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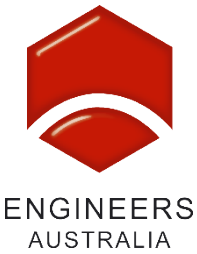
The retirement of coal fired power stations

Engineers Australia submission to the Senate Standing Committee for Environment and Communications inquiry

10 November 2016



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Introduction

Engineers Australia is the peak body for the engineering profession in Australia. With over 100,000 individual members across Australia, we represent all disciplines and branches of engineering. Engineers Australia is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community.

Engineers Australia welcomes the opportunity to provide a submission to the Senate Standing Committee on Environment and Communications inquiry into the retirement of coal fired power stations, and we commend the Committee for examining this important topic. Engineers Australia has focused its submission on terms of reference (c) and (d).

Access to a reliable, affordable electricity supply is crucial to Australia's continued industrial and commercial prosperity, and to the standard of living currently enjoyed by Australians. Australia has successfully used a diverse range of its energy resource base for electricity supply, with the majority powered by coal and gas. However, Australia has also utilised a variety of renewable energy resources including wind, solar, geothermal, ocean and bioenergy.

In the coming decade, Australia will need to reconsider this energy supply mix as a number of large capacity fossil fuel power stations near the end of their economic lives, and Australia's 2015 United Nations Climate Change Conference in Paris (Paris COP21) commitments need to be addressed. To overcome the potential loss of a large amount of embedded generation from the grid, and to meet emission targets, Australia will need to firstly diversify its energy supply and look at a number of different low emission options.

Engineers Australia welcomes the opportunity to make comment to this inquiry, and believes that the transition from a high reliance on coal fired power stations to a low carbon energy mix is essential if Australia is to meet its Paris COP21 commitments. Engineers Australia sees the choice as being between a haphazard process dependent on the vagaries of global market conditions and a smoother, sensibly planned process.

Engineers Australia believes that the Australian government needs to create a transition plan which outlines policy mechanisms to encourage the retirement of Australia's highest emitting power stations, while also providing options for affected workers and communities.

Engineers Australia believes that to prepare for the required change in the energy sector, a transition plan needs to be developed to provide a clear direction for the nation, provide certainty for workers and investors, and reduce risk and unnecessary costs to the energy sector. Engineers Australia believes there is great value in implementing policies which advance renewable energy options, transition energy options and energy efficiency options.

This submission highlights the current issues facing the electricity generation industry following the Paris commitments, and discusses potential policy options that are essential in an energy transition plan. This document highlights the current issues facing the electricity generation industry in Australia, and calls on government to create a transition plan to steer Australia in the right direction. Without a clear plan, Australia risks the potential to lose a large portion of its generating capacity in a short period without any alternatives in place, while at the same time undermining its Paris COP21 commitments.

Reliability and resilience of supply need to be considered in any transition plan, not only in generation, but also in transmission and distribution through an interconnected electricity grid through an increasing deployment of local generation close to the point of consumption. An energy future in the context of COP21 commitments and associated constraints will require the expertise of Australia's engineering profession. Engineers have the critical skills that can prosper in a future economy with reduced emissions, and engineers will be vital to a successful transition.

Electricity supply in Australia

Terms of reference:
(c) policy mechanisms to encourage the retirement of coal-fired power stations from the National Electricity Market, having regards to:

(i) the 'Paris Agreement' to keep global warming below 2 degrees Celsius, and ideally below 1.5 degrees Celsius,

(ii) the state and expected life span of Australia's coal-fired power plants,

(iii) the increasing amount of electricity generated by renewable energy and likely future electricity demand,

(iv) maintenance of electricity supply, affordability and security, and

(v) any other relevant matters

Electricity supply in Australia is fast approaching a juncture as traditional fossil fuel power stations come under increased pressure from renewable energies due to the need to address climate change. At the same time, there has been falls in the demand for electricity due to industry restructuring, greater public awareness of energy conservation, the use of renewables, and altered consumer behaviour.

Australia made significant commitments to reducing global emissions at the (Paris COP21), and future decisions about energy supply must comply with this commitment. Electricity generation in Australia as part of the energy supply industry has become characterised by aging power stations and old technology. If the status quo continues, Australia will find it very difficult to comply with its Paris COP21 commitments.

The existing major generators are powered by fossil fuels and are high emitters of greenhouse gases, with electricity generation being responsible for the largest source of emissions in Australia, accounting for 35 per cent of total emissions in the year 2015[1]. Although emissions have declined from peaks in 2008-09, 2015 saw a 1.8% increase in emissions from 2014 levels[2]. If Australia is to meet its obligations, it will need to transition away from the highest emitting power stations.

The majority of the highest emitting power stations in Australia are coal-fired, and also provide Australia with the largest electricity generation capacity. Electricity supplied by Australia's current power stations are expected to produce enough to continue to fuel peak demand, and no additional capacity is expected to be required in the electricity market for the next 10 years[3].

Notwithstanding the above, it is estimated that as many as three-quarters of Australia's coal-fired power stations are operating beyond their original design life, and some significant and costly investment in electricity generation will be required in the coming decades[4]. Not only does this confront us with the challenge of substantial and costly investment in replacing these power stations, but it highlights the character of the problem. Old power stations are more difficult to operate and maintain and this risks repetition of the Hazelwood closure when it is least expected. For Australia to make a transition away from these high-emitting power stations, government policy intervention may be required.

The decision facing governments, policy makers and generators will not only be when these older plants will need to be replaced, but what technology they should be replaced with. Old technologies and aging electricity generation plants have implications beyond the electricity supply industry and could

[1] Australian Government, Department of Environment, 2015, *Quarterly Update of Australia's National Greenhouse Gas Inventory: December 2015.* www.environment.gov.au
[2] Ibid.
[3] Australian Energy Market Operator, 2016, *National Electricity Forecasting Report June 2016*. www.aemo.com.au/
[4]Australian Government, Department of Industry and Science, 2015, *Energy White Paper 2015*, www.ewp.industry.gov.au

become a drag on national productivity as a whole. As there is no forecasted growth in electricity demand, there is also no incentive for any new generators to enter the market unless an existing operator exits the market.

Government policy intervention, clearly laid out through a national transition plan, has the ability to shape the future of Australian electricity generation and to reduce uncertainty to current and future generators, and must send the right signals to potential investors.

In the latest Energy White Paper, the Australian government has stated that fossil fuels, particularly coal, will continue to play a vital role in providing Australia's electricity supply[5]. However, traditional fossil fuel powered generators are much less flexible in the way they can operate in comparison to other technologies. With no real ability for reduced operation, there are limits to the involvement of older high capacity fossil fuel power stations in a transition plan.

Delaying a shift away from aging fossil fuel plants to low carbon options increases the likely risks and costs of a transition in the electricity sector, as it can take decades to plan, permit, finance and build new power infrastructure[6]. Engineers Australia believes that it is time for a transition plan to be developed which looks at the best options for consumers, the economy and the environment.

In the absence of a transition plan, current market forces as well as two key uncertainties could prevent the exit of aging power plants in the market. These uncertainties are:

- Obligation costs when exiting the market. The remediation site cost is typically the most significant cost faced by a generator exiting the market[7]. If there is uncertainty about this cost, then a generator may decide to remain in the market for a longer period than desired, which can also prevent new operators entering the market.

- Australia's climate change policies. This uncertainty stems from the wide speculation that current direct action policies are believed to be inadequate to meet Australia's emission reduction target, and that the current policy would either need more funding, or need to develop into an emissions trading scheme for Australia to reach this target[8]. Further confusion is compounded as a number of jurisdictions are already putting forward their own climate change policies[9], which results in many states and territories working on different targets and approaches. Climate change polices, which target the amount of emissions that a generator can produce, can greatly alter expectations that generators may have about future costs or revenues. Uncertainty surrounding this policy, which has undergone substantial changes in recent years, can influence a generator's decision to remain in the market in the hope that it could benefit from little or no changes to government policy. At the same time new renewable technology generators are affected in respect to their ongoing profitability under the current policy scenarios.

Government policy intervention, clearly laid out through a national transition plan, has the ability to shape the future of Australian electricity generation, moving away from fossil fuels, and promoting the development of renewables. This transition must reduce uncertainty and send the right signals to

[5] Australian Government, Department of Industry and Science, 2015, *Energy White Paper 2015,* www.ewp.industry.gov.au
[6] Stock, A, 2014, The Climate Council, *Australia's Electricity Sector: Ageing, Inefficient and Unprepared.* www.climatecouncil.org.au
[7] Australian Energy Market Commission. Advice to the COAG Energy Council, *Barriers to efficient exit decisions by generators*, June 2015.
[8] L. Taylor. The Guardian June 27, 2016. *Greg Hunt plays the long game on his glaringly obvious emissions trading scheme*. https://www.theguardian.com/australia-news/2016/may/27/election-2016-greg-hunt-coalition-emissions-trading-scheme.
[9] The Hon Daniel Andrews MP. 2016. *Victoria to Lead the Nation on Climate Change*. Media Release 9 June.

potential investors[10]. While government tone about the importance of a transition to help tackle climate change has recently become more positive[11], real action, and a real transition plan are still missing from the national discourse.

In the 2015 Australian Energy White Paper, the government states that it does not favour any intervention in promoting the transition away from coal-fired power plants, and that this should be left to the energy market to signal these changes[12]. The paper states that prematurely forcing new technologies in the energy market through policy interventions runs the risk of early adoption coming at a higher cost and lower efficiency than if that product found its way onto the market by a competitive basis.

There are substantial differences, however, between the large and long lived investments needed for baseload power and other investments. Even under the best of conditions the market is poorly equipped to deal with these situations.

Engineers Australia believes that some government intervention is warranted to kick start this transition in the light of the Paris COP21 agreement, and the subsequent emission reduction targets that were set. To meet these obligations, Engineers Australia believe that policy intervention in renewable energy and energy efficiency policy options should be considered.

Renewable and low emission energy options

There are already a number of emerging low carbon technologies which are being utilised in Australia, and many more that are being developed further. Options including solar PV and wind generation are already influencing the electricity market, and other options are continuing to develop such as solar-thermal, hydro, geothermal, bio-mass, waste gas and ocean wave energy. The role of nuclear energy as a zero emission (though not renewable) option is being explored in South Australia.

The emergence of battery storage options will become more prevalent in the next decade as technology development improves, opening up the possibility to transition from reliance on centralised electricity generation to a more shared system with distributed energy generation. Energy storage holds great potential to benefit the electricity system, and has the potential to solve challenges such as smoothing intermittency of renewable generation and managing peak demand[13]. As Australia's transmission electricity grid is typified by being long, thin and stretched out to remote regions[14], these technologies are able to adjust both the supply of electricity to the grid and demand for electricity from the grid.

The result may be options to transition from almost complete reliance on centralised electricity generation to a more shared system with distributed electricity generation. Battery storage technology will enable households to access lower cost energy, and AEMO is already forecasting an increase in the uptake of battery storage options in the mid-2020s when it is believed the technology will become more economic to the average consumer[15]. Battery storage on a large scale may only be an emerging technology, but it has the potential to make a real lasting change in the electricity generation market. This includes how electricity will flow both ways through the grid, and how generation will be close to the point of consumption.

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[10] Clean Energy Council. *Power Shift: A Blueprint for a 21st Century Energy System*. www.cleanenergycouncil.org.au
[11] Middleton, K, 2016. Josh Frydenberg's approach to environment and energy. *The Saturday Paper*, 13 August 2016. www.thesaturdaypaper.com.au
[12] Australian Government, Department of Industry and Science, 2015, *Energy White Paper 2015*, www.ewp.industry.gov.au
[13] CSIRO, 2015, Electrical Energy Storage: Technology Overview and Applications, prepared for the Australian Energy Market Commission, www.amec.gov.au
[14] Australian Government, Department of Industry and Science, 2015, *Energy White Paper 2015*, www.ewp.industry.gov.au
[15] AEMO 2015. 2015 *National Electricity Forecasting Report June 2015*. www.aemo.com.au

Government policy intervention has the potential to foster change, and promote the use of renewable energy. For investors of current low emission energy generators, governments can initiate change by creating sustainable markets by filling funding gaps, and creating enabling infrastructure for new technology. This would include digital software management that can flexibly optimise feed in to the grid from multiple sources while maintaining network stability.

For technologies that are still emerging, policies to create initial markets must run alongside research and development programmes, far ahead of widespread deployment of the technologies, and draw on competitive market forces where possible. Fostering the development and deployment of emerging technologies expands the number of low carbon technologies available at scale on a commercial basis, providing more flexibility and lowering overall cost[16]. The cost competitiveness of new products usually improves as the production of technology becomes more efficient.

Other energy options which may assist in a transition away from coal-fired power stations are transitional energy sources such as gas. Gas is effective as a peaking plant with the ability to ramp up quickly, where coal-fired plants are not easily able to adjust to demand.

While gas fired generation will increasingly be used to complement intermittent generation from renewables, the extent of use will be dependent on the cost of gas, and on the environmental policy considerations of carbon dioxide emission reduction[17]. Results suggest that portfolios sourcing significant quantities of energy from gas-fired generation in 2030 and 2050 will not achieve the greenhouse gas emission reduction levels required[18].The lowest cost scenarios in 2050 source less than 20 per cent of energy from gas with the remaining energy sourced from renewables. Increasing gas fired generation for electricity supply would assist in the reduction of carbon dioxide emissions if it is used in conjunction with renewables.

Energy efficiency options

The Australian government has signalled energy productivity as a major focus of Australia's energy policy through the release of the Australian National Energy Productivity Plan (NEPP). Through this plan the nation will manage and embrace changes in the energy industry, and aim to meet a significant portion of emission reduction targets. The NEPP sets a notional target of 40 per cent improvement in energy productivity between 2015 and 2030 and over half of the 40 per cent target could be achieved simply through continuation of current trends and within existing funding programs[19].

The proposed energy productivity savings are expected by just using a 'business as usual approach' without any further government intervention, much of which relies on current trends in industry restructuring. Engineers Australia views this passive approach as insufficient to meet Australia's future energy challenges and insufficient to make any significant contribution to Australia's emissions reduction ambitions.

Engineers Australia believes that there is great value in pursuing energy efficiency further. Energy efficiency has already played a big part in reducing the demand in energy consumption, but much of the improvement has been led by consumers and other energy users who have made energy choices in their own interests, rather than because of political leadership. Engineers Australia believes the political attention given to higher energy bills tells Australians only half the story because it neglects the potential of energy efficiency to reduce those bills.

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[16] International Energy Agency. 2015. *Energy and Climate Change, World Energy Outlook Special Report*.
[17] Heyning, C and Segorbe, J, McKinsey and Company, *The role of natural gas in Australia's future energy mix*, McKinsey Australia and Energy Insights June 2016.
[18] Riesz, J, Vithayasrichareon, P, MacGill, I, 2015. Assessing "gas transition" pathways to low carbon electricity – An Australian case study. *Applied Energy*, Volume 154, 15 September 2015, Pages 794–804.
[19] COAG Energy Council, 2015, *National Energy Productivity Plan*.

Energy efficiency improves energy productivity by reducing the amount of energy required for powering homes, businesses, vehicles and industries, which in turn reduces the amount of energy needed. Because energy efficiency improvements can be achieved in almost all uses of energy across all sectors of the economy, Engineers Australia believes that Australia needs an energy efficiency target to account for changes achieved and to guide progress along the lines proposed by the Prime Minister's Task Group on Energy Efficiency in 2010.

There is substantial potential to build on this foundation through fundamental reform to energy efficiency governance arrangements and the extension of energy efficiency programs to all sectors of the economy. Engineers Australia believes that an energy efficiency target should spear-head such reform. Energy efficiency improvements require some changes to government policies to eliminate barriers to the adoption of new approaches. These barriers include split incentives, information failures, lenders favouring existing approaches while assigning higher risks to new approaches, early adopter disadvantages as well as barriers to the commercialisation of new prototypes.

Energy efficiency is an integral aspect of engineering and Australia's engineering profession is well placed to contribute to the implementation of an energy efficiency target quickly and effectively.

Reliability and resilience

Reliability and resilience of supply need to be considered in any transition plan, not only in generation, but also in transmission and distribution through an interconnected electricity grid. Energy security for the electricity generation sector is a multi-dimensional concept, which touches on issues across the social, political, economic and environmental spectrum.

A secure energy future will be reliant on greater connectivity between state borders so energy can be traded, and the development of smart grids to help strengthen resilience. Baseload power that was supplied by fossil fuel power stations will need to transition to a mix of energy options that combined could provide enough electricity to meet demand peaks when required.

The current grid's overreliance on aging twentieth-century technology based on centralised power generation and interconnected distribution architecture will create future systematic vulnerabilities. The big cities get their power primarily from large clustered power producers located away from urban centres and is transmitted over long, vulnerable, high voltage infrastructure. Transitioning away from large scale fossil fuel power stations to smart-grid technologies with energy storage systems can increase generation and distribution resilience.

Investing in energy infrastructure is an expensive and long-term proposition. To develop this infrastructure, energy producers need to have security of demand to justify the investment. To allow the market to respond appropriately and flexibly to challenges, ongoing market reforms along with assistance mechanisms may be required.

A comprehensive view of energy security is important because electricity does not sit isolated from other energy considerations in Australia. The looming disruption of transport by electric and autonomous vehicles will shift the reliance from liquid fuels to a decentralised grid. Regulators and Government must plan for this disruption now or risk not being able to meet future demand.

To maintain energy reliability and resilience a transition plan is essential. Australia cannot wait to be shocked by future events without a plan for a reformed energy grid. A transition plan needs to include a mix of energy generation and distribution applications, energy storage solutions, and smart-grid technologies into future investment cycles.

Recommendation

Engineers Australia recommends that the Federal Government develop a national energy transition plan which outlines:

- How Australia will achieve its emission reduction targets through the electricity generation sector, outlining a transition from fossil fuel power plants to renewable and low carbon emission options.
- A timeline for when Australia will begin the transition away from major capacity fossil-fuelled power stations, and what generation options will be used to replace them.
- The obligation costs that the major fossil fuel power stations will incur when exiting the market, outlining incentives to exit where required.
- Incentives for investors of new zero and low emission technologies with policies to run alongside research and development, drawing on market forces where possible.
- Changes to the electricity grid to accommodate more distributed generation and management of supply availability and resilience.
- Policies for increased reliability and resilience of Australia's electricity system through a mix of generation and distribution applications, energy storage solutions and smart-grid technologies.

Transition for affected workers

Terms of reference:

(d) policy mechanisms to give effect to a just transition for affected workers and communities likely impacted by generator closures, as agreed in the 'Paris Agreement' including:

(i) mechanisms to ensure minimal community and individual impact from closures, and

(ii) mechanisms to attract new investment and jobs in affected regions and communities;

Public discussion around the future of Australia's electricity generation options can often overlook the potential consequences it can have on workers and communities. Many of Australia's coal-fired power stations are located in regional areas and on the fringes of major cities in small regional towns[20]. These communities become dependent on the economies of the power station, and if the power station were to close, the local town economy and community can be greatly affected.

Widespread community dependence on a major power plant in a regional area can also place pressure on decision makers to continue the status quo, and delay a transition when it is required. Any energy transition policy put forward must address the potential burden a closure would have on a workforce or community that is dependent on the power station.

Both Commonwealth and state governments must work together to ensure the best potential outcome for workers and their families, by investigating further options for structural adjustment packages and the stimulation of new industries. Structural adjustment has long been discussed as a mechanism to handle significant changes in the economy, and this can occur through stimulation to other industries in the region, and through compensation or training to affected workers.

Recently the announced closure of one of Australia's largest capacity power stations, Hazelwood power station and mine, has been in the news, with many workers in the La Trobe Valley expected to lose their jobs. It is estimated that to assist the regional workers and communities, governments have pledged almost $100 million[21].

Sudden announcements such as the Hazelwood closure places pressure on the government to deliver a fast solution to the affected workers. However, a transition plan for Australia's electricity generation system which includes planned structural adjustment packages for workers can help avoid reactive decisions when generators exit the market.

The argument for structural adjustment assistance is that it has the aim to reduce short term economic disruption during a transition period, and it has the potential to minimise long-term unemployment[22]. Any structural adjustment package would need to accompany a clear set of rules, as if there are not clear rules set in place for structural adjustment, costs associated with the program can quickly escalate. This is to ensure that identification of the most affected workers can occur, so that benefits are not wasted[23].

Additionally, any compensation should look to facilitate adjustment rather than providing passive support, and any method of compensation should be transparent as to ensure accountability. The aim of

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[20] Alcorn, D and Stanton, K, June 2016, *What will fill the hole left by coal?* https://www.theguardian.com/australia-news/2016/jun/29/what-will-fill-the-hole-left-by-coal?CMP=share_btn_link

[21] Drape, J and Meehan, M, November 3 2016. The Australian, $85m support for sacked Hazelwood workers. www.theaustralian.com.au

[22] Argy, F, 1999, Distributional effects of structural change: some policy implications. Australian Government Productivity Commission, Structural Adjustment – Exploring the Policy Issues. www.pc.gov.au

[23] Gray, M, 1999, Policy issues in structural adjustment. Australian Government Productivity Commission, Structural Adjustment – Exploring the Policy Issues. www.pc.gov.au

the adjustment should include plans for energy industry workers to upskill, or transition into new industries. Governments have the ability to put forward training and upskilling packages and this can include training these workers to be skilled in the production and maintenance of new emerging renewable technologies. Some structural adjustment methods point to compensation being delivered at a region-wide level, to provide for agreed purposes[24].

Furthermore, research in the United States points to the potential of traditional power station workers to transition into new energy technology workforces. A study which compared existing coal industry jobs to ones in the solar industry found that many of the skill sets were readily transferable[25]. The study found that a relatively minor investment in retraining enables the vast majority of coal-fired power station workers to transition into solar related positions.

As Australia moves towards a new energy mix, it is essential that Australia has the people with the right skills needed to implement and operate these new technologies. An energy transition plan should investigate the potential to transition regional power station workers affected by a shutdown into the next generation of renewable power station operators.

Engineers are vital to the construction, planning, design, maintenance and operation of Australia's electricity generation systems, with a large number of engineers working in the energy industry[26]. Engineers Australia believes that the future of Australia's energy supply will be dependent on a strong engineering workforce.

Engineers will play a critical role in the research, development, production and implementation of energy efficiency measures, and emerging technology options, helping to provide reliable energy to Australian consumers, while at the same time helping to meet Australia's emission reduction targets.

Recommendation

Engineers Australia recommends that the federal Government:

- Investigates the potential use of structural adjustment packages for regional workers and communities most likely to be affected by a shutdown of a major capacity coal fired power station.

- Investigates the potential for a skills transition for workers of coal fired power stations to renewable and other energy power stations.

- Includes a transition plan for workers of regional major capacity power stations alongside any power station transition plan.

[24] Walsh, C, 1999, Structural adjustment: a mainly regional development perspective. Australian Government Productivity Commission, Structural Adjustment – Exploring the Policy Issues. www.pc.gov.au
[25] Louie, P and Pearce, J, 2016. Retraining investment for U.S. transition from coal to solar photovoltaic employment. *Energy Economics*, Volume 57, June 2016, Pages 295–302
[26] Engineers Australia, 2015, *The Engineering Profession: A Statistical Overview*.

Annex A: Inquiry terms of reference

On 13 October 2016, the senate referred the following mater to the Environment and Communications References Committee for inquiry and interim report:

(a) the experience of closures of electricity generators and other large industrial assets on workers and communities, both in Australia and overseas;

(b) the role that alternative mechanisms can play in alleviating and minimising the economic, social and community costs of large electricity generation and other industrial asset closures, drawing on experiences in Australia and overseas;

(c) policy mechanisms to encourage the retirement of coal-fired power stations from the National Electricity Market, having regards to:

> *(i) the 'Paris Agreement' to keep global warming below 2 degrees Celsius, and ideally below 1.5 degrees Celsius,*
>
> *(ii) the state and expected life span of Australia's coal-fired power plants,*
>
> *(iii) the increasing amount of electricity generated by renewable energy and likely future electricity demand,*
>
> *(iv) maintenance of electricity supply, affordability and security, and*
>
> *(v) any other relevant matters*

(d) policy mechanisms to give effect to a just transition for affected workers and communities likely impacted by generator closures, as agreed in the 'Paris Agreement' including:

> *(i) mechanisms to ensure minimal community and individual impact from closures, and*
>
> *(ii) mechanisms to attract new investment and jobs in affected regions and communities;*

(e) the appropriate role for the Federal Government in respect of the above; and

(f) any other relevant matters.

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