs of the past. Final uses for the mine voids offer a wide variety of opportunities including recreational lakes, wildlife conservation, irrigation, water storage, aquaculture, hydro-electric power generation and more.

Underground coal mining often results in subsidence of overlying strata and the surface. Mine subsidence is tightly regulated in NSW to reduce potential impacts to acceptable levels.

Opportunities for Sustainable Economic Development

Opportunities for sustainable economic development in regional areas do not necessarily preclude coal. New industries will, however, require intensive land use and some competitive advantage to allow exports to replace coal mining exports in the future. Some of the options include:

- Processing materials for the burgeoning electric vehicle market worldwide. These vehicles and similar technologies will require significant additional supply of metals such as copper, aluminium and battery components. NSW can have a competitive advantage in low cost base load power to attract these energy hungry industries due to our abundant supplies of high quality coal and available infrastructure.
- Providing additional base load power generation for electric vehicle recharging.
- Providing a source of hydrogen for hydrogen powered vehicles. By far the lowest cost source of hydrogen is from gas or coal coupled with a combined cycle gas turbine. The turbine can be used to provide much needed backup generation for existing renewable energy sources.
- Small modular nuclear reactors may well be the future of power generation. The first of these is at least ten years away in NSW. Coal remains the lowest cost form of power generation in NSW. New high efficiency, low emission (HELE) power stations should be used to replace retiring power stations. This will reduce greenhouse emissions while maintaining a low cost power supply for industry until alternative low cost base load power supply is proven and available.
- Federal Government policies through to 2005 sought to increase processing of Australia's raw materials. In recent years smelters and refineries have deserted NSW due to a combination of restrictive international trade practices, pollution concerns and electricity price increases. There is a need for government to facilitate low cost, stable electricity supply.

The status of and forecasts for energy and resource markets: emerging trends in energy supply and exports, including investment and other financial arrangements.

Predictions for Global and Regional Coal Markets

Metallurgical Coal

Metallurgical coal is a key constituent of crude steel making. Though there are several processes to make steel including blast furnace, Direct Reduction Iron technology (DRI) or using recycled steel in an electric arc furnace (EAF), only the EAF process uses little to no coal.

Metallurgical coal as hard coking coal is used in 70% of steel manufacturing. The coking coal forms the bed which supports the reduction of the iron ore to liquid iron. The coals used in steel making aid in three ways:

- Hard Coking coal (HCC) is converted to coke then layered with the iron ore in the blast furnace supporting the ballast of the furnace allowing permeability for the air/oxygen through the base of the blast furnace;
- Pulverised coal injection (PCI) and Semi Soft Coking Coal (SSCC) provide heat of combustion (reducing the amount of HCC required):
- Coke, PCI and SSCC act as reducing agents for the iron ore.

These three roles are hard to replace in the bulk of steel making. It should be noted that pig iron, the precursor to steel, contains 4% carbon. The refining process reduces the carbon content to less than 1% depending on the required steel composition and properties. Increasing carbon content increases steel strength but reduces ductility.

Recycling scrap steel may increase in the future. Older steel is recycled in Electric Arc Furnaces (EAF) with little coal required.

HCC is generally produced from the Illawarra coalfield in NSW. Hunter Valley mines do not produce a HCC due to lower coke strength. As such the metallurgical market and products produced in the Hunter are SSCC and PCI.

SSCC are used in blends with HCC to reduce the cost of producing coke. Where HCC is in demand and prices are high, demand for SSCC increases.

The main threat to Hunter PCI is semi-anthracite coal from the northern Bowen basin. While this coal has no coking properties, its low ash and high carbon content has resulted in reducing sales of Hunter PCI over past decades.

Thermal Coal

Several substitutes are available for thermal coal fired electricity generation, including:

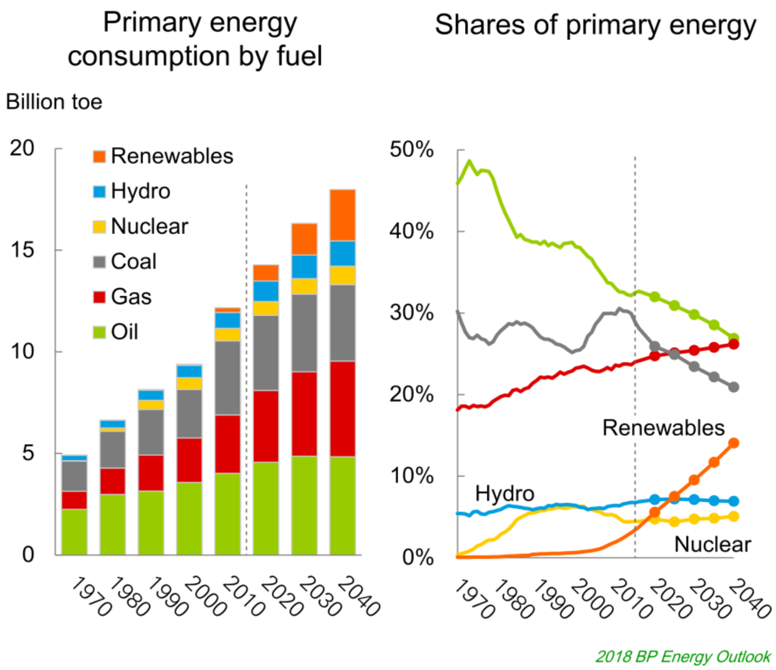
- Photo Voltaic Cells (PV);
- Wind Turbines;
- Biomass Combustion;

- Hydro Electric;
- Gas; and
- Nuclear.

These generation sources are seen by some as a desirable response to Catastrophic Anthropogenic Global Warming. For the last three decades a growing effort to replace coal as the fuel for electricity generation has been underway. This has been very prominent in first world countries and, in particular, Europe.

Renewables and gas are forecast to supply much of the increased energy demand out to 2040 (Figure ***1***). Nine independent energy forecasts were reviewed as part of this submission. The 2018 BP energy outlook has been used for illustration because it predicts a greater reliance on renewables (Figure 6) than other projections. All forecasts, however, provide a similar outlook although most predict more coal fired power generation.

Figure 1 Primary Energy Fuel Mix Projections



Renewable energy is advantaged in some jurisdictions based on supportive government policies during the growth phase of that industry. Growth rates in renewable energy are predicated on expanded policies worldwide. Gas has expanded partially as a means to respond to the inherent variability of renewable power generation in the absence of large-scale battery systems.

The impact of this will be the flat lining of coal demand from 2016 to 2040 (***Figure and Figure***).

Figure 2 Coal Consumption by Region

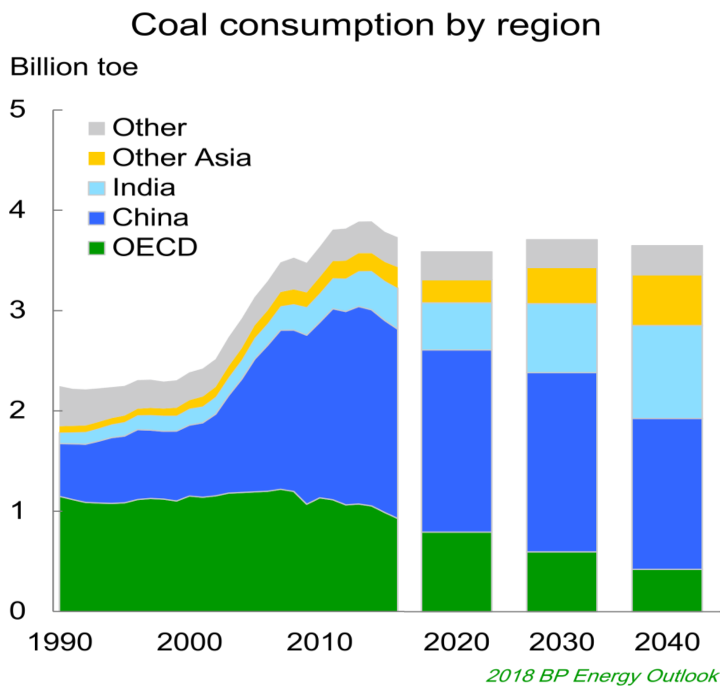
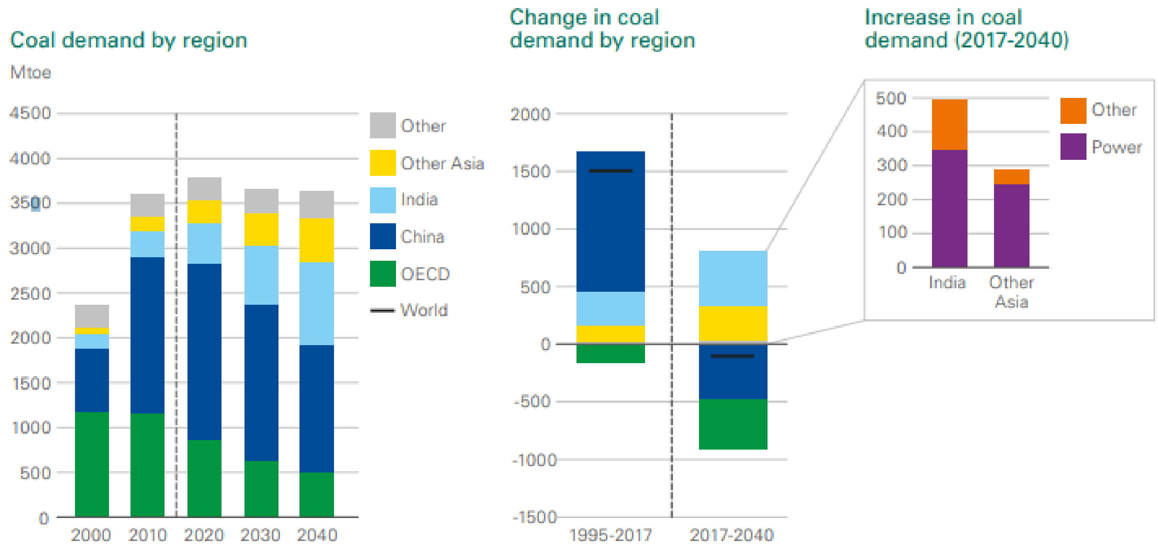


Figure 3 Projected Coal Consumption Growth by Region (5)



While nuclear is a mature industry, uptake has been hampered by incidents such as Fukushima. Nuclear is not expected to be a significant supplier of additional energy over the period to 2040.

Electricity Demand

Demand for electricity increases due to a rapid electrification of many parts of the world economy, including industry and buildings as the world urbanises.

First world economies are moving away from fossil fuels as the primary generation fuel for electricity, however this approach is not consistent around the world.

Of particular importance to Australian coal producers are the large growth rates in demand for coal in India and Asia ex-China. Approximately 60% of the growth in power generation in India and Asia (ex China) will be provided by coal (***Figure***).

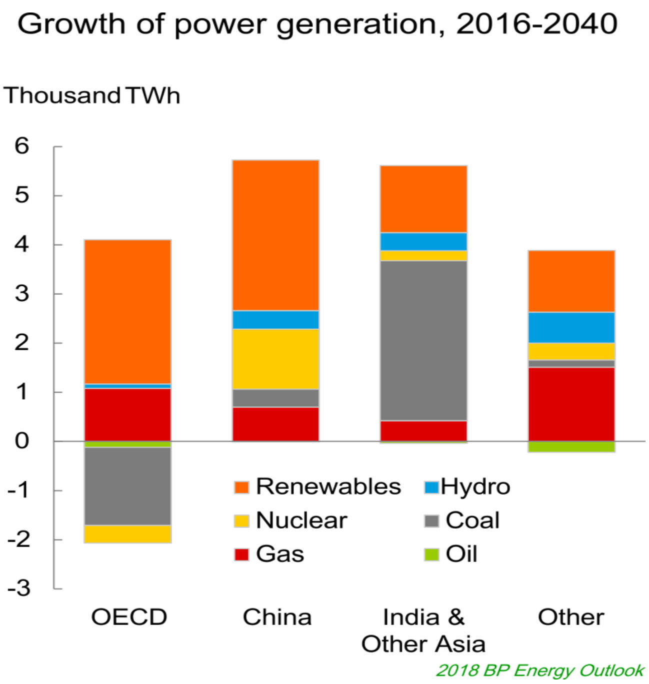


Figure 4 Growth in Power Generation, 2016-2040

Solar Trends

Germany is one of the world leaders in grid scale uptake of solar, with strong policy support for the fledgling industry. The industry is mature and provides insights into the future of solar power generation. It is the only country with a higher per capita installed solar capacity than Australia, even though it has 25% less annual insolation.

Canada's Financial Post reported in April 2018 that commencing in 2012 German subsidies began to reduce. By 2018, virtually all major solar producers had gone out of business due to a collapse of margin when competing on a level playing field. New investment has fallen by 92% and 70% of the 80,000 workforce have been made redundant. Solar plants with cells at the end of their economic life are being retired rather than having the cells replaced.

Wind Trends

Germany is also one of the early adopters of grid scale wind generation. Commencing in 2020, subsidies will begin to phase out and forecasts are that at current policy supported prices wind generation is not economic. Recent wind auctions for new capacity have closed under-subscribed.

Maintenance costs are much higher than predicted due to issues such as accelerated leading edge erosion, which also reduces power output during operation due to poor aerodynamics. Blade life is approximately half the original estimates. Disposal costs are also high and have not been factored into the original cost estimates.

Approval bodies are also modifying the consent process by dramatically increasing the minimum distance from nearby residences in response to loss of amenity to neighbours. The minimum distance is a function of blade dimensions which significantly reduces the ability of wind farms to install larger and more efficient turbines.

Impact of Aggressive Increase in Renewables Generation

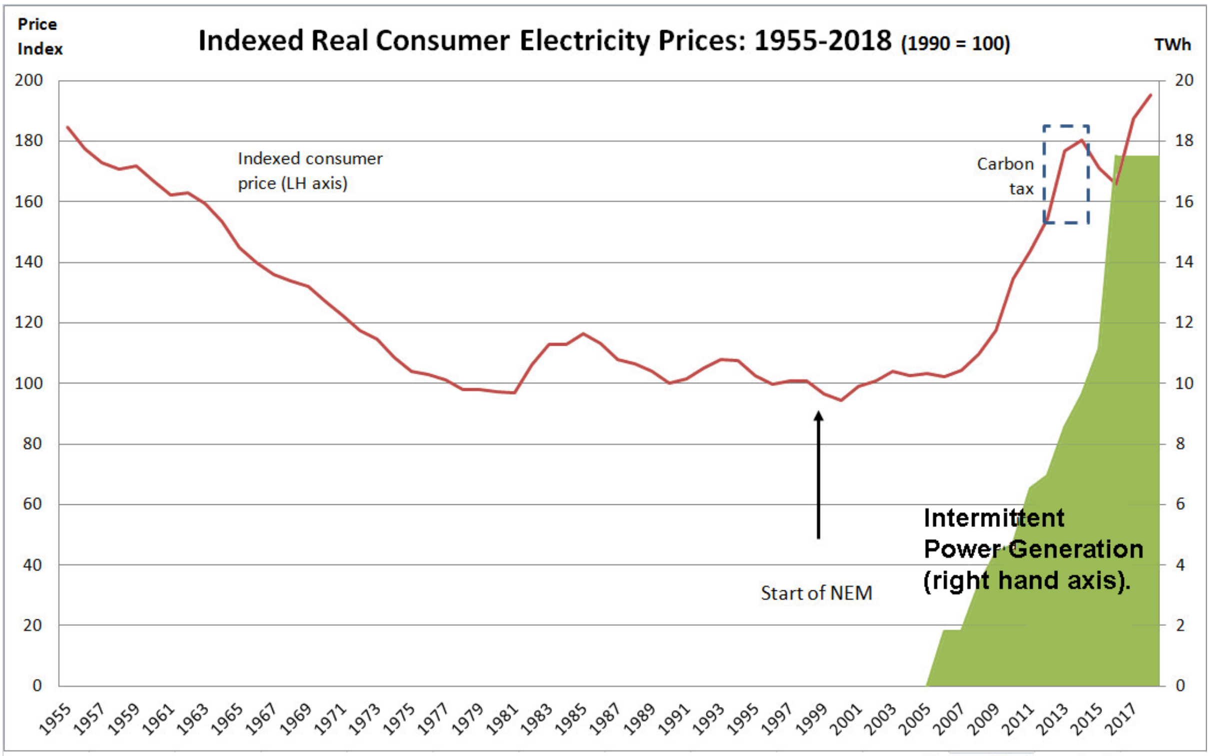
All forecasts of future energy supply show strong growth in renewable energy.

Most of the total increase in demand is met by an increase in the renewable energy generation fleets. This growth rate is predicated on favourable policy settings being introduced and even increased. As economies become increasingly reliant on renewable energy, the cost of such policies will become a significant burden on government budgets. As seen in Germany, even slight reductions in policy support have catastrophic economic impacts on renewable generation companies.

The economics of wind and solar generation require strong policy support. The cost of providing backup power and network enhancements for intermittent generators increases with increasing renewables. It is something for government to consider as to whether support can be sustained for the long term.

Australian experience with electricity price increases due to renewables introduction has mirrored that in other countries. Real electricity prices have doubled due to the introduction of intermittent renewable power generation (***Figure 5***).

Figure 5 Increases in Australian Real Consumer Electricity Prices

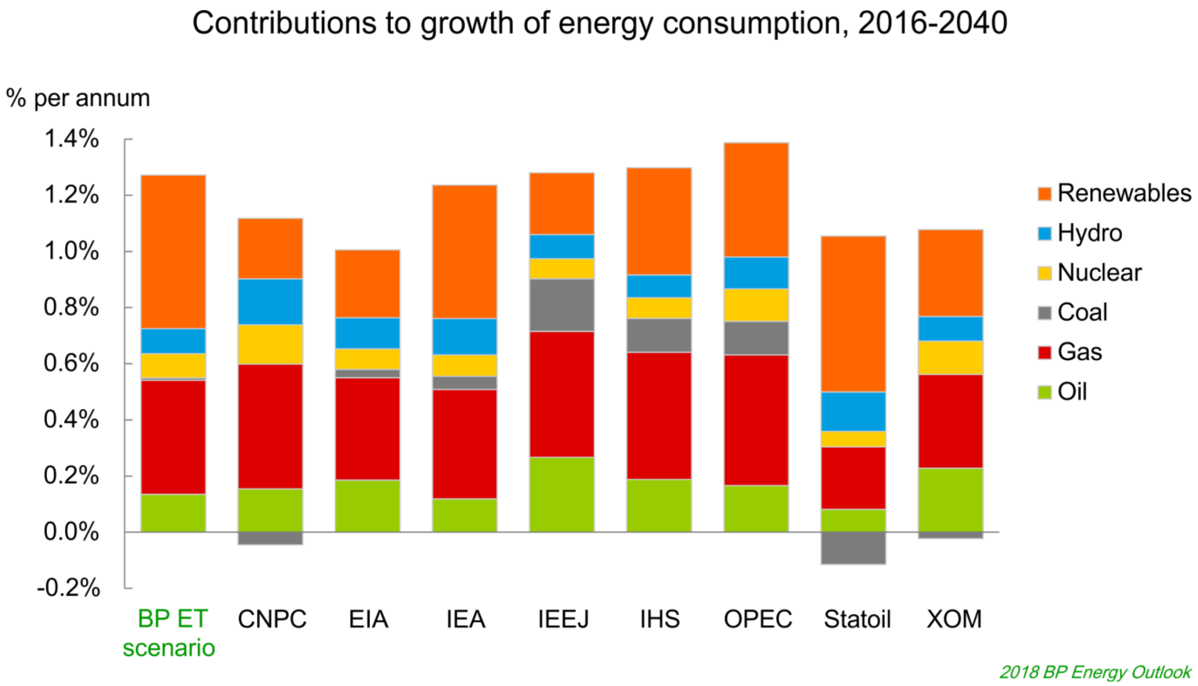


Sources ***Original: Dr Michael Crawford***

Prices 1955 - 1980: *Electricity in Australia*, prepared for CIGRE by Frank Brady AM (former CEO, Electricity Commission of NSW), 1996
1980 - 2016: ABS 6401.0 Consumer Price Index
2017 - 2018: Adjustment (15% nominal increase) to take account of price increases announced by major elect distributors in June 2016
Intermittent power generation (Terra Watt hours, TWh) from Figure 4.2 in *Independent Review into the Future of the National Electricity Market*

The 2018 BP Energy Outlook shows a cumulative annual growth rate of total energy of approximately 1.3% between 2016 and 2040. Coal has almost no growth, with renewable energy contributing 0.5% growth and gas at 0.4% growth. This is a middle of the road estimate on total energy and relatively pessimistic on coal growth between nine major long-term energy market forecasting organisations (***Figure***).

Figure 6 **Forecasts of Contributions to Growth of Energy Consumption (Compound Annual Growth Rate)**



Should policy settings fall below the forecast requirement, renewable energy may not be in a position to meet forecast demand for energy.

Gas can step in as a replacement but has proved to be a more expensive means of generating base load power compared to coal.

It should be noted that the coal to liquids, forecast to be an increasingly significant source of liquid fossil fuels, is not included in the coal estimates by BP and the major forecasting organisations.

The forecasts show oil and gas are increasingly being valued as feedstock for chemical processes, in particular fertilizers for food production. This will account for 20% of total demand for oil and gas by 2040.

Forecast summary

Current forecasts show little risk to coal being substituted by any other generation type out to 2040.

The major competitors, renewables and gas, are reliant upon the success of strong government policies supporting renewables.

Should the forecast policy support be reduced, it is likely that coal demand estimates will be extremely conservative.

Policy support withdrawal for renewables is already underway in Germany.

It is feasible to argue that coal could be the substitute for renewables and gas.

Predictions for Coal Production from the Hunter Region

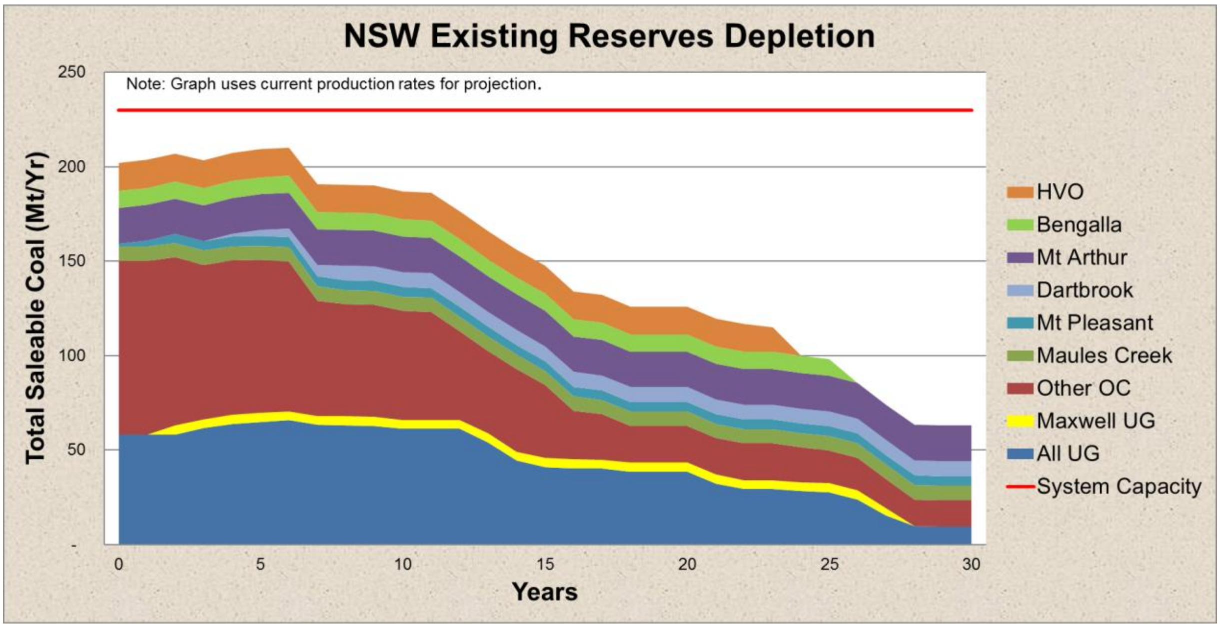
The two products which are generated from the Hunter Coal Chain (Newcastle, Hunter, Gloucester, Gunnedah and Western) are thermal coal and SSCC/ PCI.

Existing thermal coal producers are constrained by the reserves and potential reserves within their existing mining leases.

It is evident that the depletion of current reserves will lead to significant reductions in the Hunter Valley coal chain output. ***Figure*** shows that the development of Mt Pleasant and Dartbrook will only sustain current production from the HVCC for six years. For the subsequent four years there is a shortfall of 20Mtpa. This then increases rapidly to a shortfall below current export levels of 70Mtpa in 20 years' time.

Some operations, such as Bengalla and HVO, have the opportunity to increase reserves. Many of the older mines reach the end of their economic life. Significant brownfields expansions and some greenfields developments are required to maintain production from the Hunter. New capacity in the Hunter will remain more financially attractive than greenfields developments in the Surat or Galilee Basins.

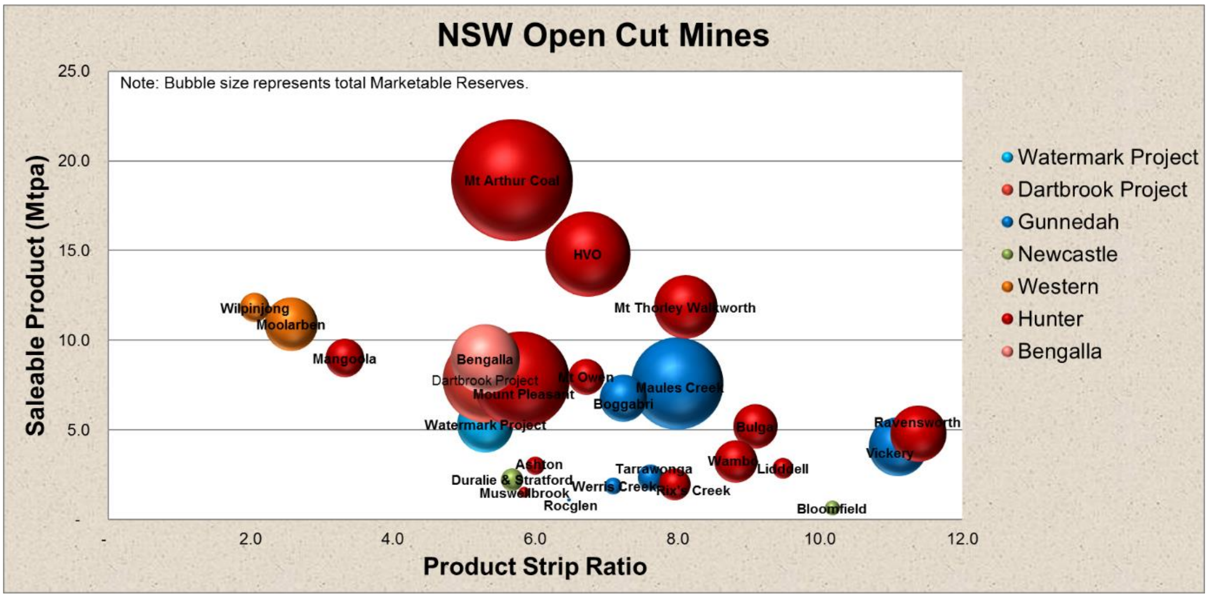
Figure 7 Existing Reserves Depletion



GPPH & Associates

The Hunter valley has several very low product strip ratio open cut mines (***Figure***). Product strip ratios are the volume of waste rock required to be removed to achieve one tonne of saleable product. Lower strip ratio mines generally have lower costs of production.

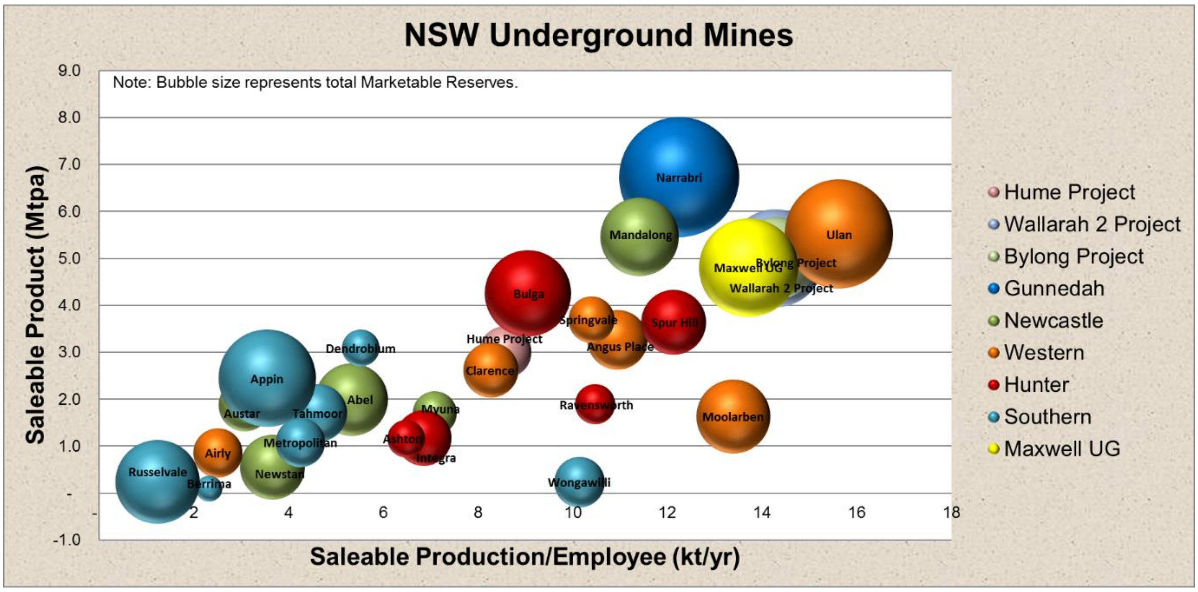
Figure 8 NSW Open Cut Mines



*GPPH & Associates*Labour costs represent approximately 35% and 40% of mining costs in open cut and underground mines, respectively. Labour productivity is therefore an indicator of mining costs. ***Figure*** shows the relative labour productivities of NSW underground mining operations.

Underground mines are less cost competitive than low strip ratio open cut mines. This is likely to remain the case until both longwall production and development automation are implemented. Fully automated development is at least ten years' away. The economics of underground operations is not entirely dependent on automation and faces many hurdles.

Figure 9 NSW Underground Mines



GPPH & Associates

Due to a higher cost structure underground mines typically target seams which provide a significant proportion of metallurgical coal. Underground mines are the steady suppliers of this product.

Open cut mines have more blending options due to a wider range of coal qualities from numerous seams. The decision to produce a semi-soft product depends upon short term pricing and available market demand.

Competitors

Metallurgical Coal

Australia is the largest seaborne exporter of metallurgical coal, with 60% of global shipments. The main competitors are the United States with 20% and Canada with 12%. Mozambique and Russia provide the bulk of the remaining supply.

The Australian portion of the market has grown by 32 Mtpa from 2007 to 2017, peaking at ~160 Mt in 2014-2016.

Australian exports have several factors that aid their competitive position. Some of the factors include:

- proven supplier;
- existing infrastructure;
- significant resources;
- high quality metallurgical coals;
- low cost supplier; and
- located close to most Asian markets hence lower shipping costs.

The Queensland metallurgical coal supply is the largest competitor producer in Australia. The HCC's from the Bowen Basin in Queensland are significantly better quality in terms of coke strengths and hence garner a premium price. The by-products of Queensland operations produce PCI and SSCC which competes directly with the Hunter Valley coals.

Illawarra HCC has similar advantages to Queensland metallurgical coal supplies. Much of the Illawarra coal is used domestically with only minor quantities being traded internationally.

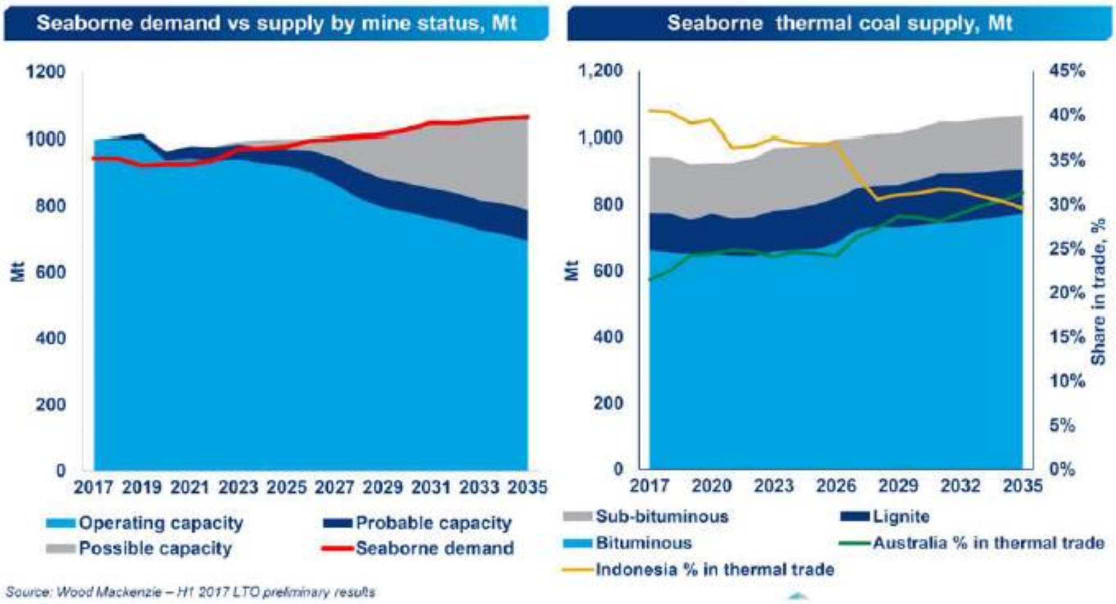
Thermal Coal

Australia is the second largest seaborne exporter of thermal coal after Indonesia. Australia has approximately 22% and Indonesia 40% of global shipments. The main competitors are Russia with 16%, Columbia with 9% and South Africa with 8%. The Australian portion of the market is anticipated to grow to over 30% by 2035 as Indonesian domestic consumption increases.

Australian thermal exports have similar competitive advantages to Australian metallurgical exports. Thermal coal from the Hunter Valley is high quality with low sulphur content, high heat value, good combustion characteristics and minimal deleterious properties.

Market demand forecasts indicate rising seaborne coal demand in the Asia Pacific Region. Of particular significance is the rising proportion of supply predicted from Australia. This requires an increase in thermal coal exports from Australia of more than 50% over the next 18 years. Sustained high thermal coal prices at present indicate that the over-supply in the early years is not as pronounced as shown in the graphs in ***Figure*** .

Figure 10 Projected Seaborne Thermal Coal Supply and Demand



Over 70% of Australia's thermal coal exports come from NSW. The majority of this is shipped via the Hunter coal chain utilising the Newcastle port and rail infrastructure. Current infrastructure capacity can support a production increase of more than 20%. Transport infrastructure plus ample high quality, low cost resources make northern NSW the best region for further export thermal coal mining capacity.

Thermal coal is not a scarce resource. If coal is not mined in NSW then it will be sourced from elsewhere at slightly higher cost. Significant untapped coal resources exist in the Surat and Galilee basins in Queensland which will also be required to meet the growing demand for Australia's high quality thermal coal.

Threats to Coal Mining in NSW

There are very significant barriers to new coal mining entrants into the Hunter Valley.

Mining in first world countries has traditionally been a capital-intensive business due to high labour costs and significant start-up expenses. Costs of construction of $150 to $100 per annualised tonne of production are typical for new mines which have access to existing logistics infrastructure.

Mining approvals are also a very considerable hurdle for new entrants. Legislation changes in NSW, particularly since 2012 have added uncertainty to the process. There has been a significant move away from a more technically based approvals process, to the prioritisation of a broader social license approach. Both are important.

Mining Approvals Process

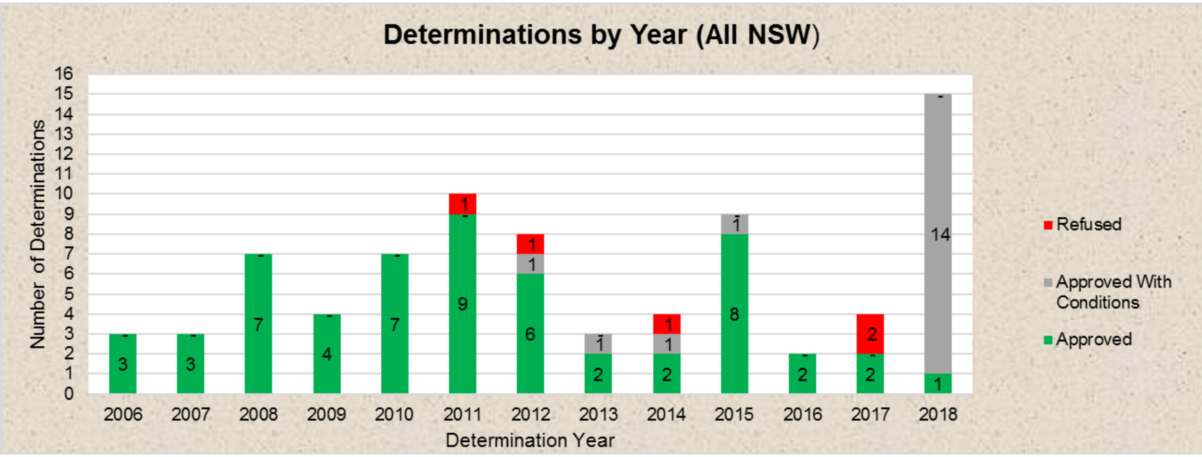
The time taken for the NSW Government to determine the approval status of a coal mining project is an important factor in the development of new coal mining projects.

Figure and ***Figure*** show the number of determinations made on coal mining projects under the Part 3a and State Significant Development (SSD) assessment systems per year, as of May 2018. Only applications that were for new coal mines, or extensions to existing mines, were included.

Modifications to applications, and applications to develop infrastructure (such as upgrading a processing plant) were not included.

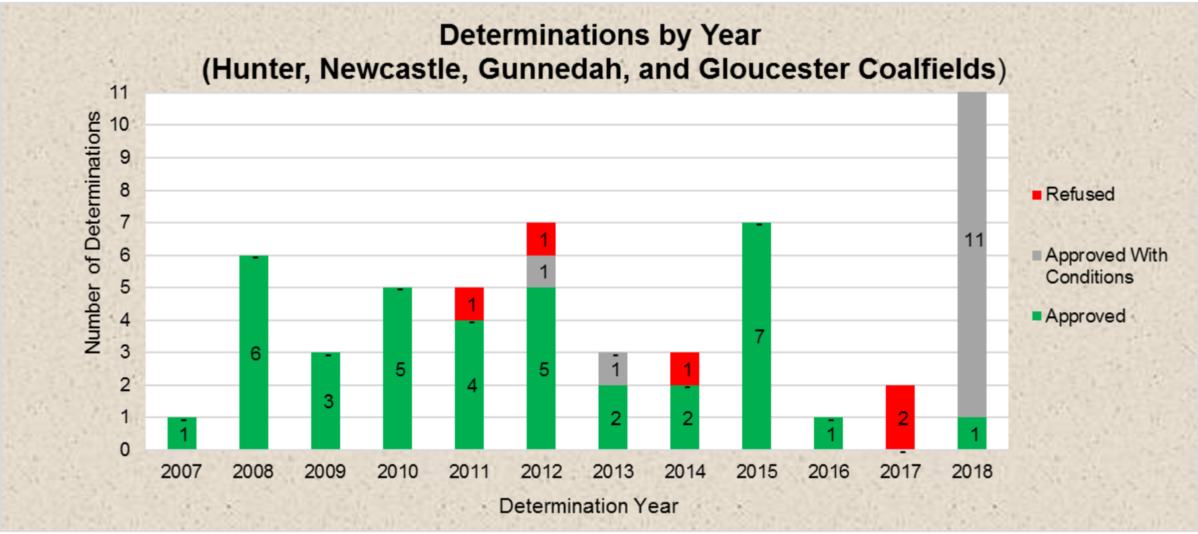
In the 2006 to 2010 period, no coal mining applications were refused. The refusals in the years that followed were all in the Hunter, Newcastle, and Gloucester coalfields.

Figure 11 Determinations by Year (All NSW)



Source: *http://www.majorprojects.planning.nsw.gov.au/*

Figure 12 Determinations by Year (Hunter, Newcastle, Gunnedah and Gloucester Coalfields)



Source: http://www.majorprojects.planning.nsw.gov.au/

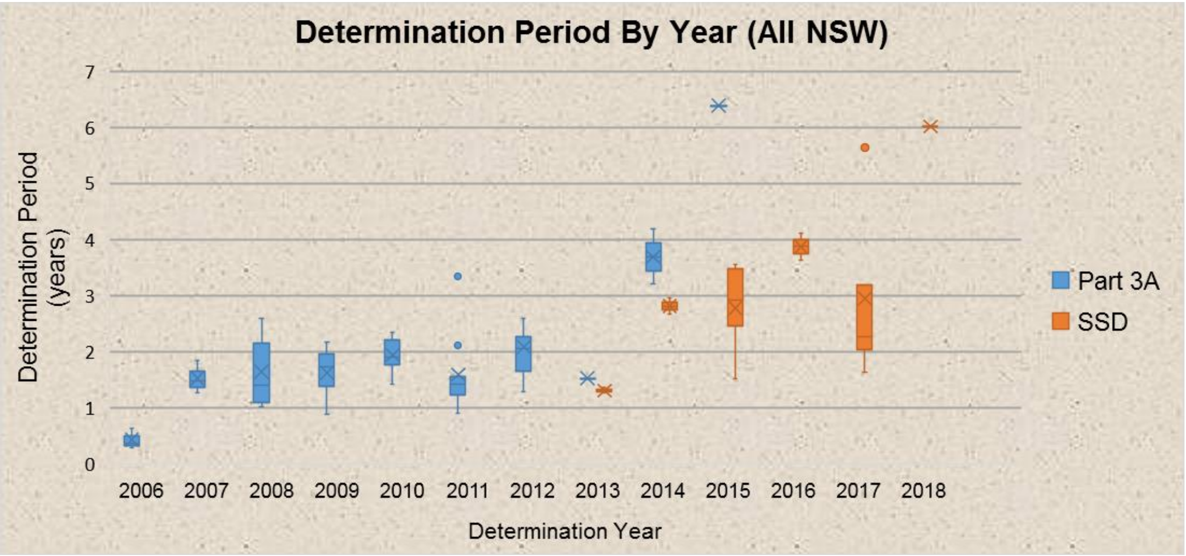
It is clear that an increasing number of projects have been refused or approved with conditions. Also apparent is the reduction in the total number of projects approved in recent years. This is partially impacted by the relative oversupply of coal into the market following the commodities boom early in the decade.

The charts below (***Figure***, ***Figure***, ***Figure*, *Figure*** and ***Figure*** show the range of determination periods for each of these applications.

Here, the determination period was calculated as the time from when the DGRS (Director General's Requirements Submission) was first issued to when the determination was made. The charts show the same dataset filtered in different ways. Seen in these ways, some key points become apparent:

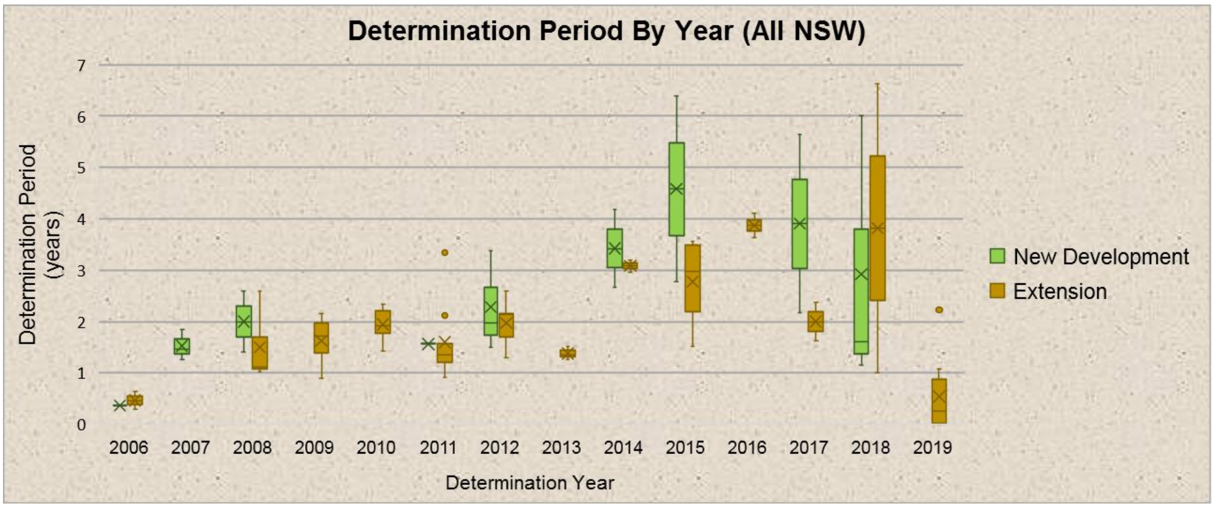
- In general, it is taking longer for coal mining projects to get a determination.
- The trend of increasing determination time is especially evident in the Hunter, Newcastle, Gunnedah and Gloucester coalfields.
- New developments generally require a longer determination period than extensions, although this can vary significantly depending on community and activist opposition.

Figure 13 Determination Period by Year (All NSW) SSD vs. Part3a



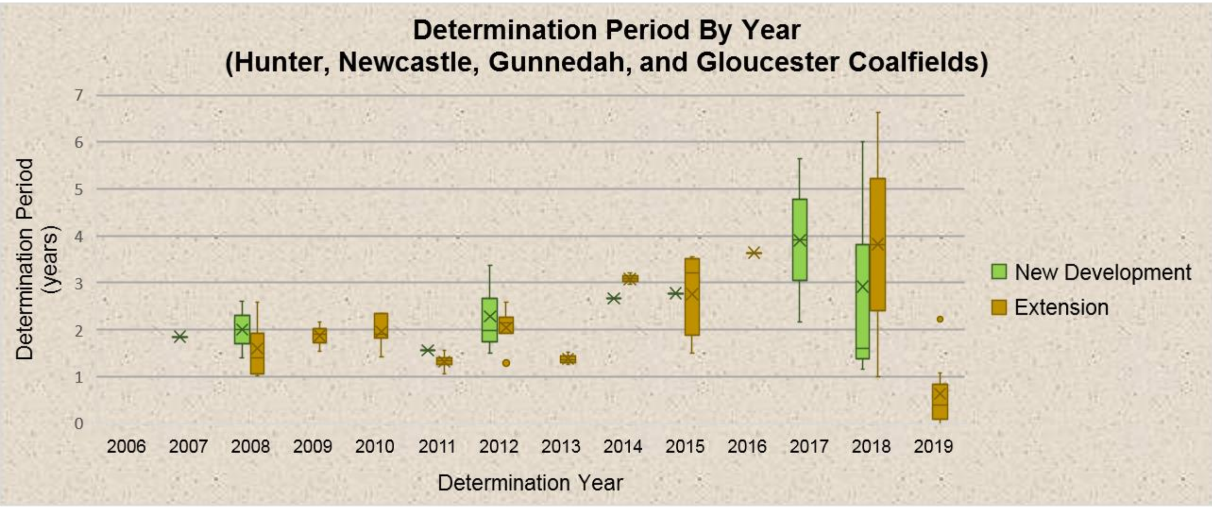
Source: http://www.majorprojects.planning.nsw.gov.au/

Figure 14 Determination Period by Year (All NSW) New Developments vs Extensions



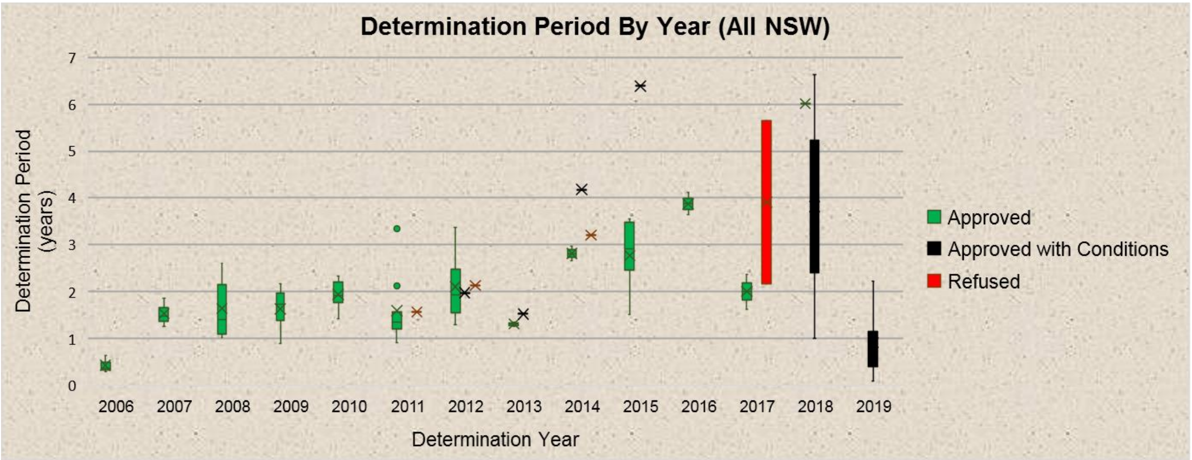
Source: http://www.majorprojects.planning.nsw.gov.au/

Figure 15 Determination Period by Year (Hunter, Newcastle, Gunnedah and Gloucester Coalfields) New Developments vs Extensions



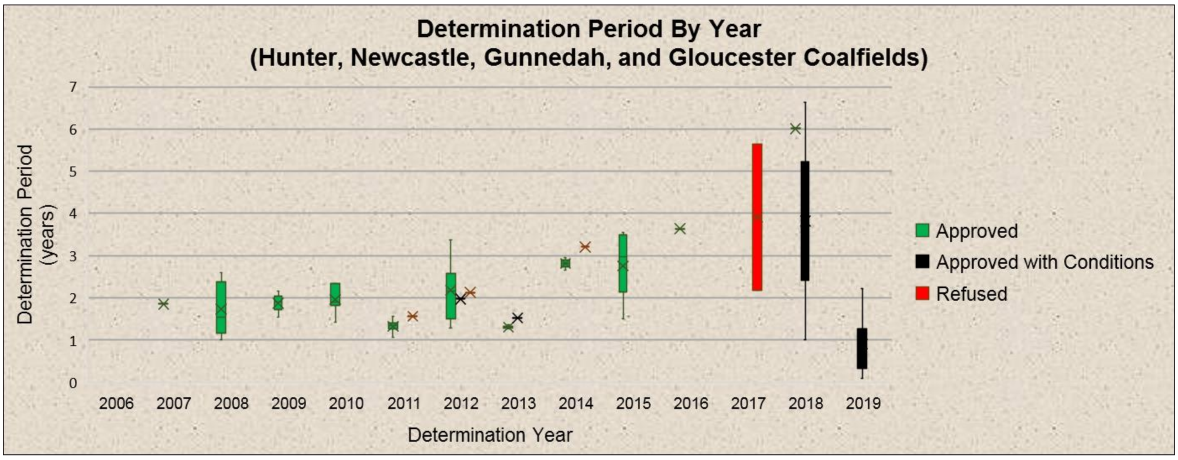
Source: http://www.majorprojects.planning.nsw.gov.au/

Figure 16 Determination Period by Year (All NSW) Showing Approval Success



Source: http://www.majorprojects.planning.nsw.gov.au/

Figure 17 Determination Period by Year (Hunter, Newcastle, Gunnedah and Gloucester Coalfields) Showing Approval Success



Source: http://www.majorprojects.planning.nsw.gov.au/

Effects on regional communities, water security, the environment and public health.

Employment and Economic Impacts

Coal is NSW's largest export earner in value terms, worth around $17.0 billion in 2017-18. This is approximately 75% of the total value of the State's mineral exports. It also contributes almost $1.8 billion to State revenues as coal royalties.

The continued development of our coal resources delivers significant economic benefits to local communities and provides a low economic cost and reliable source of electricity.

Coal is currently one of the world's most important sources of energy. It is reliable and abundant. Coal helps to keep electricity prices down, reducing pressure on household budgets and supporting local manufacturers and industry. In NSW, about 80% of the electricity we use comes from coal. Even as we seek to diversify our sources of electricity, coal continues to be a major contributor to energy security for NSW.

A strong mining industry generates employment in regional NSW, drives investment in regional communities and increases export growth. Today, the coal industry in NSW directly employs nearly 20,000 and supports around a further 80,000 in mine and non-mine related services. Many regional towns are reliant on a vibrant coal mining sector with over 50% of local employment being dependant on mining. Only significant, intensive, export-oriented industry could take the place of mining employment in these communities.

Recent negative reports about the demise of the coal industry and the end of the mining boom have led to a significant shortfall in enrolments in mining professions at university. These reports are false and misleading. The shortfall in suitable graduates will result in filling vacancies from overseas and in retraining graduates from other disciplines.

The mining industry continues to offer some of the most challenging and rewarding careers for new graduates in Australia. The future prospects for the industry are very good. Australia is a world leader in adoption and development of mining technologies. We require the best graduates to allow us to maintain this primacy especially as we move to a more environmentally sustainable mining industry.

It is incumbent on government and industry to maintain positive messaging on our major export industries. Professional and trades education for mining industry related courses should be funded and encouraged.

Environmental Impact of Open Cut and Underground Coal Mining

Dust

Just like agriculture, construction and other industrial activities, dust is a side-effect of mining. Dust emissions can impact communities near mines. The industry is always working to keep dust emissions to a minimum.

Dust at mine sites comes from activities like moving rock and soil, bulldozing, blasting, vehicles travelling on dirt roads or where wind blows over bare ground and stockpiles. Most dust particles from mining are large dust particles, also called coarse particles or Particulate Matter (PM10). These coarse particles are mostly associated with nuisance issues.

Only five percent of dust from mine sites is fine particles (PM2.5), which can be of greater health concern. Fine particles mostly come from vehicle exhausts and combustion processes, just like in urban areas.

Dust emissions are managed through a combination of mine planning, minimising disturbed areas, undertaking continuous rehabilitation, limiting road haul distances and traffic, using enclosed conveyors, using sprays on stockpiles and water carts on unpaved roads. Mines constantly innovate, test and implement new technologies to reduce dust.

Dust levels at mine sites are monitored and kept to below standards set under the National Environment Protection Measure. These standards are based on independent national and international studies. On-site monitoring programs don't just measure compliance with air quality standards and conditions, but also help find ways to improve dust management.

The industry has also provided millions of dollars for the installation and operation of the Upper Hunter Air Quality Monitoring Network, which has fourteen monitoring sites across the Upper Hunter. The monitoring sites are operated independently by the NSW Environment Protection Authority, and real-time data is available to the public.

Noise

Mines in NSW have comprehensive noise management plans to keep any disruptions to neighbours and the community to an absolute minimum. They are also tightly regulated for noise against standards adopted by the NSW Environment Protection Authority and outlined in its Industrial Noise Policy.

Mines reduce noise in a number of ways, through mine planning, plant and equipment design and selection, housing crushing and processing plant within buildings, enclosing conveyor systems, using terrain to acoustically shield the operations, and operational procedures like speed limits on roads around site, which also helps to minimise other impacts like dust emissions from trucks. Examples of these noise management techniques in practice in NSW include weather monitoring systems, the world's quietest trucks and excavators and customised trucks with rubber matting to dampen sounds when they are being loaded.

Reducing dust and noise impacts is a process of continuous improvement. New mining operations offer an opportunity to implement improved technologies that assist in reducing environmental impacts. New technologies exist that will help to significantly reduce dust and noise emissions while reducing mining costs for new deep open cut mines.

Blasting

Blasting is used to fracture rock, giving access to mineral deposits, so it's an essential part of mining. The two main impacts from blasting are overpressure (vibrations that travel through the air) and ground vibrations. Mines monitor blasting extensively, reporting the outcomes to regulators and analysing results to help minimise impacts.

Blast Management Plans, based on Environment Protection Authority guidelines, outline management and monitoring methods to minimise blasting impacts. These methods include restricted timing of blasts, direction and detonation design, avoiding blasting during adverse weather conditions that will enhance vibration impacts, and designing the detonation sequence with delays between holes so blast waves from individual holes don't arrive simultaneously at a neighbouring home or property.

Rehabilitation

Mining land use is very minimal in NSW. Mines work with government authorities to determine the post-mining use of the land and develop a rehabilitation plan. A rehabilitation plan has objectives that are agreed upon by the community and government, and lays out the post-mining use of the land.

For example, on land previously used for agriculture, the aim might be to restore the land to its pre-mining level of productivity. For other land uses, the objective may be to restore the area as close to its original condition as possible. Sometimes the land is completely remodelled to a better condition than before mining, like converting a mined area to a wetland, habitat zone, recreational area or land suitable for urban development.

Restoration of land occurs while the mine is still in operation. Mines return the land to a safe, stable and self-sustaining condition by filling in voids and reshaping disturbed areas so they are consistent with the landscape. Mines create habitats for native plants and animals by planting trees and local seeds, installing nesting boxes, replacing dead trees and controlling weeds and feral animals. They also manage buffer lands or offset sites to improve biodiversity and partner with community groups on conservation initiatives.

Some mining impacts are unavoidable, for example, when they need to clear native vegetation for buildings and infrastructure. Mines establish biodiversity offset areas to counterbalance any losses, often at a ratio as high as ten to one. They also relocate major fauna to nearby habitat areas, and take care to relocate and preserve precious plant species.

New mining approvals now require the use of improved geomorphic design techniques to provide natural, stable landforms. This is a vast improvement on the engineered landform designs of the past.

Final Voids

The primary consideration when planning a mine void is the long term safety and stability of the site. Once safety has been assured, mines then consider other potential beneficial uses for mine voids so that they can be an ongoing asset to the community.

A soon to be released Upper Hunter Mining Dialogue study of mine voids found that mine pit lakes could provide a range of possible positive contributions to the Upper Hunter long after mining has finished. The recently completed, two-year project has identified potential final uses for the voids which offer a wide variety of opportunities including recreational lakes, wildlife conservation, irrigation, water storage, aquaculture, hydro-electric power generation and more.

Many of the larger Hunter mines were approved decades ago when issues involving final voids were less of a priority. Modern mining operations now include requirements for progressive rehabilitation as part of the regulatory and approval process, and there is an increasing focus on ensuring any final voids are as small as possible and incorporated into the local landscape.

Regardless of the final land use for voids, there are strict requirements for voids to be rehabilitated to a safe, stable and non-polluting sustainable condition. The NSW Government ensures that this occurs by requiring mines to lodge rehabilitation security deposits that aren't returned until they are satisfied that those conditions have been met. Over $2 billion is currently held for this purpose.

Subsidence

When coal is extracted using caving methods from an underground mine, the overlying sediments subside. The extent of mine subsidence depends on the mining method, local geology, depth of mining and amount of material extracted.

Mines are designed to manage and minimise the potential impacts of mine subsidence. Longwall coal mines can vary the width of coal extracted to reduce subsidence, avoid mining near sensitive features, or change the original layout of the mine. In other cases, the impacts of mine subsidence can be repaired or rehabilitated once mining is complete. The type of management measures used will depend on what features are present and what level of protection they require.

Years of experience allows mines to manage subsidence. There are many examples of mines successfully operating beneath infrastructure and alternate land uses – like under the Hume Highway and the Southern Rail Link, mining under vineyards and olive groves.

Mine subsidence is tightly regulated in NSW. When an underground mine is proposed the potential impacts of subsidence are assessed and are only approved if the government accepts that the proposed management measures will reduce potential impacts to acceptable levels.

Underground mines have very specific working requirements. The target coal seams need to have good quality characteristics, low structural disturbance, thick coal, low intrusions and inclusions, ready access and favourable mining conditions. Open cut mines recover the majority of available coal and rely on beneficiation to improve product quality. The result is that open cut mines recover a significantly higher proportion of available resources and therefore disturb a smaller area for a given coal production. In the Hunter open cut mines typically recover more than four times the quantity of coal from a given resource compared with underground mining.

Opportunities to support sustainable economic development in regional and other communities likely to be affected by changing energy and resource markets, including the role of government policies.

Electric Vehicles

Pollution from combustion products emanating from vehicle exhausts is a major health concern in cities. The fine particles, less than 2.??m, are of greatest concern and are largely the result of combustion products. Electric vehicles (EV) are anticipated to increase in popularity in cities over the coming decades. This could provide industries for the Hunter. Since these technologies are still in development it is not the role of government to pick winners. Rather, the government needs to have policy settings and regulations that facilitate new industries.

Potential industries for the New South Wales include:

- Smelting and refining materials required for batteries and vehicles. Aluminium, copper, and other metals used in electric vehicle manufacture require a low cost, stable electricity supply for smelting and refining. Base load power combined with port and rail infrastructure gives the Hunter a competitive advantage.
- Electricity supply for charging EVs. Power requirements for recharging EVs will require a significant upgrade to electricity generation and networks. Since recharging takes up to 10hr most recharging is likely to occur at night. This will require an increase in low cost, reliable electricity generation.

Hydrogen Vehicles

Hydrogen vehicles are the alternate technology that may provide a practical solution for heavy haulage. Hydrogen fuel cells that create electricity are a proven technology. Research is being conducted into safe hydrogen storage and transport. Once the technology is proven industries may develop around producing the materials required for hydrogen storage.

Hydrogen can be produced by a number of means. By far the lowest cost approach is to use coal or natural gas along with electricity generation using a combined cycle gas turbine. The cost is estimated to be less than 25% of renewable energy and water electrolysis. The gas turbine will provide much needed reliable backup for existing renewable energy.

Nuclear Power

There is a growing call for consideration of nuclear power in Australia. Successful introduction of nuclear power is likely to require some time to build the necessary consensus across the political and community divide. It will also require market reorganisation to ensure certainty for base load energy providers. The current energy market works against high capital, low cost providers by subsidising and favouring intermittent electricity generators. This unfairly increases the cost of dispatchable power generation.

The life of nuclear power stations is 60 years or longer. The capital cost of nuclear is decreasing. Small modular reactors are eminently suitable for distributed power applications in regional Australia, particularly air-cooled units.

Pending the eventual introduction of nuclear, there is strong argument for HELE coal fired power in the energy mix over the next 50-year power cycle. This is cheaper and significantly more reliable than fully costed hybrid renewable systems without subsidy.

Heavy Industry

Smelting and refining of metals are industries that could be attracted to the New South Wales. The port, rail infrastructure and ready source of labour give the Hunter a competitive advantage. These industries were previously attracted to the region by low cost, reliable base load power generation. Federal Government policies through to 2005 sought to increase processing of Australia's raw materials. This can provide significant employment and revenue benefits.

In recent years smelters and refineries have declined in NSW due to a combination of restrictive international trade practices, pollution concerns and electricity price increases. Government interference in electricity supply has increased prices significantly, causing industry to relocate overseas. Industrial closures include the Newcastle steelworks, Cockle Creek lead / zinc smelter, Port Kembla copper refinery and smelter and Kurri aluminium smelter. Continued high electricity prices threaten the viability of the Tomago aluminium smelter.

There is a need for government to facilitate low cost, stable electricity supply. NSW is now a high cost electricity supplier. Electricity prices for heavy industry need to reduce to those existing in 2005 to be competitive. Industry needs to be able to negotiate long term base load electricity supply contracts directly with reliable, low cost generators, free from excessive regulation.