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Getting off coal

Economic and social policies to manage the phase-out of thermal coal in Australia

Discussion paper

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Key points

The evidence of a climate emergency is now undeniable. Any coherent response requires a rapid phase-out of coal-fired electricity generation. That also implies an immediate halt to new thermal coal mines and a gradual closure of existing thermal coal mines.

Successful implementation of such a policy requires a strong and concrete commitment to facilitating employment transitions for workers in the industry (including to alternative jobs and/or support for early retirement), and equally strong and concrete measures to promote alternative sources of development and employment for regional communities dependent on coal mining.

Thermal coal mining is not a major employer in Australia's overall labour market, and most employees in the industry have skills that make them employable in a wide range of industries. Moreover, no-one is proposing to “shut down” the industry overnight. A sensible, staged plan for getting off coal, with plenty of notice to affected workers and communities, and with concrete measures to facilitate an orderly transition, could certainly achieve this inevitable shift in Australia's economy with a minimum of economic and social dislocation. Indeed, given the highly uncertain prospects for this industry even in the absence of necessary climate policies, many coal-dependent workers and communities will be better off under a compassionate, proactive transition program than by simple carrying on with “business as usual”.

Because of reliance on FIFO operations, only a small number of communities, mostly in central Queensland, depend critically on coal mining to provide livelihoods for their residents. Specific place-based policies for these communities must be developed.

Specific policies associated with an orderly, effective, and fair phase-out of thermal coal would include:

- An immediate moratorium on new thermal coal mines, including those at an early stage of pre-construction such as the Adani Carmichael mine.
- A phased program of closure for existing thermal coal mines over the period to 2030.
- A phased program of closure of coal-fired power stations over the period to 2030.
- A commitment to (renewable) electrification of transport and a co-ordinated program of investment in necessary infrastructure.
- Measures for further decarbonisation of the economy, including the rapid expansion of renewable electricity generation (to replace the portion of Australian electricity currently provided by coal-fired facilities) and development of a hydrogen industry based on electrolysis and sourced from renewable electricity.

- Strong rights to redeployment, no forced redundancies, early retirement incentives, and income protections for people who end up in alternative but lower-paying jobs.
- A transition fund to assist workers with specialised coal-related skills in retraining or moving to other parts of the mining sector, and the creation of a transition authority with adequate funds and decision-making powers to guide and support transitions in fossil-fuel-dependent regions.
- Targeted development of utility-scale solar PV and associated transmission infrastructure.
- An end to FIFO mining operations in areas where a local workforce is available. Elimination of other exploitative practices including the use of labour hire and excessive overtime.
- Support for unionisation and protection of working conditions in the renewables sector.

Introduction

The consequences of global failure to decarbonise the economy have been dramatically illustrated by the smoke haze that surrounded major Australian cities from spring through summer, including Sydney, Brisbane and Canberra, and by the hundreds of bushfires which generated that smoke. At least 20 people died, thousands of homes and other buildings were destroyed, millions of hectares burned, and uncounted numbers of wild animals killed. The long term effects of smoke exposure will lead to hundreds, perhaps thousands, of premature deaths in the future (Quiggin 2020).

The failure of the Australian government to reduce emissions here, and its promotion of thermal coal exports abroad, have played a significant role in that failure.

Taking account of Australia's own emissions of carbon dioxide and those arising from the burning of coal produced in Australia, this country, with less than 0.3 per cent of the world's population, is responsible (partly or wholly) for 3–5 per cent of total global energy-related emissions of carbon dioxide (RMIT Fact Check 2019a).

Decarbonising the global economy is a task that must be completed over the next three decades. The most immediate and urgent step is decarbonising electricity supply, and in particular, ending the use of coal to generate electricity (thermal coal). Australia needs to phase out thermal coal mining and coal-fired power generation, but not at the expense of workers and communities dependent on these industries.

This paper examines, in detail, the steps required for the first stage in decarbonisation: a transition away from coal-fired power generation in Australia and the mining and export of thermal coal.

The paper is organised as follows. Section 1 deals with the global transition from coal, and explains the important distinction between thermal coal, used to generate electricity, and metallurgical coal used in steel production. Section 2 describes the role of thermal coal in the Australian economy, showing that the role of the industry as a source of jobs and export income for Australia has been greatly exaggerated. This analysis provides a basis for considering the policies needed for a fair and orderly economic transition away from coal. Section 3 sets out the core elements of a phase-out of thermal coal, managing a shift from coal while protecting affected workers and vulnerable communities. In Section 4, some examples of successful transition policies from other jurisdictions are presented.

1. Transition is inevitable, a fair and orderly transition is not

The transition from coal is not, in the end, a matter of policy choice for Australia. Coal-fired electricity generation is in terminal decline globally. The only real choice is between a fair and orderly planned transition,[1] including supports and protections for workers and communities affected by the change, and a policy of delay which will lead ultimately only to a chaotic collapse and more painful displacements. These approaches are exemplified on the one hand by the German energy transition and on the other hand by the collapse of coal-fired power in the United States.

Germany currently spends around $2 billion euros per year (about $A 3 billion) on supporting the transition away from coal (Wettengel 2019). As part of its energy transition, Germany has already ended domestic coal mining, and has set a target of ending coal-fired electricity generation by 2038, a date that is expected to be brought forward (Vaughan 2019). The country's coal exit commission agreed on far-reaching measures to financially assist the affected regions and coal workers and to invest in dozens of infrastructure and training projects. The government has said it aims to maintain the mining areas as "energy regions" and to develop corresponding infrastructure for the production and storage of energy from renewable sources.

The contrast with the United States is striking. Despite the best efforts of the Trump Administration, coal production is collapsing, along with coal-fired electricity generation. The Energy Information Administration forecasts that coal production will fall to 680 million tons in 2020, from a peak of nearly 1200 million tonnes in 2009 (IEEFA 2019). The current number of US coal mine employees is 54,000, down nearly half from 2011. Further declines are inevitable in the future.

Because the process is unplanned, bankruptcies are occurring at a rapid rate, abruptly throwing workers out of employment. In Wyoming, the biggest coal mining state, the bankruptcy of the BlackJewel coal mine cost 600 jobs. The same is happening in West Virginia. Both states voted heavily for Trump, but the Administration has ignored their

[1] There is a diverse range of terminology that has been invoked to refer to the goal of reducing and eventually eliminating fossil fuel production and use, but with due attention to fairly sharing the costs and benefits of that phase-out and supporting affected workers and communities. Many advocates use the term "just transition" to refer to this goal, while others prefer alternative language. Since this paper is concerned with the broader economic aspects of the phase-out of coal (not just its employment dimensions), we refer more broadly to the need for a "fair and orderly" economic and labour market transition.

plight. Displaced coal miners in the US are getting no special assistance more tangible than "thoughts and prayers".

THERMAL AND METALLURGICAL COAL

There are two main uses for coal. Thermal or steaming coal is used primarily in electric power generation and heating, and to a lesser extent in industries such as cement production. Thermal coal is burnt to produce heat energy, turning water into steam and driving turbines. Metallurgical or coking coal is used in the production of steel from iron ore.

Metallurgical coal trades at higher prices than thermal coal. Current prices for metallurgical coal are around $US 130-150/tonne. The highest grade of thermal coal, with a heat content of 6000 kcal/kg, is currently trading at $US 65/tonne. Lower grades of coal, such as that proposed to be produced from Adani's Carmichael mine, typically trade at a discount of 30 per cent or more.

Globally, only about 17 per cent of coal is used in steel production (about 1 billion tonnes out of 7 billion). In Australia, however, metallurgical coal accounts for about half of all exports, and (because of higher prices) the great majority of export income. This means that the impact of a transition away from thermal coal will be easier than is often supposed.

THE GLOBAL TRANSITION FROM THERMAL COAL

Ultimately, it will be necessary to phase out the use of both thermal and metallurgical coal. In the short run, however, the transition must focus on thermal coal. Not only does thermal coal account for the great majority of production, but there exist readily available, and economically competitive alternatives, including solar (photovoltaics and thermal), wind and hydro, as well as rapidly improving storage technologies to address the problem of intermittent supply.

Even without taking account of the environmental costs of carbon dioxide emissions and the health damage caused by particulates, and after allowing for backup storage, solar and wind generation is the cheapest source of new electricity. According to a Bloomberg New Energy Finance report (Scott 2018):

> Our analysis suggests that new-build solar and wind paired with four-hour battery storage systems can already be cost competitive, without subsidy, as a source of dispatchable generation compared with new coal and new gas plants in Australia and India.

Everywhere in the world where decisions are made on an economically sound basis, construction of new coal-fired power stations has ceased. No new coal-fired power stations

have commenced construction in North America, Western Europe or Australia for a decade or more. In the absence of massive subsidies such as those being proposed by the National Party in Australia, no new coal-fired power stations will be built in these jurisdictions,

Once social and environmental costs are taken into account, even partially, existing coal-fired power stations represent the costliest source of electricity currently in operation. As a result, where the social costs are taken into account, coal-fired power is being closed as rapidly as it can be replaced by renewables and (to a diminishing extent) gas.

The end of coal-fired power is already in sight in much of Europe and North America. Coal-fired power generation has effectively ended in Britain, and is set to end throughout Western Europe between 2025 and 2030. Canada has similarly announced a commitment to end coal-fired power by 2030. In the United States, despite the attempts of the Trump Administration to keep coal alive, it seems likely, according to IEEFA and EnergyCentral, that renewables will surpass coal as a source of electricity by 2021, and that most of the country will be coal-free by 2030.

Unfortunately, economic development in Asia accelerated at a time when coal-fired power appeared to be the cheapest option. The prevalence of cronyism and corruption ensures that many of these projects will be carried through, whether or not they are economically justified.

In both India and China, a large number of new coal-fired plants were commissioned before 2015, when they appeared to be cost competitive. Crony capitalists and provincial governments, particularly in China, are heavily exposed to these investments. These investors have used political pressure in an effort to ensure that their projects are completed, and that their financial viability is not undermined by low cost renewables. Despite this political interference, many coal-fired generation investments have nevertheless been cancelled in both China and India (see, for example, Johnston 2017, Russell 2019, Reuters 2020, and Hill 2019).

In addition, a number of East Asian governments and financial institutions have offered concessional finance for coal-fired power plants in less developed countries. China's Belt and Road Initiative has been the vehicle for a number of these projects.

Africa is at the crossroads. As with mobile telephony, much of Africa looks set to skip over the age of large fuel-burning power stations feeding a grid, and move straight to distributed systems based on local renewable energy. Nevertheless, a large number of coal-fired power stations have been proposed, though many have faced resistance. Proposals for coal-fired power stations have been abandoned, or had funding withdrawn in Botswana, Kenya and Senegal, among others (Winning 2019; Zarembka 2019; Bir 2019).

Particularly in countries with limited domestic supplies of coal, the viability of these projects depends on the availability of imported coal. An end to Australian exports of thermal coal

therefore has an important role to play in blocking the expansion of coal in developing countries and accelerating the movement towards carbon-free electricity.

THE GLOBAL TRANSITION FROM METALLURGICAL COAL

By contrast, the transition away from metallurgical coal will be more gradual. In the short run, the most important step will be an improvement in recycling scrap, particularly in China. With efficient recycling, electric arc furnaces, powered by carbon-free electricity generation, can supply a substantial proportion of steel demand.

In the longer term, the most promising approach involves using hydrogen, generated from renewable electricity, to directly reduce iron ore to iron, which can then be used as feedstock for an electric arc furnace. An experimental plant has just opened up in Germany (Mazengarb 2019), and a full-scale switch to carbon-free production is proposed for a US plant, powered by renewable energy, and using directly reduced iron from Sweden (Eller 2019).

Hydrogen can also be produced from lignite, and the Australian government is currently supporting this approach bolstered by the dubious claim that carbon dioxide emissions from the process can safely be captured and sequestered (Parkinson 2018). In reality, the technology for carbon capture and sequestration is totally uneconomic. The most advanced project in the power generation sector, the Boundary Dam project in Saskatchewan, concluded after just one of the coal-fired plant's four units had been converted to carbon capture and sequestration (Seal 2017).

The development and widespread adoption of a carbon-free technology for steel production is unlikely to take place before the 2030s. This implies that the need for Australian metallurgical coal will continue, and that the focus for the 2020s must be on phasing out thermal coal.

2. Thermal coal in the Australian economy

Thermal coal mining is a significant economic activity in Australia, but its importance is generally overestimated. A managed transition out of thermal coal is feasible with relatively modest measures. In this section, the importance of thermal coal is assessed as a source of employment, economic activity (including in particular regions and communities), government revenue and the national economy as a whole.

WORKERS IN THE COAL MINING SECTOR

It is often suggested that coal mining, and thermal coal mining in particular, is a major source of employment. In reality, the proportion of the total Australian workforce employed in thermal coal mining is below one-quarter of one per cent of our total workforce of 12 million.[2] Australian Bureau of Statistics Data on mining is drawn from two different sources, the Labour Force Survey and the Labour Account. The Labour Account is regarded as the more accurate source (RMIT ABC Fact Check 2019a). However, to avoid any risk of underestimation, attention will be focused on to the Labour Force Survey, which generally gives higher estimates than the Labour Account.

According to the Labour Force Survey the coal mining sector currently (August 2019) employs about 46,000 people, down from a peak of 60,000 in 2012. Since Australia's coal output is about evenly divided between metallurgical and thermal coal, it seems likely there are about 20–25,000 employees in thermal coal. This compares with an ABS estimate of just under 20,000 in renewable energy activities.

A successful shift to a decarbonised electricity sector would require at least a doubling of the current growth rate of renewables, implying more than 20,000 new jobs.

It follows that the net employment impact of a transition from thermal coal to renewables is likely to be very small. However, this does not mean that workers will move smoothly from one sector to the other -- nor should we expect them to. There is no reason to suppose that workers displaced from thermal coal will find new jobs in the renewable sector. An effective strategy for managing the employment dimensions of getting off thermal coal will involve providing workers with a full range of well-resourced, supported options for adjustment:

[2] Claims that a large number of people are 'indirectly' employed by coal mining are based on an incorrect understanding of the way the aggregate economy works. This point is discussed below

including opportunities for early retirement, opportunities for other jobs within their industry as it winds down, and retraining and other supports to pursue employment opportunities in non-energy fields. The jobs created in renewable energy will be a modest but welcome increment to Australia's overall employment growth in coming years, but they are not essential for imagining that affected thermal coal workers can successfully adjust to this inevitable change.

Any policy response for a transition must take account of the distinction between workers in specialised mining occupations and those with more general occupational skills who are currently employed in coal mining. Data on this question is available for the mining industry as a whole, as shown in Table 1.

Table 1: Occupational division of employees in the mining industry

Occupation	Number of workers (000)
Managers	17.7
Professionals	37.3
Technicians and Trades Workers	68.9
Community and Personal Service Workers	0.9
Clerical and Administrative Workers	13.7
Sales Workers	1.6
Machinery Operators and Drivers	84.3
Labourers	9.8
Total	**234.2**

Source: Australian Bureau of Statistics (2019b), table: Employed persons by Industry sub-division of main job

As is shown in Table 1, the majority of people employed in the coal mining sector are not miners in the ordinary sense of the term, that is, workers engaged directly in extracting coal. About 70,000 (30 per cent) are in white collar (managerial, professional and clerical) occupations. A large proportion of the remainder, such as carpenters, truck drivers and labourers, work in trades occupations that are not specialised to mining.

The most important mining-specific occupation group for which data is available is that of Drillers, Miners and Shot Firers, which currently accounts for 48,000 jobs or 20 per cent of total mining employment, according to Australian Government Job Outlook data.

If the same proportion applies in coal mining, this would imply that there are around 10,000 specialist coal miners, of whom about 5000 are employed in producing thermal coal. The task of supporting the inevitable shift in employment for these and other workers in the coal industry, fairly and effectively, will be discussed below.

Another important factor of coal mining jobs is the relatively advanced age of coal miners. The average age of mining workers in Australia was almost 42 years in 2018, significantly older than the overall workforce (39.8 years) (Australian Bureau of Statistics 2018, data cube

2, table 4). This implies that a significant portion of the burden of adjustment to the phase-out of coal can be offset through supportive policies to bridge coal miners to retirement -- including generous early retirement incentives. This makes it all the more important to implement a clear, phased timetable for the phase-out, so that older workers can take advantage of those incentives and allow younger workers to keep working for longer.

Discussions of employment associated with mines and other projects often make reference to 'indirect employment' created in industries supplying inputs and services to the project, or arising from the expenditure of people employed in the project. In the past, such discussions were bolstered by reference to 'multipliers' derived from input–output matrixes published by the Australian Bureau of Statistics. The effect was to make projects look more significant in terms of employment benefits. The misuse of this concept was such that the ABS ceased the publication of multipliers.

Except in very special cases, such as that of suppliers of specialised equipment, 'indirect' employment is not relevant in considering issues such as the transition from coal. All industries buy inputs from other industries, and all workers, wherever they are employed, create jobs through their expenditure. If jobs in one industry are replaced by jobs in another, the number of indirect jobs is unlikely to change much. To the extent that indirect jobs are a relevant consideration, the reliance of the mining industry on imported heavy equipment means that it is likely to generate less indirect jobs than other industries of comparable size.

WAGES

Average full-time annual wages in the mining sector are relatively high at around $130,000, compared to average full time earnings of $80,000 for the labour market as a whole. Nevertheless, because so few people are employed in the thermal coal sector, it accounts for a tiny proportion (about 0.25 per cent) of total labour income.

The total amount paid in wages by the thermal coal sector is about $3.3 billion per year (25,000 workers at an average of $130,000 per year). And relative to the enormous revenues generated by the industry, wage payments have declined significantly as a share of total value-added. That means that the social benefits of coal jobs are diminished, with a growing share of total wealth generated in the industry going to the industry's (often offshore) owners.

Total wages in the thermal coal sector are also small in relation to the value of output: equal to barely 15% of the industry's total revenues of more than $20 billion per year. This low share of wages reflects the very capital-intensive nature of the sector. Most of the value of output is accounted for by expenditure on capital equipment (most of which is imported) and by investment returns to owners of capital (most of whom are overseas).

FIFO AND EMPLOYMENT TURNOVER

The acronym FIFO (Fly In, Fly Out) refers to a common method for organising mining work in Australia. Miners live with their families in towns and cities, and work in remote mining locations on a roster basis, commonly consisting of 8 days on, with 12 hour shifts, followed by six days off. At the beginning of each work period, workers fly to the mine site, returning eight days later. The term is also used to encompass similar arrangements where travel to the site is by road (sometimes distinguished as Drive In, Drive Out or DIDO).

FIFO has almost entirely displaced the older mode of mine development, in which mining companies would construct a small town where miners lived with their families, working approximately standard hours. Even in instances where the mine is located close enough to an existing community to permit daily travel to work, many companies have insisted on a FIFO-only basis. The Queensland government has recently acted to restrict FIFO-only arrangements that discriminate against local workers (reported in Australian Mining 2019). However, in the absence of further policy intervention, it remains likely that the great majority of jobs in new projects will be operated under FIFO.

FIFO jobs are generally associated with high wages. But a large proportion of this high pay represents compensations for the many negative aspects and costs of FIFO work. Adverse effects that have been observed or claimed include fatigue from long shifts, family breakdown and higher risk of family violence, and a wide range of mental health problems.

Long working hours are a problem for mining workers generally, though particularly for FIFO workers. Peetz, Murray and Muurlink (2012) found that the median working week for mining employees was 44 hours, but that most workers would prefer to work 40 hours or less.

An indication that the wages earned by workers in the mining industry represent compensation for poor conditions can be derived from evidence on workforce turnover. The mining industry is characterised by annual turnover of 20–30 per cent, substantially higher than that for the labour market as a whole.

Some of this turnover may reflect insecure employment arrangements for workers employed indirectly through contract and labour hire firms. Job insecurity is another example of poor working conditions which offset the seeming value of high wages.

It seems more likely however, that high turnover is driven by the stress, fatigue and family pressures associated with mining jobs, and particularly FIFO jobs. These numbers contrast sharply with the idealised image of a ‘traditional’ mining community in which sons followed their fathers and grandfathers into the same mine, an image that still influences thinking about mining as a source of employment.

The turnover rate is the rate at which workers leave (or are dismissed) from particular jobs. They may go to other jobs in the mining sector, to jobs in other industries or may leave the workforce altogether. As noted by Beach et al. (2003), the rate at which workers switch from mining to other industries will depend on labour market conditions in the communities where they live.

Detailed information on this point is unavailable, but in circumstances of relatively low unemployment such as those prevailing at present, most workers who leave mining jobs go on to find new jobs. Further, given that the majority of workers in the mining sector have skills that are not specific to mining, it seems reasonable to assume that at least half of the workers who leave mining jobs find new jobs in other industries.

Based on this analysis, around 10 per cent of workers in the mining industry (20–25,000 workers) typically leave, either to take up jobs in other industries or to withdraw from the labour force, in an average year. In periods when total employment in mining is roughly stable, as at present, workers leaving the industry are replaced by new entrants.

To restate the point, the perception that high-wage mining jobs are 'good' jobs, compared to jobs in other industries must be qualified. As discussed below, where unions are strong and protect working conditions, better jobs prevail. In the absence of such protections, high wages are only partial compensation for long hours, job insecurity and dangerous working conditions. The high rates of turnover in the industry reflect this.

An important implication of high turnover rates in mining is the normal prevalence of high vacancy rates. If a thermal coal mine closes down as a result of climate policy, there will usually be other mining jobs opening at the same time to replace workers who are leaving their own jobs for unrelated reasons. For FIFO workers and white collar head office workers, there is no need to move home to take up a new job. Hence, for this group of workers well-designed adjustment policies should minimise transitional unemployment arising from an orderly phasing out of thermal coal. This will be discussed further below.

WAGES AND UNIONISATION

Even without the FIFO wage premium, wages in mining are generally higher than those for similarly skilled workers in other sectors.

The other important factor in explaining high wages in mining is unionisation. The mining sector has historically been characterised by higher levels of unionisation, and effective representation from mining unions (including the CFMMEU). The importance of unionisation can be illustrated by the disparity between the wages of unionised workers and contract employees who may be working in exactly the same mine.

As reported in the Newcastle Herald (Kirkwood 2015):

> Contract mineworkers in Hunter coal mines complain they are earning as little as half as much as their directly employed counterparts for doing the same work, sometimes side by side in the same crews.
>
> Directly employed mineworkers in big open-cuts are still earning a typical $150,000 a year, while their colleagues employed through labour hire companies say they usually earn about $80,000 for the same work.

Similar issues arise in the solar energy sector, where unionisation rates (and hence wages) have historically been relatively low. As reported by *The Guardian*, the Queensland government now requires work with live solar panels to be undertaken by licensed electricians, represented by the ETU – a requirement the industry claims will increase costs, but which will also improve the quality and compensation of jobs in that sector.

What matters here isn't any supposedly inherent features of jobs in any particular industry, but rather the extent to which workers are able to organise to defend their interests. The appropriate policy choice is not to defend old unionised industries against emerging industry with low levels of unionisation. It is to reverse the long decline in union membership across the economy as a whole, with a particular focus on areas of growing employment.

As will be discussed below, we need policies to ensure a transition from coal-based to renewable jobs, and to defend wages and working conditions. But the idea that coal-mining jobs are inherently good (or 'real') and solar jobs 'bad' is nonsense, largely reflecting misplaced nostalgia for the extractive/industrial economy of the 20th century.

WORKERS IN ELECTRICITY GENERATION

Electricity generation is a capital intensive industry. This means that most of the employment associated with electricity generation arises in the construction phase, with relatively few jobs involved in the operation of power stations. The 2016 Census showed approximately 10,000 employees in electricity generation. Detailed analysis suggests that around 5000 of these were employed in coal-fired power stations, roughly equivalent to coal's share in electricity generation.

About 2000 were employed in hydroelectric and renewable generation. This proportion roughly corresponds to the proportion of renewables in electricity generation (20 per cent in 2018) (Statista 2018). This means that the number of workers employed to generate a given amount of electricity is roughly the same, regardless of the technology being used. So, there is unlikely to be any net effect on employment in electricity generation from a shift to renewables.

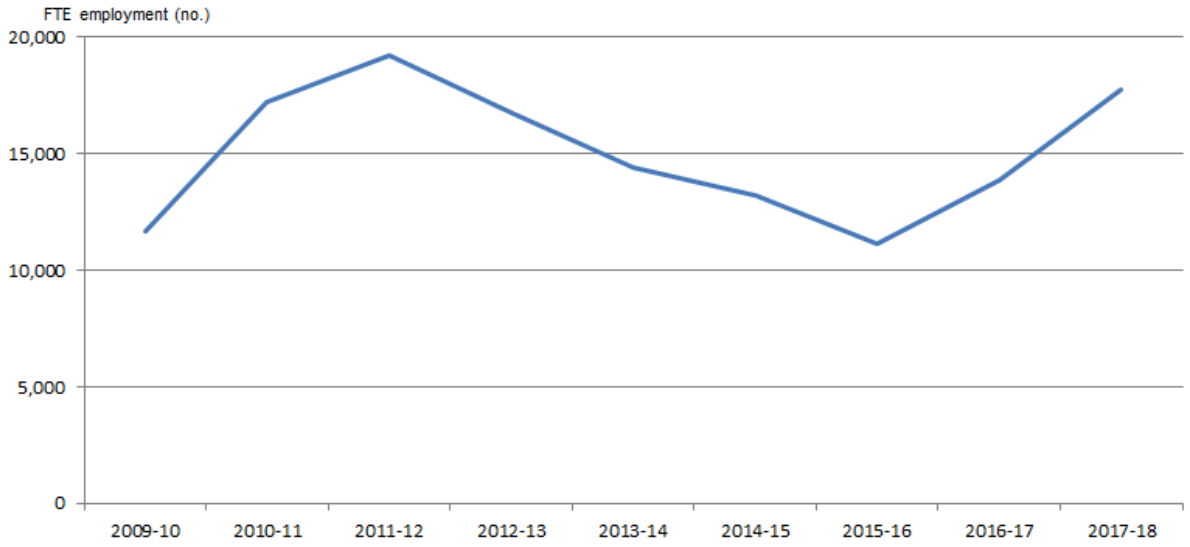
The dominance of the construction phase as a source of employment is most marked in the case of solar and wind power, which are quite labour-intensive in the construction phase. Although the relatively small number of operational jobs is sometimes advanced as an objection to renewable energy, the scale of the required energy transition means that a high level of construction activity will be needed for at least the next three decades. Not only will it be necessary to undertake very large investments in renewable energy to replace existing coal-fired (and ultimately gas-fired) generation, and meet growing demand for existing uses of electricity, but the coming electrification of transport will imply the additional massive increases in total generation.

Overall, a transition away from carbon-based electricity generation will yield a sustained net increase in employment. However, as with mining, some workers will be adversely affected by the transition. As is discussed below, this problem has been addressed in the case of some closures, and ignored in others.

EMPLOYMENT IN RENEWABLES

The renewable energy sector currently provides a little under 20,000 jobs, largely in small-scale solar installations. A policy shift to encourage rapid development of utility-scale solar in regional areas could promote a substantial increase in employment -- more than enough to offset the phasing out of thermal coal-fired electricity generation in Australia, and to replace many of the jobs now provided by exports of thermal coal. This does not imply that all workers in thermal coal should be redirected to renewables. Rather, it shows that an economy based on renewables would generate at least as many jobs as one based on coal.

Figure 1: Renewable Energy Employment, 2009-2018



Source: Australian Bureau of Statistics (2019a)

Nearly 10,000 jobs were lost in the renewables sector between 2012-13 and 2015-16 as a result of the Abbott government's (ultimately unsuccessful) attempt to scrap the Renewable Energy Target. No attempt was made to assist workers displaced by this policy, and no concern was expressed by the government of the day. This is a clear example of how not to manage energy transitions.

COMMUNITIES

The problem of transition is also important for communities dependent on coal mining. However, just as automation has reduced the significance of mining as a source of employment, changes in the structure of the mining industry have reduced the number of communities and regions dependent on mining.

In the past, many Australian communities were located close to mines, and had a long tradition of mining employment. In recent decades, however, most new mines have been based on Fly-in Fly-out (FIFO) models.

As noted above, under the FIFO model, workers and their families live in coastal centres with proximity to airports. Workers fly to the mine site for work periods (for example, ten days on, four days off). The FIFO model is cost-effective for mines, but has been criticised for disrupting family life.

The expansion of FIFO means that, as older mining areas have closed down or been absorbed by urban growth, few new coal mining-based communities have emerged. Cities once synonymous with coal mining, like Ipswich and Newcastle, are now dominated by the service sector, like the Australian economy as a whole.

This point may be illustrated using data from the 2016 Census, which provides data on the industry of employment at various levels of aggregation. The most relevant level of aggregation is referred to as Statistical Areas Level 3 (SA3s), often referred to as Regions. The Australian Bureau of Statistics (n.d.) states:

> **Statistical Areas Level 3 (SA3s)** are designed for the output of regional data. SA3s create a standard framework for the analysis of ABS data at the regional level through clustering groups of SA2s that have similar regional characteristics, administrative boundaries or labour markets. SA3s generally have populations between 30,000 and 130,000 persons. They are often the functional areas of regional towns and cities with a population in excess of 20,000, or clusters of related suburbs around urban commercial and transport hubs within the major urban areas.

In some cases, it is helpful to consider a group of neighbouring SA3s, grouped into a Statistical Areas Level 4 (SA4s).

According to Census statistics, available online as Census QuickStats (Australian Bureau of Statistics 2016), there are four regions in Australia where coal mining is the dominant source of employment, accounting for more than 15 per cent of all jobs. These are the Isaac Region in Queensland's Bowen Basin; the Central Highland Region, located west of Rockhampton and just south of Isaac; the Upper Hunter in NSW and the Collie Region in Western Australia.

The main towns in Isaac (Clermont, Moranbah and Dysart) are heavily reliant on coal mining. Metallurgical coal predominates, but there have been recent moves to expand thermal coal, notably in the Galilee Basin. Of a total resident labour force of 10,000, approximately 3500 were employed in coal mining in 2016.

Although mining is a major source of employment in the Bowen Basin, many of the jobs are filled by FIFO workers. The non-resident population of the Basin was estimated at 18,410 persons, based on surveys undertaken by the Queensland government.

Emerald, the main town in the Central Highlands Region, has historically been characterised by a diverse range of economic activity, but in recent years coal has predominated. Of a resident workforce of 12,000, approximately 3000 were employed in coal mining.

The Upper Hunter is a diverse region. Some towns, such as Muswellbrook and Singleton are heavily dependent on coal mining and electricity generation. However, a range of other activities such as horse breeding and wine production are also prominent.

In Collie, coal mining and electricity generation account for 500 jobs, or about 20 per cent of the workforce.

Clearly, the phasing out of coal mining, even over a long period, would have a substantial effect on the economic viability of these communities. Intervention would be required to develop alternative sources of employment and to prevent social disruption in the course of adjustment. Similar issues have arisen in many other regions and towns affected by the decline of agricultural industries such as dairying and woolgrowing.

These communities are part of larger regions where coal mining is an important source of employment, but accounts for less than 15 per cent of the total. The Isaac Region is part of the larger Mackay, Isaac and Whitsunday Statistical Area, where coal mining accounts for around 12 per cent of total employment. In New South Wales, coal mining accounts for about 9 per cent employment in Lithgow and in the Hunter region (excluding Newcastle). In most of these communities, continued growth in aggregate employment at a rate of 1 to 2 per cent per year, flowing on from the growth in the Australian economy as a whole, will be sufficient to offset a gradual decline in coal mining. The successful transformation of regional cities like Newcastle and Wollongong, once synonymous with coal, but now thriving and diversified regional centres, illustrates this point.

GOVERNMENT REVENUE

Thermal coal mining contributes to government revenue through royalties, company income taxes, payroll taxes, and other sources. General company and employer taxes will continue to be payable, on the same basis, by industries that expand to replace thermal coal. These revenues can therefore be disregarded in the analysis, as in the general case where some industries contract and others grow.

Budget statistics do not give a separate statement of royalty revenues derived from thermal coal. However, based on a price of $A 100/tonne, the Queensland royalty would be 7 per cent or $7/tonne. Assuming production of 250 million tonnes a year, total royalties would be $1.75 billion a year. This amount is modest in relation to the state's total revenue of $60 billion.

Moreover, the fiscal equalisation policy operated under the Grants Commission means that Queensland's share of revenue from the GST is reduced to take account of the availability of royalties. The ultimate effect is that the benefits of royalties are spread across all the states.

Finally, if a carbon price were applied to exports of coal, as well as to carbon emissions within Australia, the revenue from this source would, at least initially, be substantially greater than the royalties from mining.

In sum, the phase-out of thermal coal would have no significant impact on government revenues.

AGGREGATE ECONOMY

Thermal coal production accounts for around 2 per cent of Gross Domestic Product and around 12 per cent of exports (worth around $20 billion per year). Thermal coal is our fifth-largest commodity export behind iron ore, liquefied natural gas, metallurgical coal, and gold; thermal coal exports also lag behind our main exported services, education and tourist/business travel, both of which are likely to be gravely damaged by the climate catastrophe.

However, even these relatively modest figures overstate the economic significance of the thermal coal industry for Australia's trade performance. This is because coal mining relies heavily on imported capital, both in terms of physical capital (plant and machinery) and financial capital (debt and equity). A large proportion of the output and export revenues of the industry is thus offset by payments to foreign suppliers of equipment, and flows of interest and dividends to foreign owners of capital.

The same point applies in relation to the balance of payments. The contribution of coal exports to the balance of payments on goods and services is offset by imports of equipment

and the payment of dividends and interest to foreign owners. As a result, the impact on the balance of payments on current account is modest.

It is already evident that the economic cost of climate change, through damage to tourism, agriculture, and other industries, will far exceed the costs of an orderly phasing out of thermal coal mining. While analysis of the cost of the current drought and bushfire catastrophe cannot yet be undertaken, it will clearly amount to substantially more than 2 per cent of GDP.

To summarise, thermal coal mining is not a significant source of employment, economic activity or government revenue for Australia as a whole. The problem of transition is one of managing localised impacts on small groups of workers and a handful of regional communities. In the context of an economic policy based on a commitment to full employment and a sustainable economy, the achievement of a phase-out of thermal coal is entirely feasible, with no need for undue sacrifice or hardship for the people who currently work there.

3. Planning for a fair and orderly phase-out

Policies that would facilitate an orderly, effective, and fair phase-out of coal, considering its implications for all aspects of Australia's economy (including output, exports, employment, and government budgets) would include:

- An immediate expansion of renewable electricity generation, involving both public and private enterprises with the aim of doubling the current rate of installation and replacing the generation currently provided by coal-fired facilities.
- A commitment to (renewable) electrification of transport and a co-ordinated program of investment in necessary infrastructure.
- Measures for further decarbonisation of the economy, including the development of a hydrogen industry based on electrolysis and sourced from renewable electricity
- An immediate moratorium on new thermal coal mines, including those at an early stage of pre-construction (such as the Adani Carmichael mine).
- A phased program of closure for existing thermal coal mines over the period to 2030.
- A phased program of closure of coal-fired power stations over the period to 2030.

This program would be accompanied by measures to ensure that workers and communities currently involved in the coal industry did not bear the costs of transition. The measures suggested here broadly align with those proposed by the CFMMEU for the transition from domestic coal-fired power generation (Maher 2019), though the CFMMEU remains committed to the production of thermal coal for export.

The key measures include:

- Strong rights to redeployment, no forced redundancies, early retirement incentives, and income protections for people who end up in alternative but lower-paying jobs.
- A transition fund to assist workers with specialised coal-related skills in retraining or moving to other parts of the mining sector, and the creation of a transition authority with adequate funds and decision-making powers to guide and support transitions in fossil-fuel-dependent regions.
- Targeted development of utility-scale solar PV and associated transmission infrastructure. This could be undertaken through new firms such as the Queensland government’s renewable energy enterprise CleanCo. Given the quality of Australia’s solar resource, such investments would be self-financing in an economically rational electricity market. Sadly, mismanagement of the grid, particularly in relation to transmission, is slowing the transition (Keane 2020).

- An end to FIFO mining operations in areas where a local workforce is available
- Elimination of labour hire and excessive overtime

MORATORIUM ON NEW COAL MINES AND THERMAL POWER STATIONS

The first step in a transition from coal must be an end to the development of new thermal coal mines, and particularly of the exploitation of previously undeveloped regions. The result of such developments is to increase the pressure on existing mines competing for the same global market. This will create more disruption and job loss as existing mines (including in Australia) are forced to close earlier. This point may be illustrated by analysis of Adani's Carmichael mine project, which showed that FIFO jobs created in central Queensland would come partly at the expense of existing mining jobs, particularly in New South Wales.

In the absence of government subsidies, it is likely that there will be no further investment in new coal-fired power stations in Australia, and little if any investment in gas-fired power stations. Solar PV and wind are the cheapest sources of new generation, even in the absence of a carbon price, and even taking account of requirements for storage and grid 'firming'. However, these market signals should be reinforced by a clear commitment to end the development of new coal-fired power stations, and gas-fired power stations, and to accelerate electrification of the vehicle fleet. These measures will increase certainty for workers, and slow down the rate of job loss at existing mines and power stations.

A PHASED PROGRAM TRANSITION TO RENEWABLE ELECTRICITY OVER THE PERIOD TO 2030

Most coal-fired power stations in Australia are more than 20 years old, and many more than 30 years old. They are increasingly unreliable, and prone to breakdown at times of peak demand, particularly in summer. With the introduction of a carbon price, all will be uneconomic to operate in the long run. However, the urgency of the task, and the need to manage the transition means that it is no longer sufficient to rely on market forces alone. Governments should set out a proposed schedule for closure of all remaining coal-fired power stations, beginning with the oldest and most polluting. Jotzo et al (2018) provide a detailed analysis of the required measures.

ELECTRIFICATION OF TRANSPORT

Since Australia no longer has a domestic passenger vehicle manufacturing capacity, the transition to electric vehicles does not present significant industrial adjustment issues.

Vehicle companies can simply be required to increase the proportion of electric vehicles they import, increasing to 100 per cent over time, while concessions on registration and other road user charges can be used to encourage motorists to switch.

The main problem is to match demand for electricity to charge vehicles with the supply delivered by the system. A sensible program of time-of-day pricing, combined with incentives to provide charging capacity in workplace and shopping centre car parks, would encourage daytime charging, taking advantage of low-cost solar power. Depending on the technical capacity of the grid, this might be paired with the use of the collected population of car batteries as a method of electricity storage, whereby the batteries of cars not in use could discharge power back into the grid at times of peak demand.

The main requirement is for a co-ordinated program of investment in vehicle charging capacity. Some progress has already been made, but it is not standardised, with the best facilities only available to drivers of Tesla vehicles.

TRANSITION FOR WORKERS

The key elements of an orderly and fair transition for workers are:

- Measures to improve conditions for all workers in the energy sector and in the workforce more generally. In the energy context, these include ending exploitative aspects of FIFO employment, limiting the use of labour hire and other insecure work practices in mining, and extending union conditions to workers in the renewable sector.
- During the transition from thermal coal mining, strong rights to redeployment, no forced redundancies, early retirement incentives, and income protections for people who end up in alternative but lower-paying jobs.
- A transition fund to assist workers with specialised coal-related skills in retraining or moving to other parts of the mining sector.

This section will focus on the transition from thermal coal mining, and will assess the feasibility of measures which would yield a fair and orderly transition. The requirement for redeployment rights and no forced redundancies has already been implemented in the power generation sector in relation to the closures of the Liddell and Hazelwood power stations.

Extending such a requirement to mining companies would be a major step forward for workers in an industry that is already characterised by insecure employment. Planning to avoid redundancies should be part of the process of planning a mine closure – similar to the requirement to clean up mine sites once mining is completed. Similar procedures, such as the requirement to post a bond, could be imposed.

For major corporations, a requirement for redeployment of workers within their organisation should not be problematic. However, many such corporations are abandoning coal, so it is likely that some mine closures will be associated with bankrupt companies unable to meet their obligations (Linc Energy provides a notable recent case).

Government funding will therefore be necessary to support a fair and orderly transition. However, the amount required is modest by comparison with expenditure on lower-priority items.

It is useful to begin with an estimate of the number of workers requiring assistance.

Workers affected by the closure of coal mines fall into four categories

(i) Workers with enough age and seniority to be able to transition to retirement as the industry phases down.
(ii) Workers with general skills and access to the general labour market.
(iii) Workers with specialist mining skills.
(iv) Workers in coal-dependent or depressed regions.

The average age of workers in the mining industry is almost 42 years old (Australian Bureau of Statistics 2018, table 7). Over 25,000 mining workers are already over age 55, with another 43,000 in the 45-54 year old category. Hence a substantial proportion of the mining workforce will be at or approaching retirement over the next decade. Early retirement could be encouraged further with financial incentives to transition to retirement. Younger workers, and older workers who are not ready to retire, can in most cases can be redeployed within the same organisation, or find comparable work in other enterprises. Given sensible planning and the fact that turnover in the industry is high in any case, most such workers will not need to rely on special transition arrangements, although these should be available if needed.

What is also needed here is a more expansionary macroeconomic policy focused on reducing the overall unemployment rate, so that displaced workers can more easily find new jobs. There is no reason for discriminating between workers in identical or similar circumstances simply because their reasons for losing their previous jobs are different.

A phase-out of thermal coal mining over ten years would imply a loss of between 500 and 1000 specialist mining jobs each year. Taking account of early retirement, natural attrition, and redeployment within the mining industry, the number requiring special assistance for transition, or a top up to offset the loss of premium wages, would probably be no more than 250 per year. An assistance package of $100,000 per year, available for up to 2 years, would imply an outlay of no more than $50 million per year.

While the details of the assistance provided would depend on individual needs, it would be reasonable to budget $50,000 per worker in adjustment assistance, implying a budget cost of $25-50 million per year.

The needs of workers in the second category are best addressed at the regional level, with targeted measures to assist in a transition. Policies of this kind are discussed in the following section.

ASSISTANCE TO COMMUNITIES DEPENDENT ON COAL MINING

In aggregate, the transition from coal to renewables will generate a net increase in employment. This has already been seen in the United States, for example, where renewables employ more people than coal, even though their share in electricity generation is comparable, and coal is also used in steelmaking and exported.

It is sometimes argued that employment in renewables is only associated with the construction phase of projects. It should be noted that the same is true, to a substantial extent, for coal mining and coal-fired power investments. What matters in both cases is employment averaged over the operating life of the asset. This is higher for renewables. These aggregate results indicate that fears about the impact of a shift to renewables are misplaced as regards the national economy. However, it is of little comfort to coal-dependent communities that job losses in their region may be matched by gains elsewhere.

The problem of finding new work opportunities in coal-dependent regions is potentially eased by the fact that Queensland has excellent solar resources, and this is especially true in coal-dependent regions. However, investment decisions in the National Electricity Market are mostly left to private firms, and driven by factors such as connections to transmission grids, which have proved highly problematic (Hannam 2020).

An orderly and fair transition for regional communities requires intervention by governments at two levels. First, governments must direct focused attention to job creation in affected regional areas. This can include the construction of new solar and wind projects in coal-dependent communities. But it can also include job-creating investments and services in other sectors: including other mining, manufacturing, and private and public services. Regional communities face a challenge of creating new jobs, and retaining local workforce, that is much larger than just the transition impacts of phasing out coal. By implementing a broader response to those regional employment challenges, the task of adjusting to the phase-out of coal becomes much easier.

Second, the procedures of the NEM must be changed to make grid connections for renewables a top priority, even if the result is to impose higher costs on existing coal-fired generators.

As was noted above, the main communities where coal mining plays a major role as a source of employment are in Queensland's Bowen Basin (Mackay, Isaac and Whitsunday) and Central Highland regions, and in the Upper Hunter region in NSW. Historically, these communities have had a diverse economic base, including agricultural production, tourism and a variety of service industries, as well as coal.

The Bowen Basin has excellent potential for solar and wind energy, but only a fraction of this has been exploited. As of June 2018, six solar energy projects were under construction across the region. The largest of these, the Collinsville Solar Photovoltaic Project (RATCH), and the Rugby Run Solar Farm (Adani Australia 2018), generated 200 and 175 jobs respectively in the construction phase, which lasted about a year, and created capacity of 43 MW and 65 MW respectively (Australian Renewable Energy Agency 2020).

The areas in question would be ideally suited to the development of utility scale solar and photovoltaics. The solar resource is excellent, with around 300 sunny days per year, and 3000 annual hours of sunshine. Coastal areas including Bowen are generally windy. Under the current National Electricity Market (NEM) system, however, the availability of an energy resource is not sufficient to ensure its development. Despite the 'market' label, the NEM embodies a complex and opaque set of rules governing investment in electricity generation, distribution and transmission, designed with coal-fired power in mind and operated largely in the interest of existing coal-fired generation. As is now widely recognised, the system has been a complete failure in its primary goal of delivering reliable and cheap electricity, and is in need of fundamental reform, with the goal of facilitating a fair and orderly transition to a fully renewable electricity generation system.

In the absence of such reform, however, direct government action will be needed to ensure the development of the renewable resource in the Bowen Basin and Central Highlands regions. Government should commit to the expansion of utility scale renewable energy, with a construction program planned to continue over 10 to 20 years.

Investment in generation can be facilitated through CleanCo, the Queensland government's renewable energy enterprise. In addition, there will be need for large-scale investment in battery storage, which can also be undertaken through CleanCo, and in the transmission networks needed to connect new energy sources to the grid.

The Upper Hunter has similar potential but it has not yet been exploited fully. The Upper Hunter wind energy project has been under development for some years but is only just entering the construction phase (Upper Hunter Energy Park n.d.).

Both the Bowen Basin and the Upper Hunter are located in regions with excellent potential for growth in a range of industries, notably including tourism. Managed expansion of those industries will be needed to ensure that currently coal-dependent communities share in the benefits of growth.

4. Examples of successful and unsuccessful transition

The most prominent example of a successful move away from coal is provided by the German Energiewende (energy transition). The process began with a decision to move away from nuclear power. This was a mistaken choice of priorities, given the greater urgency of reducing carbon dioxide emissions from coal. However, the main interest here is the way the transition was managed to minimise harm to workers and communities.

As discussed by Climate Strategies (2018), the key features of the process include:

- Research to understand the labour market and the profile of the coal workforce (age, skills, and educational profile).
- Setting a timeline for coal phase-down and allowing existing workers to retire naturally.
- Providing a bridge to pension for older workers or offering voluntary redundancy packages.
- Developing regional worker transfer programs to support the direct transfer and on-the-job retraining of workers with appropriate skills to move to an alternative local job.
- Redeploying: offering employees who may struggle to find work in other roles or sectors the option to transfer their skills to alternative coal-based sites with the company.
- Establishing integrated multi-purpose retraining programs.
- Supporting workers who have appropriate skills or are willing to retrain to take on alternative roles within energy companies.

The Energiewende has provided a model for other European countries, including Spain. A similar Europe-wide approach, the 'European Green Deal', is now being developed.

The success of a well-planned, well-resourced approach to getting off coal, based on solidarity with affected workers, can be seen in European countries that have eliminated or greatly reduced reliance on coal, without the social and political conflict that has plagued Australian policy for decades.

There have been local successes in Australia. With the impending closure of the Liddell Power Plant, the owner AGL has agreed to repurpose the Liddell site to produce electricity from gas turbines, battery storage and pumped hydro storage. The company has also given the CFMEU a commitment that there will be no forced redundancies (Maher 2019)

Another example is the Worker Transfer Partnership Scheme, created after the sudden closure of the Hazelwood power station – and later expanded in response to additional shocks including the closure of a timber mill in the district with a total loss of 900 jobs. The Andrews government established a special economic zone as part of a $266 million investment package.

Although not all workers returned to full-time permanent employment after the closure, the aggregate effect on the community was striking, with 2000 new jobs created and an unemployment rate of only 3.5 per cent. That is lower than the average for regional Victoria and for the state as a whole.

As in the case of Liddell, the involvement of the CFMEU was crucial in the development of the scheme (CFMEU 2017).

FURTHER DECARBONISATION

As the analysis above has shown, a transition from thermal coal will be only the first step in a broader transformation of the energy economy, aimed at achieving full decarbonisation by 2050. Such a transformation will require the end of nearly all carbon-based fuel production and use, including metallurgical coal, natural gas and petroleum. This in turn requires decarbonisation of electricity supply, electrification of motor transport and the replacement of current industrial processes for the production of materials such as steel and cement. A number of detailed plans for such a process have been developed, including by Rockstrom et al (2017) and Jacobsen et al (2017).

The magnitude of the climate crisis and the failure to respond in Australia means that a gradual, market-driven transition to a carbon-free economy is no longer an option. Carbon pricing is still necessary to ensure that emissions are reduced across the economy as a whole. A carbon price of at least $A 50/ton should be introduced as soon as possible, and increased to at least $A 75/tonne by 2030.

For large-scale emissions, market based measures such as carbon pricing must be combined with a managed program of decarbonisation. An outline of the other measures that are needed includes:

(i) Gradually replacing gas-fired electricity generation with a combination of renewables and storage (battery and pumped hydro). The Morrison government's plans to underwrite new gas-fired stations should be abandoned, and existing gas-fired plants closed down progressively over the 2030s, after the transition from coal is complete.

(ii) Decarbonisation of transport. The first step should be the introduction of fuel efficiency requirements for motor vehicles, becoming more stringent over time. Internal combustion engines should be phased out over the 2030s in favour of

electric vehicles. This process will imply continued construction of utility-scale renewable plants, replacing imported oil and generating a substantial gain in jobs.

(iii) Improved land use. Existing measures should be greatly expanded, including reforestation and the development of feed mixes that reduce methane emissions.

(iv) Industrial processes. The adoption of alternatives to carbon-intensive industrial technologies must be required as soon as it is technically and economically feasible.

Concluding comments

A fair and orderly phase-out of thermal coal from Australia's economy is both essential and economically feasible. Australia can end its production and use of thermal coal by 2030, while protecting the interests of workers and communities, at a very modest cost. The costs of not acting, by contrast, are both huge and obvious.

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