Powering the next boom

Part 1

Phasing down gracefully

Halving electricity emissions this decade

Blueprint Institute

Contents

About Blueprint Institute

Every great vision starts with a blueprint. We help move ideas to action.

Blueprint Institute exists to inspire reform by presenting bold ideas, honest conversations and evidence-based research. We offer fresh thinking to help leaders take a step back from the day-to-day and see the bigger picture. We design blueprints for practical action as a step towards creating a more resilient and prosperous Australia.

Blueprint Institute was established in the era of COVID-19, in which Australians have witnessed how tired ideologies have been eclipsed by a sense of urgency, pragmatism, and bipartisanship. The challenges our nation faces go beyond partisan politics. We have a once-in-a-generation opportunity to rethink and recast Australia to be more balanced, prosperous, resilient, and sustainable.

For more information on the institute please visit our website - blueprintinstitute.org.au.

Acknowledgements

Thanks to the various experts who have been consulted on the development of this work, and for the excellent research assistance provided by Thomas Barrett and Aurora Hawcroft.

Images courtesy of UnSplash.

This series

On 29 October 2020, Blueprint Institute launched our energy initiative with the report *Powering the next boom: Priorities for energy reform in the coming decade*. The report set out our lacklustre progress on emissions reductions to date, as well as the challenges and opportunities we face in decarbonising our energy sector in the coming decades. This paper, *Phasing down gracefully: Halving electricity emissions this decade*, which is the first edition in our *Powering the next boom* series, will be followed by subsequent editions addressing the critical impediments to our energy decarbonisation task.

Attribution

This report may be cited as: Beal, E., D'Hotman, D., Hamilton, S., Heeney, L., Steinhert, J. (2020) Phasing down gracefully: Halving electricity emissions this decade. Blueprint Institute.

21 December 2020

About the authors

Emma Beal
Researcher

Emma has a Bachelor of Advanced Finance and Economics (First Class Honours) from the University of Queensland. As part of her Honours, she investigated the commercial viability of large-scale battery energy arbitrage within the Australian market. Throughout her studies, she completed an exchange with Harvard University, and was awarded one of six international Women in Business Scholarships by Zonta Club for demonstrating outstanding potential within the field. With experience in private equity and consulting, Emma has previously worked for the Queensland Investment Company's Global Infrastructure team and within Deloitte's Energy Financial Advisory team.

Daniel D'Hotman
Director of Research & Operations

Daniel is a Rhodes Scholar and medical doctor currently completing his PhD at the University of Oxford. With a strong interest in business and innovation, Daniel was awarded one of two undergraduate scholarships in the Asia-Pacific by the Boston Consulting Group, undertaking health systems and private equity projects in Sweden. Daniel has published a variety of academic papers, with one of these articles selected amongst the 'Best in Philosophy' collection for 2019 by Oxford University Press. His work in the media has been featured in The Spectator, The Sydney Morning Herald, The Sun Herald, Herald Sun, Brisbane Times, The Critic, The Mandarin, Government News, and The Conversation.

Steven Hamilton, PhD
Chief Economist

Steven is an Assistant Professor of Economics at The George Washington University in Washington, DC. Steven authored a major small business support policy proposal in the US for the Brookings Institution, and has provided extensive commentary in the US and Australia on wage and small business supports during the COVID-19 crisis. Steven has published opinion pieces in the Washington Post, the Australian Financial Review, and The Age, among others, and has provided economic commentary to the New York Times, the Wall Street Journal, the LA Times, Time Magazine, Newsweek, The Atlantic, Slate, The Hill, the Sydney Morning Herald, and The Australian, among others. Steven is a former economist at the Australian Treasury, where he worked on the federal budget and the Garnaut Climate Change Review Update. Steven holds a PhD and MA in economics from the University of Michigan, and a Bachelor of Economics with First Class Honours and Bachelor of Business Management from the University of Queensland.

Luke Heeney
Researcher

Luke recently graduated from the Bachelor of Advanced Finance and Economics (Honours) at the University of Queensland, where he is also completing a Bachelor of Science. Luke has previously worked at Grattan Institute in both their Energy and Health Programs, where he modelled wind farm developments and published on aged care reform. Luke worked as an intern economist at the Reserve Bank of Australia and as an undergraduate analyst at Queensland Investment Corporation. During university, Luke developed a new method to optimise and compare the value of developments in Renewable Energy Zones. He is passionate about fostering student leadership and improving cultures in student residences, and serves on the Advisory Board of the National Association of Australian University Colleges, where he also writes and presents on student leadership topics.

Josh Steinhert
Researcher

Josh recently graduated from the University of Oxford with a degree in Politics, Philosophy, and Economics (PPE), where he specialised in Politics of the Middle East and Political Theory. He is currently completing postgraduate studies in resource economics at University College London.

Summary

Net-zero is inevitable, by 2050 or even earlier. To get there, our economy will need to undergo a tremendous structural transformation. The longer we delay, the costlier it will be. Our 2030 emissions target is a critical milestone on the path to net-zero. Relying on the COVID-19 slowdown and uncoordinated state action only to fall short of our Paris target isn't a promising start.

To begin the transformation, we should commit to halving emissions from coal-fired electricity this decade. Given the states are already committed to forcing renewables into the grid at record pace, we could very well reach our 2030 target without federal action. But this ad-hoc and scattershot process will be unnecessarily costly, and poses significant risks. One only needs to remember the debacles that were Port Augusta and Hazelwood—and imagine them on a national scale—to appreciate the threat we face. Failing to act risks supply shortfalls and price spikes.

We need national leadership to secure certainty for energy communities, workers, consumers, and investors around the inevitable phasedown of coal-fired generation. To that end, the Government should introduce the Coal-Generation Phasedown Mechanism (CPM), to be administered by the Clean Energy Regulator as with the Emissions Reduction Fund and Safeguard Mechanism. The CPM has five components:

1. **ANNOUNCE SECTORAL EMISSIONS TARGETS FOR 2026, 2028, AND BEYOND 2030.** Under the Safeguard Mechanism, sectoral emissions caps can be applied to generators down to 50% by 2030 to drive participation in the CPM. A certain step-down in coal generation would generate a clear market signal, pulling investment in renewables and firming into the grid in advance.

2. **OFFER CONTRACTS ACROSS THE THREE TIMEFRAMES FOR EMISSIONS SUMMING TO THE TARGETS.** Contracts for emissions (rather than electricity supply) for the three timeframes would be determined simultaneously, favouring less emissions-intensive plants. The contracts wouldn't only cap emissions, but also guarantee a minimum electricity supply right up to contract expiration.

3. **IMPLEMENT A SEALED-BID AUCTION SYSTEM FOR ALLOCATING THE CONTRACTS.** Participants would submit their valuations for generating quantities of emissions for each timeframe. The auction system would then allocate contracts and determine relative prices to minimise economic costs, but could also accommodate other factors; e.g., geographic concentration.

4. **IMPOSE MUTUAL OBLIGATIONS TO AFFECTED WORKERS UPON EXPIRY OF THE CONTRACTS.** In order to participate in the CPM, generators would be required to offer redeployment opportunities for affected workers upon contract expiry. Where this is not possible, retraining and generous remuneration arrangements would be required.

5. **ACCOMMODATE A GOVERNMENT FUNDING ALLOCATION (POSITIVE, ZERO, OR NEGATIVE).** At one extreme, the CPM could generate revenue to be redirected to local communities. At the other, generators could be fully compensated for their lost profits, though this would come at considerable cost to taxpayers. The CPM can also accommodate any intermediate funding allocation.

What energy communities, workers, consumers, and investors have long desired is the certainty that comes from national leadership. It isn't about ending coal-fired generation—the plummeting cost of renewables and state policies to push them into the grid have already made that decision. But the last thing anybody wants is an uncontrolled detonation. The Commonwealth's role is to coordinate an orderly phasedown at minimum economic cost, and to ensure that cost is shared fairly. It's time to step up.

Introduction

A massive transformation of our electricity supply is underway. In 2019, 21% of our electricity came from renewable sources. Since the last coal plant was commissioned in 2009, wind power has grown by 15% a year, while solar has grown by almost 50% a year. And that pace is accelerating.

The surge was spurred initially by the Renewable Energy Target and generous subsidies for rooftop solar. But in recent years, renewables have begun to fly under their own power. Since 2009, the cost of solar energy has fallen by a factor of ten. Long gone are the days of coal as our cheapest source of energy. Quite apart from climate change, we've stumbled upon zero-marginal-cost energy—and coal makes no sense for filling in the gaps. Coal plants have become so uneconomic they're sometimes paying to produce electricity because idling them would be even costlier.

Meanwhile, this trend—along with a desire to quench the public's thirst for leadership on climate—has prompted state governments to aggressively promote renewable energy. Every state and territory is committed to net-zero by 2050. The Queensland and Victorian governments are committed to 50% renewables by 2030—and South Australia to 100% by 2030. New South Wales has set out an ambitious plan to build out renewables and firming capacity. Queensland is moving there via significant investments by its state-owned renewable electricity generator, CleanCo. And Victoria by state funding for additional Renewable Energy Zones to be served by the private sector.

Yet despite this aggressive promotion of renewable energy, Australian governments—both state and federal—are yet to face up to the inevitable implications for our legacy coal-fired electricity generators. As it stands, just 18% of coal-fired generation is due to go offline in the next decade. At the current pace of renewables growth, that is implausibly low. The relentless march of renewables will undoubtedly result in many more plant closures, perhaps significantly earlier than currently scheduled.

But the communities affected and the investors needed to replace this lumpy generation remain in the dark. The Commonwealth doesn't face a decision of whether to end coal-fired generation. Its end is inevitable, its role in permanent decline. All that's left for the Commonwealth to decide is whether it's willing to step up and coordinate an orderly phasedown that provides certainty for communities, workers, consumers, and investors.

It might be tempting to take the path of least resistance—if the coal-fired generators are going to jump on their own, why bear the political costs of pushing them? But the status quo carries significant risks. We know they'll go, but we don't know when. And while they're currently required to give 42 months' notice, that's untested and might be bypassed if critical equipment fails or market conditions deteriorate. But even if they were to follow the rules, it's not clear this would be enough. Replacement generation and the wires to connect it take many years to plan and build. And what if several generators announce closures all at once?

The National Electricity Market (NEM), by definition, crosses state borders. Renewables investments and resultant coal withdrawals in one state unavoidably spill over to the others. Coal plants are lumpy sources of electricity—a single plant can supply up to 20% of a state's total capacity. An early withdrawal—as we saw with Port Augusta and Hazelwood—can be highly disruptive to neighbouring states. An uncoordinated, ad-hoc, state-based approach—as we currently have—will make the transition costlier and riskier than it needs to be. This is exactly the kind of scenario envisaged in the Constitution for federal action.

We should instead aim to achieve an orderly phasedown of coal-fired electricity, starting with a 50% reduction in coal emissions this decade. We should do so at the lowest possible cost, while ensuring that cost is shared fairly. We should secure certainty in the path of coal-fired generation to provide a clear signal to investors in the renewables and firming needed to replace the lost capacity. And to give communities and workers clarity about their future, and ample time to plan and adapt.

Coal's exit from the grid is inevitable. How it exits is up to us. But it deserves to bow out gracefully.

The exit of coal-fired generation is inevitable

Halving electricity emissions this decade is a downpayment on net-zero by 2050

Under the Government's latest projections, formulated during the COVID-19 economic recovery phase, emissions are expected to fall by 6.8% this decade (see Figure 1). An improvement over previous projections, this relies on assumptions that are highly sensitive to factors beyond the Government's control. The Government has expressed optimism about achieving its Paris target of a 26% reduction on 2005 emissions by 2030 on the back of these projections—but even with them, we are set to miss the target by 56 Mt CO_2-e.

The pandemic generated a significant reduction in economic and physical activity, which flowed through to a significant reduction in emissions in 2020. The projections then bank this reduction in emissions through the decade. Indeed, they include an alternative projection that assumes a stronger economic recovery from COVID-19, which would see Australia miss its Paris target by 262 Mt CO_2-e.

Emissions reductions achieved via a contraction in economic and physical activity do contribute to a reduction in global warming and thus rightfully count towards our emissions abatement task. But they are by nature temporary, and subject to significant downside risk. Moreover, our international partners aren't looking for us to achieve emissions reductions in this way—rather, they want to see us take real action that reduces our carbon footprint irrespective of economic conditions at a given time.

If we're successful in restoring more rapid economic growth, our emissions too will resume more rapid growth. This is because we will have failed in the meantime to structurally transform our economy into one that generates fewer emissions from a given level of activity. Any reduction in emissions that isn't achieved via a reduction in the emissions intensity of economic activity should not be considered an achievement. To permanently reduce our carbon emissions, we must reduce our economy's structural reliance on them.

All sectors of our economy will eventually decarbonise. But in the absence of an economy-wide carbon price, we must choose the areas to decarbonise first. The electricity sector is the low-hanging fruit of our emissions-reduction task. Electricity is our largest source of emissions, accounting for a third of the total (see Figure 2). By starting there, we can feasibly

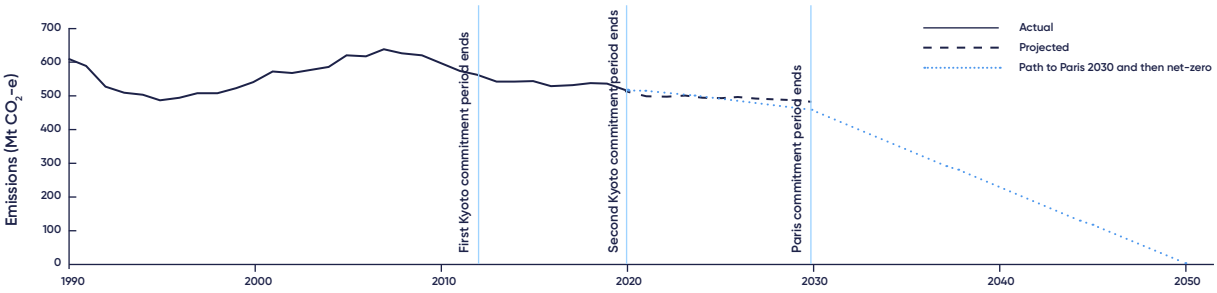

Figure 1 Australia's emissions, 1990 to 2030 with projected path to net-zero **Source** Department of the Environment and Energy; Blueprint Institute Analysis

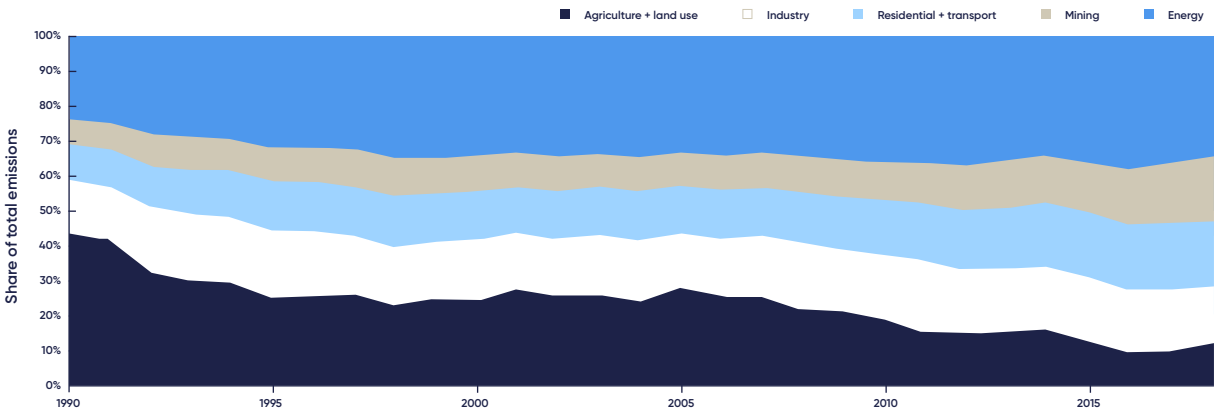

Figure 2 Australia's emissions by sector, 1990 to 2018 **Source** Department of Industry, Science, Energy and Resources

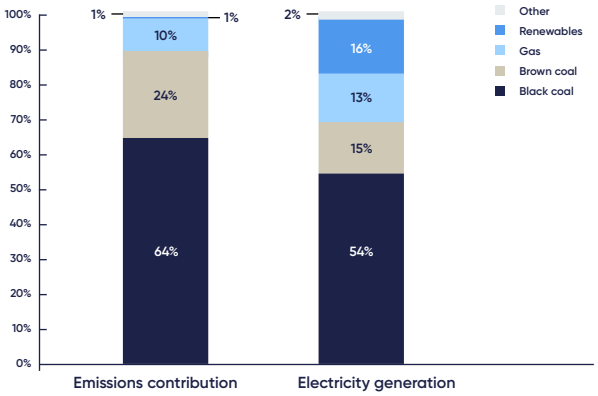

Figure 3 Contribution of generation type to electricity supply & emissions

Source Clean Energy Regulator

achieve our Paris target at minimal cost, and get ourselves on a shallower glide path to net-zero by 2050. Though even in the absence of federal action, significant progress is being made there.

Abatement in the other sectors will be tougher. While we could (and should) make at least marginal progress in areas like transport, industry, and agriculture, deeper gains will require innovations that will take the right policy settings and time to materialise. Not even an economy-wide carbon price would be able to unlock all of the necessary gains in the near future. But in electricity, at least, the solutions for achieving deep decarbonisation are more or less known: variable wind and solar generation with firmed capacity from gas, batteries, and hydro. All we require are the right market settings to make it happen.

The Government currently expects electricity emissions to decline by around a third this decade due to greater renewables penetration. This is driven by cost reductions in renewables technologies, greater rooftop solar take-up, and significant support for renewables projects by state governments. It is happening despite the Federal Government, not because of it.

Based on pre-COVID-19 emissions in other sectors, a reduction of 43% in emissions from electricity generation would be needed to achieve our Paris target—a target that we will face international pressure to strengthen in the lead-up to the 2021 climate meetings in Glasgow. To ensure we comfortably meet our current target, and begin to structurally transform our economy on the way to net-zero, we should aim to halve our electricity emissions this decade.

Coal contributes 89% of emissions in the electricity sector (see Figure 3). At current emissions levels, a 38% reduction in our coal emissions would be sufficient to meet our Paris target (see Figure 4). Australia's ageing fleet of coal-fired generators are unlikely to be suitable candidates for carbon capture, utilisation, and storage technology. Some are likely to be unviable as it is, and the cost of retrofitting would only make them less so. The most efficient means of reducing emissions from coal-fired generation is likely to involve closures or capacity reductions.

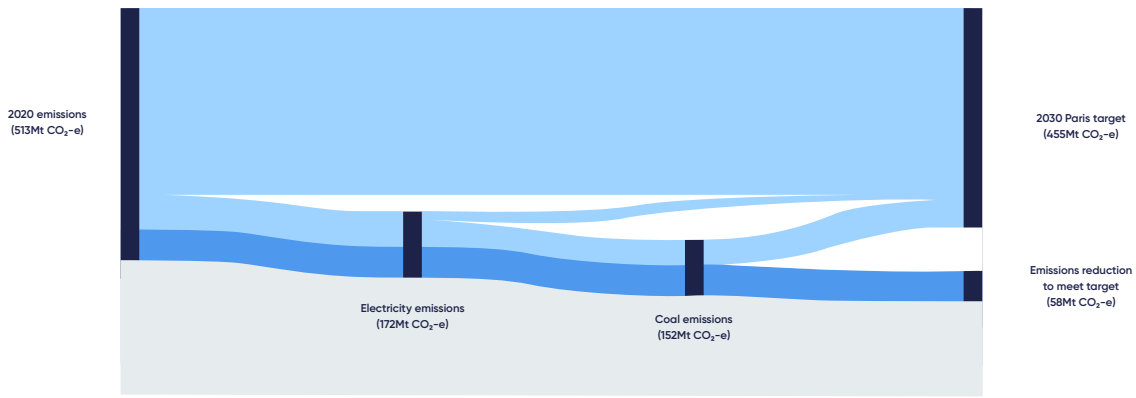

Figure 4 Pathway to reducing emissions from coal-fired generation to meet Paris target

Source Blueprint Institute analysis

Our coal industry can thrive even as coal-fired electricity generation declines

Australia has enjoyed a massive boom in coal exports since the 1990s, with domestic production nearly doubling in the decades since (see Figure 5). Coal has been our second-largest export over the past decade, second only to iron ore (see Figure 6). Australia exported $55 billion (2.9% of GDP) worth of coal in 2020—$34.6 billion of metallurgical coal and $20.4 billion of thermal coal. These exports contributed $6 billion to state government revenues in 2019.

While the two are often conflated, the inevitable decline of coal-fired generation has very little to do with the success of our coal industry and the overwhelming majority of jobs it supports. Most of the coal mined in Australia is metallurgical coal, used in steelmaking. The rest is thermal coal, used in electricity generation, but the majority of that is exported. Indeed, more than 80% of all the coal mined in Australia is exported—the prices paid and volumes bought by our trading partners are out of our hands.

The coal industry in total employs more than 50,000 Australians, and an additional 120,000 workers indirectly. But the coal-fired generation sector employs fewer than 10,000 workers, including the thermal coal miners that supply the generators. A commitment to halve our emissions from coal this decade would see roughly half these workers lose their jobs. Any suggestion that an Australian commitment to net-zero by 2050 or a drive to decarbonise our electricity sector risks the future of our coal industry is simply false. A zero-emissions electricity sector and a thriving coal export industry are perfectly compatible.

While almost all of our major trading partners have signed up to net-zero, they're likely to continue to buy significant quantities of our thermal coal this decade. But as they begin to decarbonise their electricity sectors, their demand for our thermal coal will decline. Indeed, coal-fired generation peaked globally in 2018. Over 74% of our thermal coal exports go to China, Japan, and South Korea, which have all pledged net-zero. Some of the lost demand will be filled by India, where coal imports are forecast to rise 4.1% annually to 2050. Even so, this will not be enough to prevent a fall in demand for our thermal coal in the medium term.

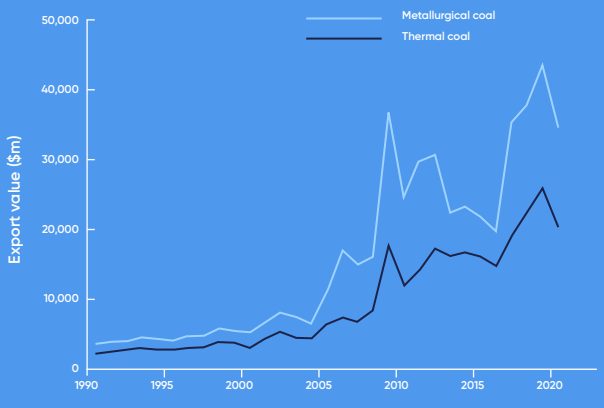

Figure 5 Exports of thermal and metallurgical coal
Source Department of Industry, Science, Energy & Resources

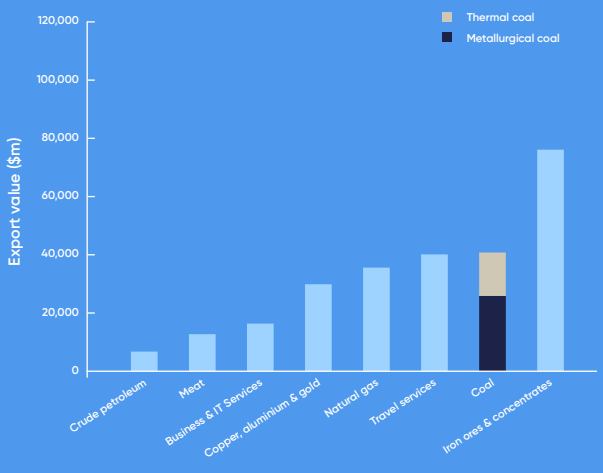

Figure 6 Value of major exports in 2019–20
Source Department of Foreign Affairs and Trade, Department of Industry, Science, Energy & Resources

The future of metallurgical coal, which makes up the majority of our exports, is secure for at least the next decade. Metallurgical coal is necessary to make steel, and we are yet to develop and commercialise zero-emissions alternatives. So notwithstanding their net-zero commitments, robust steel production by our major trading partners is likely to continue to underpin robust demand for our metallurgical coal for some time. This will secure the majority of jobs in our coal industry, as well as generating economic activity in local communities and revenues for state governments.

Beyond this decade, the future for metallurgical coal is less certain. To reach net-zero, our trading partners will need to develop and commercialise alternative, zero-emissions industrial techniques. Green hydrogen, produced using renewable energy, presents a promising opportunity. Many nations have made significant investments in green hydrogen during COVID-19; this could accelerate technological progress and cost reductions. To guard against a decline in metallurgical coal exports, Australia should build on our natural advantages in renewable energy, and investigate the opportunities presented by green hydrogen, consistent with the Technology Investment Roadmap.

Renewable energy is changing the economics of coal-fired generation

Coal-fired generators are designed to last around 40–50 years, but about two-thirds of Australia's current coal-fired generators—accounting for around a quarter of NEM capacity—are due to retire in the next two decades (see Figure 7). No coal-fired generator has been built in Australia since 2009. Coal-fired generation peaked in absolute terms in 2006-07, declining thereafter following a series of generator closures (see Figure 8). New investment in coal-fired generation seems inconceivable due to the falling cost of renewables and storage, not to mention the emissions policy outlook.

Australia's coal fleet varies in type, size, age, and remaining technical life. These are all important determinants of profitability, but uncertainty about future costs plays a critical role. As they age, coal-fired generators require significant capital expenditures to remain operational. Increased renewables penetration—driven by state government support and declining costs—is driving down the cost of electricity, which is putting pressure on coal-fired generation.

Some will inevitably close ahead of their currently scheduled closure dates. Renewable energy is rapidly transforming the NEM. Gone are the days when coal was the cheapest source of energy. Significant investment by governments and corporations has led to a massive decrease in the cost of renewable energy technologies—unsubsidised renewables are now being pursued for their low cost alone.

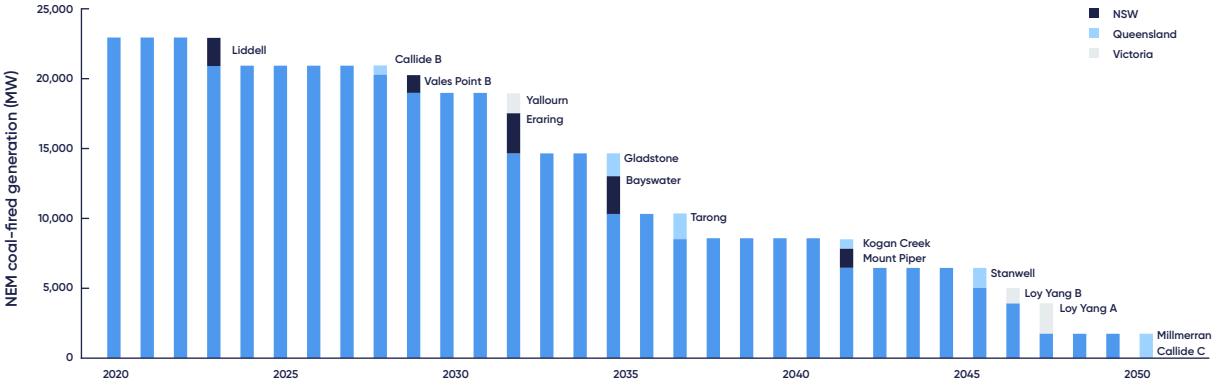

Figure 7 Timeline of expected coal-fired generator closures in the NEM

Source AEMO 2020 Integrated System Plan

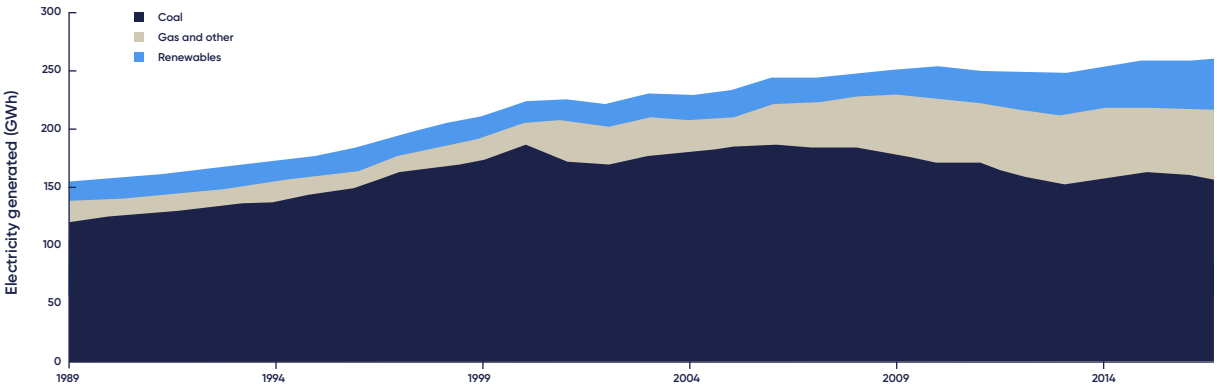

Figure 8 Share of total electricity generation by energy type, 1989 to 2018

Source Department of Industry, Innovation, Science, Energy and Resources

Between 2009 and 2019, technological advances, economies of scale, and improvements in supply chains drove down electricity costs for solar and onshore wind by 89% and 70%, respectively (see Figure 9). In Australia, both wind and solar are now producing cheaper electricity than coal or gas—and this cost advantage is expected to improve even further in the future. The world has done the hard work in making renewable energy economically viable through RD&D; now the market is making strong investments in renewable generation (see Figure 10).

Wind and solar are also impacting the economics of existing coal-fired generators. This is due to the near-zero marginal cost of renewables. Renewables assets have no fuel costs and low maintenance costs. Once built, renewable energy is almost always dispatched into the grid ahead of coal-fired generators, which are sometimes unable to sell their electricity. During periods of high demand, or when the wind doesn't blow or the sun doesn't shine, the 21st century NEM is best served by generators that can quickly cycle their supply up and down. This flexible generation serves to firm variable supply from renewables, a task suited to gas, batteries, other storage, and hydro rather than Australia's ageing coal fleet. Coal provides flat, baseload electricity.

In a renewables-dominated grid, coal-fired generators are forced to ramp their supply up and down (known as cycling), which can lead to higher operating and maintenance costs. The variability in cycling costs across Australia's coal fleet is a major reason some coal-fired generators will exit the market sooner than others. Some coal-fired generators already sell electricity at negative prices (that is, they pay to dispatch electricity) to avoid cycling costs during the day. Gas-fired generators are far better suited to cycling.

Some of Australia's coal-fired generation capacity will inevitably be replaced by gas, which is less emissions-intensive than coal. In 2019, the emissions intensities of coal-fired and gas-fired generation in Australia were 0.96t CO_2-e per MWh and 0.53t CO_2-e per MWh, respectively. By this measure, gas is 46% cleaner. But a substantial increase in gas-fired generation is unlikely. Current projections show gas-fired generation is set to decline by 2040. And the idea of replacing coal entirely with gas is now considered outdated; the economics no longer stack up.

State government support is also playing a major role in driving renewables. The states led the Federal Government by establishing emissions trading schemes (ETS) earlier this

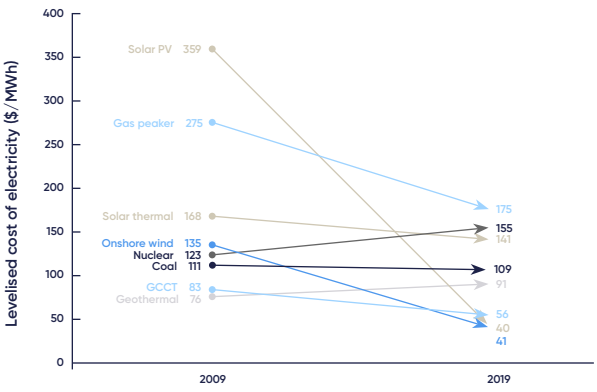

Figure 9 Historical changes in levelised cost of electricity by generation type, 2009 to 2019

Source Lazard

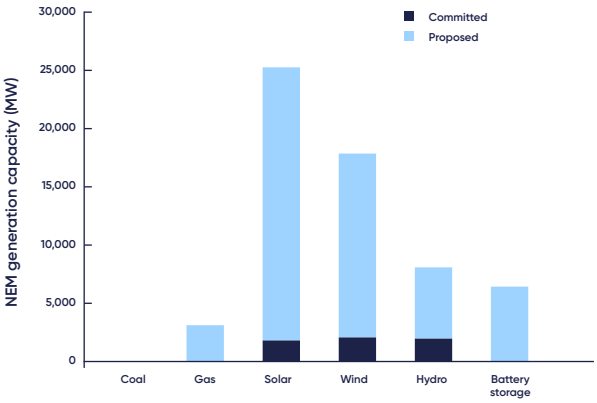

Figure 10 Generation development in the NEM by technology type, 2020 to 2030

Source AEMO

Note Proposed and committed generation developments over the next 10 years in the NEM. Solar excludes rooftop PV installation.

century, only to step away from them after a federal ETS was proposed. Now that we are again without a national policy to reduce emissions in our electricity sector, the state governments have stepped in to fill the void. All state governments have committed to net-zero by 2050. And to get there, they're setting out ambitious plans to drive greater renewables penetration.

Victoria has renewable energy targets of 25% by 2020, 40% by 2025, and 50% by 2030. The state's 2020-21 budget committed $540 million to establish six Renewable Energy Zones. Queensland has a 50% renewable energy target by 2030. It plans to push renewable energy into the grid through its publicly-owned clean energy generator, CleanCo, and a $500 million Renewable Energy Fund. After achieving its initial target of 50% renewables seven years ahead of schedule, South Australia is now targeting 100% renewable energy by 2030.

New South Wales doesn't have a renewable energy target. But it does have the most detailed plan to reduce emissions from electricity while maintaining reliability and supply. The Electricity Infrastructure Roadmap will see 12GW of renewable energy enter the grid by 2030, which could result in 6GW of surplus coal generation in NSW by 2030, with flow-on impacts for coal-fired generators in Queensland and Victoria.

These renewable energy targets will accelerate structural change in the generation mix of the NEM. Renewables would replace coal-fired generation even without these targets. But their presence means change will happen faster. By 2025, the NEM will source an estimated 45% of annual demand from renewables and will be able to support 75% instantaneous renewable penetration. But to ensure adequate generation comes online at the right time, certainty is required around closure dates for coal-fired generators.

Clumsy exits for Hazelwood & Port Augusta offer lessons for Liddell

The more-than-50-year-old Hazelwood power station accounted for 20% of Victoria's electricity supply and 5% of the NEM's output. In March 2017, it shut down with just five months' notice and significant ramifications. Victorian energy spot prices jumped from $60 to $100 per MWh in the year to 2017-18. NEM-wide, prices rose from $52 to $96 per MWh (see Figure 11). One reason for the increase was the higher fuel costs of the gas and black-coal-fired generators that replaced Hazelwood's capacity.

More importantly, though, Hazelwood's closure caught the market off guard. The lack of warning meant there was inadequate replacement capacity, and this led to tightened supply conditions (see Figure 12)—driving higher prices for households and businesses. While there was much blame shifting between the federal and state governments over the closure, Hazelwood's operators affirmed that it was simply the plant's advanced age that meant its operations were no longer viable.

The early closure of the Northern power station in Port Augusta reiterates the point. In the face of increased competition from zero-marginal-cost renewables, the closure was brought forward to May 2016 with just five months' notice. The reduction in supply that followed led to high prices in the ensuing six months. Average wholesale spot prices in South Australia were driven up from $79 per MWh to $102 per MWh. The impact on the typical South Australian household in 2016-17 was a likely $200–$250 hike in retail electricity bills.

Liddell will be the next to go, with the 2,000MW black-coal-fired generator set to close in 2023. Representing 13% of NSW's electricity supply, Liddell's exit has raised concerns of another Hazelwood/Port Augusta debacle. The Federal Government initially felt the need to guarantee 1,000MW of publicly owned capacity. But with notice, private investment led the Government to revise down its estimate to 250MW, and regulators predict that just 154MW will be needed.

In December 2020, one of Liddell's units experienced a sudden failure, with a worker severely injured. The resultant supply shock led to a large price spike in New South Wales, with wholesale prices reaching the maximum $15,000 per MWh. Liddell may now be offline for two-and-a-half months over the critical summer period. What happened at Liddell could happen at any coal-fired generator. The question for policymakers is: which plant will be next?

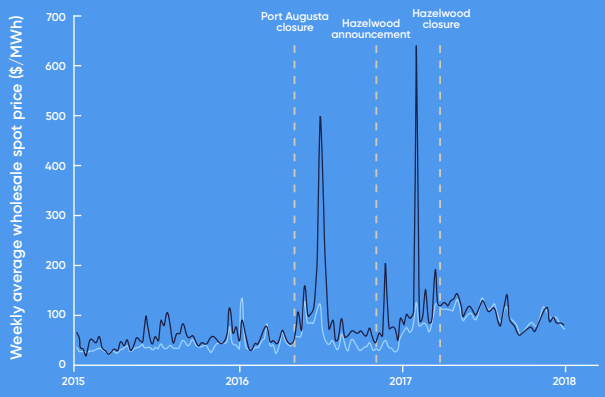

Figure 11 Wholesale electricity price impact of Port Augusta & Hazelwood closures

Source AER

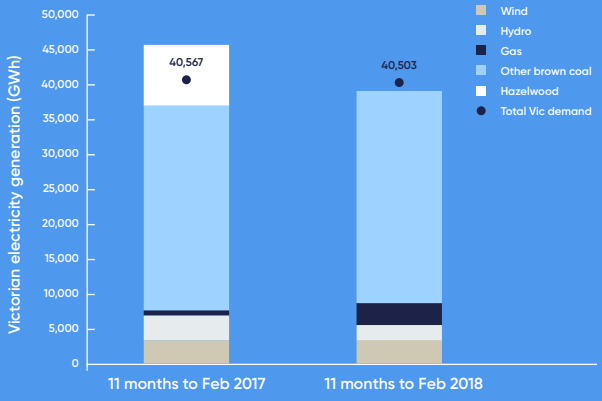

Figure 12 Victorian electricity generation before & after Hazelwood

Source Green Energy Markets

Current policy leaves the timing of coal-fired generator closures uncertain

Regulators were rightfully concerned about the way Hazelwood and Port Augusta closed. In response, the Australian Energy Market Commission (AEMC) recommended a rule change in 2018 that required large generators to provide three years' notice of their intention to close. Based on a recommendation by the Finkel Review, the three-year notice period aimed to minimise the likelihood of price spikes and reliability concerns that occur following unexpected plant retirements.

In 2019, the minimum notice period was amended to 42 months as part of the Retailer Reliability Obligation, with generators required to inform the Australian Energy Market Operator (AEMO) of their intention to close. Generators can apply to the Australian Energy Regulator (AER) for an exemption from the notice period. Applications must include supporting documentation, such as technical reports or records of discussions that led to a decision to close (e.g., by directors or sub-committees).

The rule change works to provide regulators with more information about the operational plans and projected closure dates of generators. But it's unclear how unexpected costs, unit failures, or safety concerns interact with the rule. These factors are generally unforeseeable in nature, difficult to forecast, and could drastically shorten or end the life of a generator.

The AER states they will remain flexible in determining criteria for exemption; that is, applications are evaluated on a case-by-case basis. The AER notes a number of factors could come into play, including: the reliability and security impact of a generator's exit; plans for replacing the capacity being retired; whether the application is necessary to meet legal and regulatory changes; and whether the application for exemption is necessitated by urgent and unforeseen circumstances. This last factor suggests that an exemption could be granted due to safety concerns or large unexpected capital expenditures (e.g., a boiler failure).

Even if an exemption is refused by the AER, civil penalties might not provide a sufficient incentive for plant operators to comply. Operators could decide civil penalties are a 'lesser evil' when weighed against the cost of returning a plant to operation. And if market dynamics change quickly, it is difficult to believe the rule could force a coal-fired generator to run at a loss.

Replacing supply following the closure of a coal-fired generator requires careful planning. A 42-month notice period might not be sufficient. Transmission lines alone can take seven years to construct, even after passing a regulatory investment test (RIT-T). The RIT-T itself averages 1.5 years. And this is before complex environmental approvals.

Furthermore, the rule change won't ensure that closures occur in a staggered, geographically distributed, and socially or economically efficient way. There would be nothing to stop all coal-fired generators informing the AEMC they will simultaneously close in 42 months. Less outlandish but still threatening outcomes are also possible.

If coal-fired generators do close on short notice, investors may have insufficient time to plan new supply. This could lead to another Hazelwood or Port Augusta. The system also requires the appraisal of coal-fired generator plans on a case-by-case basis, with part of the process occurring confidentially between the AER and a particular generator. In this setting, it is impossible for other market participants to know when projected closure dates will be accurate, and when they will change. For example, Yallourn power station is currently scheduled to close in 2029. But New South Wales' transmission plan could bring forward its closure date. Other plants may follow suit. This will test the AEMC's closure rule, and the AER's treatment of exemption applications.

We aren't the first country to confront this task

In 1937 George Orwell wrote:

> **"... practically everything we do, from eating an ice to crossing the Atlantic, and from baking a loaf to writing a novel, involves the use of coal, directly or indirectly. For all the arts of peace coal is needed."**

In many advanced economies, this is no longer true. US President-elect Joe Biden brings with him the promise of carbon-neutral electricity in the US by 2035. Germany is implementing a coordinated phasedown of coal-fired generation. Canada has pledged to remove coal from its electricity mix by 2030 through regulation. The UK grid is effectively coal-free, with less than 0.5% of supply coming from coal. China, Japan, and South Korea have all made net-zero commitments. On electricity emissions, Australia is very much a global laggard.

United Kingdom

In 2013, the British Government, led by Conservative Prime Minister David Cameron, introduced the Carbon Price Floor. In effect, this was a carbon tax that decreased the competitiveness of high-emitting coal-fired generators. The mechanism played a significant role in the UK's 21% emissions reduction from 2013 to 2018.

Parallel to the Carbon Price Floor, Emissions Performance Standards (EPS) were implemented in 2013. These standards set a statutory limit on the emissions of new fossil-fuel electricity generators at 450g CO_2-e per kWh, similar to the emissions intensity of gas-fired generation, and around half that of coal-fired generation (see Figure 13). The cost to comply with the regulations—along with increased competition from renewables and gas-fired generation—meant new investments in coal were unviable.

In 2015, the Conservatives went a step further. The emissions intensity limit set out in the EPS for new electricity generators would be extended to existing coal-fired generators in 2025. This essentially mandated the closure of unabated coal-fired power stations in the UK. Crucially, the EPS would only be applied to generators that burned solid fossil fuels; gas-fired generators were exempt.

Like many of Australia's current coal-fired generators, a large number of the UK's generators were reaching the end of their technical lives at the time. With coal already struggling to compete against cheaper gas and renewables, operators responded by bringing forward planned closure dates. Since November 2015, eight of the UK's 12 remaining coal-fired generators have closed.

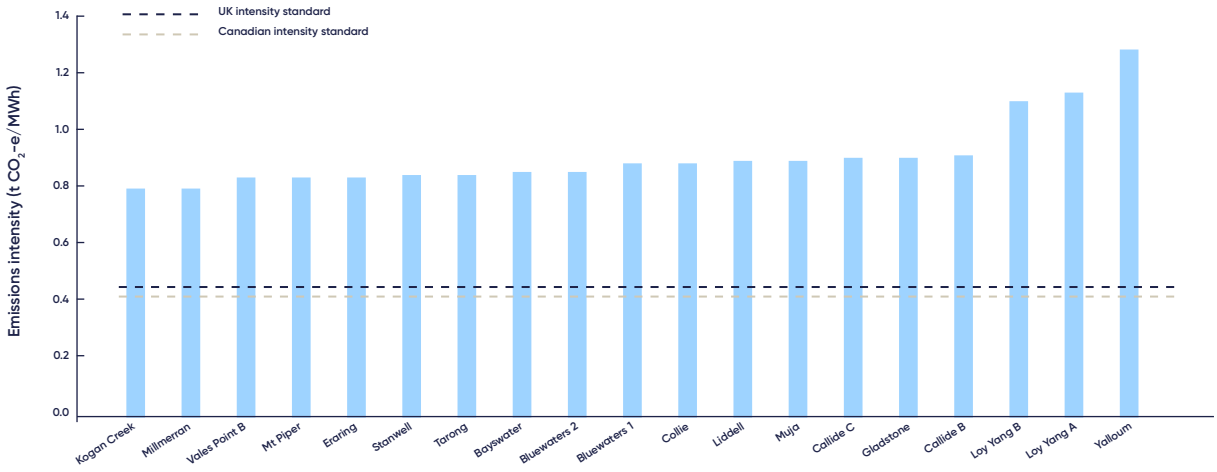

Figure 13 Comparison of Australian coal-fired generators' emissions intensity against international standards.

Source Clean Energy Regulator

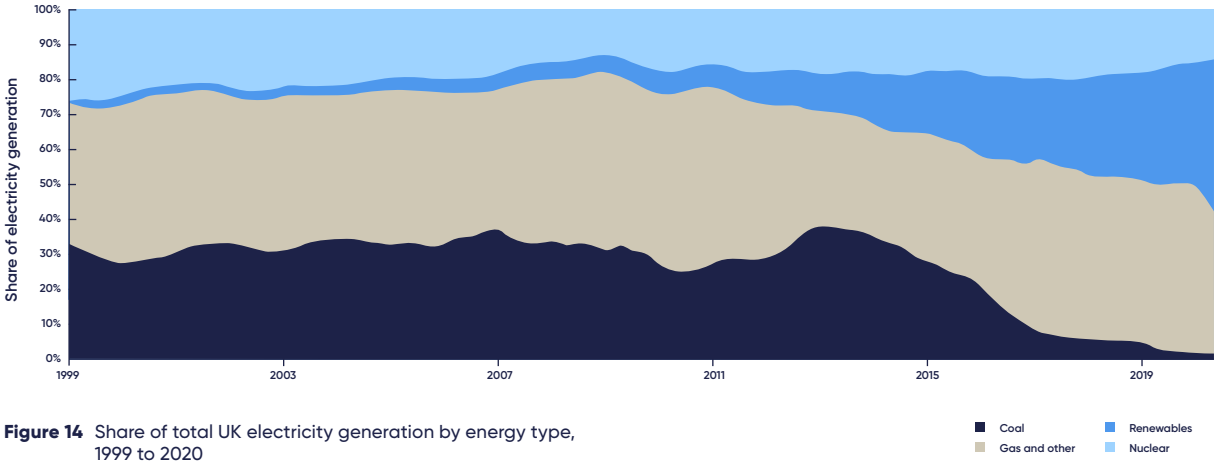

Figure 14 Share of total UK electricity generation by energy type, 1999 to 2020

Source UK Office of Gas and Electricity Markets

A policy of mandated closures by 2025 may seem heavy-handed. But in the UK, it made little difference to the competitiveness of coal-fired generators. All that changed was the exact date of closure. 2014 projections showed that coal-fired generation would only produce 1% of total grid power in 2025, and 0% by 2027. In this context, the UK's policy merely hastened the closure of generators that were already on their way out (see Figure 14).

Germany

Germany has far more coal-fired generation than the UK; in 2019, coal generated more than 35% of the country's energy (see Figure 15). The current capacity of German coal-fired generators amounts to 43.5GW; 20.9GW from brown coal and 22.6GW from black coal. Amidst pressure to reduce emissions and increasingly competitive renewables, the German Government is implementing two different mechanisms to coordinate a phasedown of coal-fired generation.

Germany's coal phasedown plan will run until 2038, with limits on the amount of coal-fired capacity becoming stricter over time. Coal-fired generation will be reduced to 75% of current levels by 2022, to 40% by 2030, and to 0% by 2038. A review will be conducted in 2032 to determine if total phase-out can be brought forward to 2035.

The Government established competitive tenders to compensate black-coal-fired generators for early closure. Tenders will be held between 2020 and 2027, with closures occurring up to 2030. BNetzA, the German energy regulator, will determine the quantity of capacity offered for tender each year. It will also ensure successful bids don't

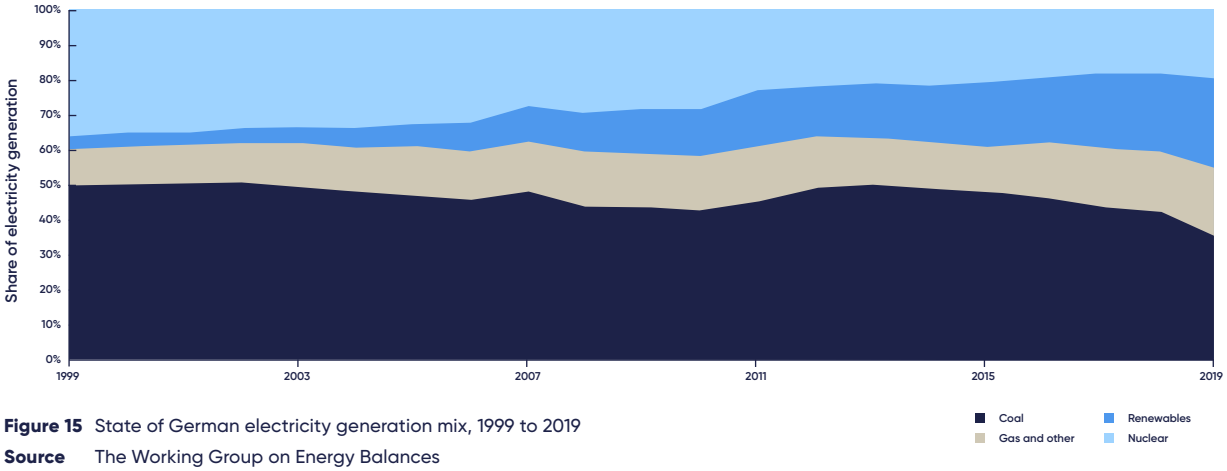

Figure 15 State of German electricity generation mix, 1999 to 2019

Source The Working Group on Energy Balances

compromise grid security. In the event of insufficient tender participation, mandated shutdowns could begin as early as 2024.

After 2027, no further tenders will be available. The last tenders will govern closures until the end of 2030; after 2030, no compensation will be available to black-coal-fired generators. All black-coal-fired generators are mandated to close by 2038, with the order of closure determined by the emissions intensity and age of each generator.

This may seem heavy-handed. But almost half of black-coal-fired generators stand to gain more in compensation than they would have profited by staying online over the next decade. Interestingly, a faster phase-out of coal-fired generation may also lead to a faster economic recovery in affected regions, with temporarily higher electricity prices driving rapid expansion of new renewable generation and associated economic activity.

The tender mechanism itself includes a price cap for compensation that decreases over the decade. By design, this motivates participation in earlier tenders, ensuring capacity targets are met while minimising the need for mandated shutdowns. Bids are ranked by emissions intensity, with a bid's value divided by the plant's average emissions intensity over the past three years. This means that more emissions-intensive generators are favoured for an earlier exit.

Results of the first tender were announced on December 1 2020. The round was highly competitive and oversubscribed, suggesting a strong incentive to close early. In total, 4,788MW of bids were accepted, despite a tender limit of 4,000MW.

Successful bids were also priced more cheaply than anticipated. The volume-weighted average price of €66,259 per MW was far below the auction price limit of €165,000 per MW. This was despite extensive lobbying by private operators to raise the tender compensation cap during the final bill's design phase. Lower bid values may have been driven by the EU's Green New Deal, which will involve EU Central Bank financing to support renewable energy projects.

Given their relatively young age, Vattenfall's Moorburg plant and RWE's Westfalen E unit were the unlikely winning bidders of the first auction. The plants were commissioned in 2014 and 2015, respectively. This unexpected result demonstrates the benefit of allowing private companies to make their own decisions to close through a market mechanism. Operators are able to assess the generator's viability better than any centralised authority. Mandating closure through a non-market mechanism—by using the plant's age, for example—simply won't be the most efficient means of coordinating a phasedown.

With only two large operators involved in brown-coal-fired generation, a competitive tender process was deemed unsuitable. As such, the German Government opted to coordinate the phasedown through a combination of direct compensation and mandated closure. Closure dates span throughout the 2020s and into the 2030s. RWE and LEAG—the two largest companies operating the vast majority of brown-coal-fired generators in Germany—will receive a combined AU$7.05 billion in compensation over 15 instalments.

A variety of smaller brown-coal-fired generators—with a capacity less than 150MW—were excluded from this arrangement. These generators are mandated to shut down at various dates without compensation, but they can choose to participate in the competitive tender process alongside black-coal-fired generators.

At the heart of the German model is the concept of a negotiated phase-out. The German Government sought consultation and consensus throughout the mechanism's design phase. At the same time, if agreement between the Government and private operators could not be reached, the German Coal Commission recommended that regulation facilitate mandated closures with reasonable compensation. This threat of mandated closure motivated private companies to come to a mutually beneficial agreement with federal and state governments.

Lessons

In the UK and Canada, where coal-fired generation made up a small minority of the grid, mandated closure had only a modest impact on emissions and supply. This is in stark contrast to Australia, where coal remains a central part of the electricity mix—approximately 56% of generation in 2019. Our transformation will be deeper and more complex than those faced by the UK and Canada, a situation compounded by Australia's geographic isolation—we can't import electricity from our neighbours. Regardless, mandated closure is unlikely to win political support in Australia.

On the other hand, Germany relies heavily on a mix of both black coal and brown coal in its electricity system—just like Australia. The German Government pursued a policy of competitive tenders to progressively phasedown coal-fired generation, compensating investors and sending a signal to the market to establish new supply. Germany's early success suggests a similar model could work in Australia.

Key lessons from Germany's experience are:

- incentivise early closure through a tiered system of auction or tender payments;
- include clear and transparent timelines;
- consider emissions intensity;
- empower market regulators to veto bids based on grid security implications;
- recognise that complex auctions may lead to higher costs and inefficiency; and
- engage in close negotiation with stakeholders to build support.

How to secure certainty for energy communities, workers, consumers, and investors

Through various commitments to support renewable energy, all of the eastern states have implicitly committed to a substantial phasedown of coal generation this decade. But no single state acting alone can achieve emissions reductions as efficiently as nationally-coordinated action. And individual states naturally don't consider spillovers from their actions onto other states. In the continued absence of federal action, a significant coal-fired generation phasedown will occur—just in a scattershot fashion, and at an unnecessarily high cost to communities, workers, and consumers.

The existing state commitments to renewables are at odds with the current schedule of closures, with just 18% of coal capacity due to be withdrawn this decade. As more renewables are driven into the grid, coal generators will increasingly become unviable. Several may be unprofitable as it is. And some of those that are profitable on a variable basis may eventually fold when faced with necessary capital expenditures.

One way or another, it seems inevitable that coal closures will be brought forward to this decade—we just don't know when or where. Much of the information guiding these decisions is known only to the generators themselves. Potential investors in the renewables and firming capacity needed to replace them have no certainty about if and when capacity will be withdrawn from the market, despite this being critical to any investment decision. Coal-fired generators are required to provide 42 months' notice of their closure, but there are ways around this requirement.

Clearly, the status quo is untenable. What everyone involved—communities, workers, consumers, investors—has long desired is the certainty that comes from national leadership. It need not even be about climate change or emissions, but simply certainty for the community and investors, and security for consumers and workers. The Federal Government should face up to the inevitable. Take responsibility for what is a national problem. And set out a plan for how our electricity market will evolve this decade and beyond.

The Coal-Generation Phasedown Mechanism

The Government should introduce the Coal-Generation Phasedown Mechanism (CPM), which would:

- achieve a phasedown in coal generation to below 50% of current emissions by 2030;
- secure certainty in the timing of coal-fired generation withdrawals this decade;
- do so at minimum cost;
- provide affected workers with opportunities for redeployment, retraining, or generous remuneration in the event of retrenchment; and
- accommodate some degree of cost-sharing between investors and taxpayers.

The CPM would be administered by the Clean Energy Regulator, which currently carries out auctions for abatement under the Emissions Reduction Fund (ERF) and regulates coal-fired generator emissions under the Safeguard Mechanism. The CPM is consistent in principle with the ERF and Safeguard Mechanism, adapting certain elements to the coal-fired generation industry.

To achieve the aforementioned objectives, the CPM has five elements:

1. Announce sectoral emissions targets for 2026, 2028, and beyond 2030.
2. Offer contracts across the three timeframes for emissions summing to the targets.
3. Implement a sealed-bid auction system for allocating the contracts.
4. Impose mutual obligations to affected workers upon expiry of the contracts.
5. Accommodate a government funding allocation (positive, zero, or negative).

Announce sectoral emissions targets for 2026, 2028, and beyond 2030

The scheme's backstop is a credible threat of government-imposed restrictions on emissions from coal-fired generators. Government regulation to reduce electricity emissions is common around the world. Indeed, we do it ourselves under the existing Safeguard Mechanism. In the UK, coal-fired generators were shut down by regulation. Canada is taking a similar approach. And much of America's recent emissions reductions have occurred via regulatory restrictions in electricity.

A gradual emissions phasedown would provide greater certainty about future market conditions to those investing in the renewables and firming capacity required to replace withdrawn coal-fired generation. A certain amount of capacity would be guaranteed to be withdrawn on a certain date, with predictable implications for the electricity price absent new supply. Market forces would then "pull" new zero-emissions capacity into the grid, as opposed to the current interventionist approach whereby the states "push" it in.

The first emissions reductions would occur in 2026, with two subsequent reductions spaced two years apart. This would provide at least five years' notice for the planning and regulatory approvals necessary to develop replacement renewables and firming capacity. In particular, this allows sufficient time to develop and receive regulatory approvals for the transmission infrastructure needed to connect new generation to the grid. This gradual phasedown would also avoid an overcrowding of new investment, which could result in shortages, delays, and cost escalation.

The emissions backstop could be implemented under the Safeguard Mechanism. Electricity generation is currently subject to a sector-wide emissions cap; if breached, caps then apply at the generator level. By equating the sectoral baseline under the Safeguard Mechanism to the targets under the CPM, individual generator caps would come into force across the electricity market, imposing the desired emissions reductions on each coal-fired generator, and preventing leakage of emissions reductions to other generators (e.g., gas-fired generators).

The ultimate goal of the CPM is to phase down coal-fired generation to halve our coal emissions. As such, the scheme should be based around emissions rather than electricity supply. At a given marginal cost of generation, the scheme would automatically favour the withdrawal of more emissions-intensive coal from the grid. This is relevant due to the presence of both black and brown coal in our energy mix—the latter concentrated in Victoria's Latrobe Valley.

Although brown-coal-fired generators enjoy lower costs and higher margins in the absence of a cost of carbon, their emissions intensity is significantly higher. By focusing on emissions rather than capacity, the scheme would impose an implicit cost of carbon on coal-fired electricity generation. This would disfavour coal relative to all other forms of generation. And amongst coal-fired generators, it would disfavour the most emissions-intensive plants. As shown in Figure 16, even a modest implicit cost of carbon of $25 per tonne would eliminate the cost differential between black and brown coal.

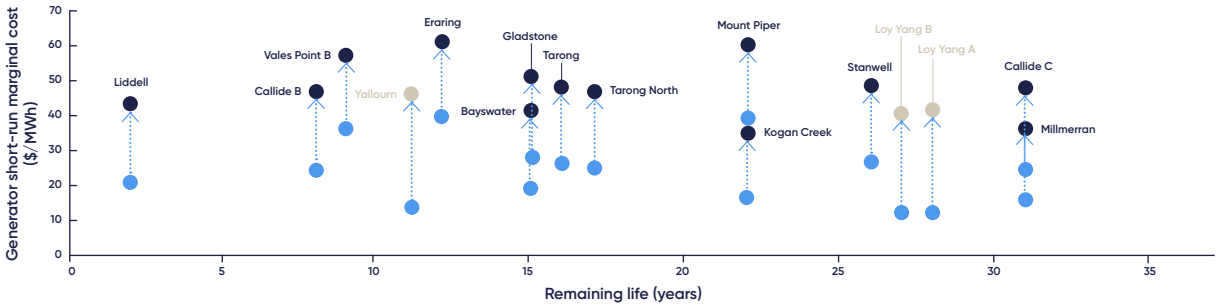

Figure 16 Australian coal generators remaining life, short-run marginal costs & emissions intensity

Source AEMO; Department of Industry, Science, Energy & Resources; Blueprint Institute analysis

Note Remaining life is calculated according to generators' expected closure year published by AEMO. Brown dots represent brown-coal-fired generators & dark blue dots represent black-coal-fired generators. Upper dots include the additional marginal cost of an implicit $25 per tonne CO_2-e carbon price, calculated as $25 per tonne CO_2-e multiplied by emissions intensity (tonne CO_2-e/MWh). Figure 16 assumes constant marginal cost.

Offer contracts across the three timeframes for emissions summing to the targets

Contracts for emissions for all three timeframes would be determined simultaneously. These contracts would specify an emissions budget (covering a range of permitted quantities of total emissions) to be used within specified timeframes (e.g., yearly) up to each duration, which would provide generators with flexibility as to when to generate the contracted emissions. While the contracts would be for emissions, this maps to a known quantity of electricity supply for each generator based on their emissions intensity. This would both guarantee a minimum supply of electricity up to a given point in time, as well as a certain emissions reduction beyond it.

Existing state government commitments may be sufficient for us to meet our Paris target. But under the status quo, there is significant uncertainty about future supply at any point in time. This extends to electricity prices and the financial viability of any new generation investment. The CPM would require coal-fired generators to produce the designated level of emissions up to contract expiration. If the current viability of coal-fired generation is as threatened as some market watchers indicate, with significant bring-forwards of closures likely, the CPM could in fact serve to delay closures in order to ensure an orderly withdrawal of supply.

The mechanism is agnostic as to exactly how emissions reductions are achieved. Participants would be free to bid for any emissions reduction—this might involve continuing to operate at reduced capacity or a partial shutdown. In theory, emissions reductions could occur through plant efficiency improvements or the installation of carbon capture, utilisation, and storage. But closure seems most likely given the age of Australia's coal fleet.

Implement a sealed-bid auction system for allocating the contracts

A sealed-bid auction system can be designed to balance the various considerations of the scheme. Under most such designs, participating generators would provide their valuations of generating set quantities of emissions out to each of the three target dates—they would do so privately and simultaneously, and be barred from communicating with one another. The auction design would then allocate the emissions contracts and prices for those contracts to generators based on the bids of all participants. Depending on the alternative considerations built into the system, the auction can be designed to generate an incentive for participants not to game the system.

Auctions are commonplace in commercial and government contexts. Google sells ads according to a generalised second-price auction, while Facebook uses the Vickrey-Clarke-Groves auction design. The Australian Government uses reverse auctions to purchase abatement through its ERF. Notably, auctions are used to allocate telecommunications spectrum. The 2020 Nobel prize in economics was awarded to Paul Milgrom and Robert Wilson for their work in auction design, which has been influential in putting auction theory into practice.

Under a well-designed auction system, the least economically viable coal generators would withdraw from the market first, ensuring emissions reductions occur at minimum cost. This would depend both on their marginal cost of producing emissions (based on their marginal cost of generating electricity along with the emissions intensity of that generation) and the amount and sequencing of future capital expenditures.

The CPM would be designed to elicit information about the generators that only they know. If the Government knew this information, then this whole process would be unnecessary—they would know which plants were the least economically viable, and could set about picking generators to close. The CPM recognises that the Government is not well placed to pick losers. It harnesses market forces to induce the least-viable plants to pick themselves.

Because the CPM allocates emissions contracts nationally, grid security concerns can be incorporated into its design. While there are transmis-

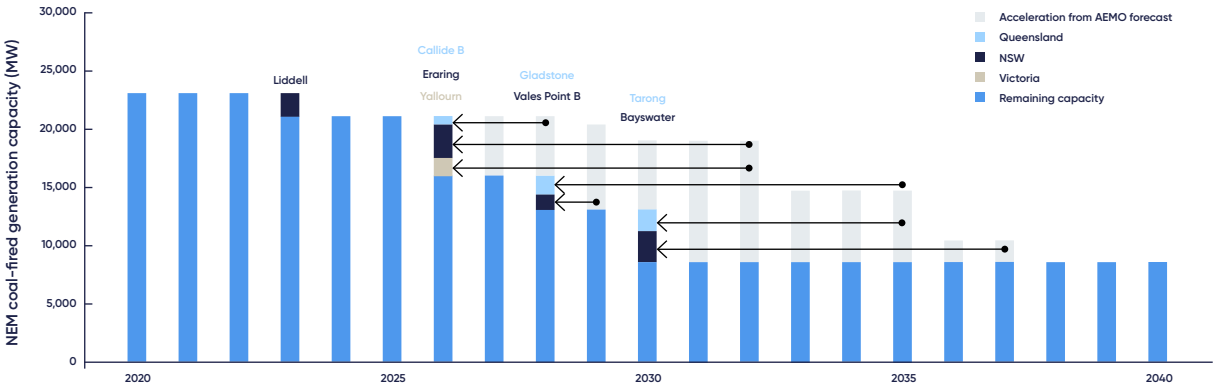

Figure 17 A worked example of Blueprint Institute's CPM and associated reduction in coal-fired capacity over time

Source AEMO; Department of Industry, Science, Energy & Resources; Clean Energy Regulator; Blueprint Institute analysis

Note Example generators have been chosen based on their short-run marginal cost and their approximate remaining life. Those with a higher short-run marginal cost and a shorter remaining life have greater incentives to take part in the auction mechanism

sion interconnectors between the southern and eastern states, their capacity is limited. Having too great a capacity reduction on a given date in a given state might compromise grid security. A weighting scheme could be incorporated into the design to penalise excessive simultaneous capacity reductions in a given state.

Because the outcome depends on private information, it is impossible to predict the ordering of coal-fired generator exits it will induce. But with an estimate of the marginal cost of electricity generation augmented by a rough estimate of the cost of carbon implicit in the scheme, along with the age of the assets, it's possible to form a hypothesis about how the phasedown might proceed (see Figure 17).

Liddell is already scheduled to exit in 2023. The scenario then sees further exits in 2026, 2028, and 2030. Reductions in any given state are spread across the various time frames—three each in Queensland and New South Wales, and one in Victoria. The coal-fired generators located in Western Australia would be open to participate in the CPM. As the scenario represents a one-off bring-forward of currently scheduled closures, it would achieve a total emissions reduction of around 390 Mt CO_2-e—85% of Australia's total emissions in the year 2030. Based on the current spot price in the European carbon market, these emissions reductions would be worth around $20 billion.

Impose mutual obligations to affected workers upon expiry of the contracts

Some withdrawal of coal-fired generation from the electricity sector will inevitably occur this decade. Whether induced by state government support for renewable energy under the status quo, or by the CPM proposed here, it will come at a cost to someone. This cost can be made a bit larger or smaller; imposed on this person or that. But it cannot be avoided. For too long, governments have sold us magical pudding thinking that emissions reductions can be had for free. But the proper role for government is in recognising that there is in fact a cost, and offering a plan to minimise and fairly distribute it.

The CPM can ensure that costs imposed on the workers directly affected by coal-fired generator closures are kept to a minimum. The Government should tie to each emissions contract a set of obligations to workers upon the expiry of the contract. Workers should be given the option of being redeployed at an alternative site, but provided with generous retraining and remuneration arrangements if separation is necessary. The impetus for support should be even greater if government funding is provided under the scheme.

Companies that operate coal-fired generators have a commercial interest in operating responsibly. They also have substantial expertise and knowledge in negotiating with workers and building community support for complex

infrastructure projects. These two factors mean companies are well positioned to manage the closure of coal-fired generators, including the impact on workers and communities. Companies have shown a willingness to coordinate with workers—AGL, for instance, has pledged job security for all 300 workers on its Liddell site.

Accommodate a government funding allocation (positive, zero, or negative)

The primary task of the CPM is to reveal the coal-fired generators' valuations of their future operation. Participation is driven by the Government's regulatory power in limiting emissions in the sector. Once it has extracted the necessary information, the mechanism automatically schedules the phasedown and the relative prices paid by participants. The question of compensation is separate, and likely a matter for negotiation between the Government and industry. The CPM itself can accommodate any government funding allocation (see Figure 18).

At one extreme, the Government could fully compensate participants for the loss of their expected future profits (the carrot option). This would be akin to the reverse auction system used to purchase abatement under the ERF, and is similar to the model used in Germany. This option could be expensive, requiring a budgetary commitment an order of magnitude higher than under the existing ERF (exceeding $10 billion under a plausible cost of carbon). This may limit its political saleability.

At the other extreme, the Government could provide no funding, and instead charge participants according to their declared valuations (the stick option). This would generate revenue for the Government. Given the design requires a minimum emissions commitment from generators, it's possible that a participant currently planning to close before 2026 would be unwilling to pay a positive price to continue to operate. Provided sufficient revenue is generated by other bidders, such a participant could be compensated for their commitment. But in the event that revenue from the other bidders is insufficient to cover that commitment, the Government would need to provide the necessary funding.

A significant potential benefit of this option is that the scheme could generate revenue, which could be used to directly compensate local communities affected by the relevant coal-fired generator closures. Funding could be used to support infrastructure projects, local government grants, or investment incentives, in a similar fashion to Western Australia's 'Royalties for Regions' program. Formulated by the Nationals and supported by then-Premier Colin Barnett, this program allocates a quarter of Western Australia's mining and petroleum royalties to programs that benefit regional and rural areas. A similar program for regions with coal-fired generators could help policy makers build public support for the scheme.

Of course, any funding allocation between these two extremes could also be accommodated, including a revenue-neutral scheme that neither uses taxpayer funds nor raises net revenue. If funding were allocated to the scheme, it would go directly to compensating existing investors in coal-fired generation. While costly to the taxpayer, such an arrangement may be necessary to secure support for the scheme among the coal-fired generators. It's worth noting, however, that in Australia there isn't a well-established history of compensating businesses for the negative effects on them of reform. Doing so would create a worrying precedent.

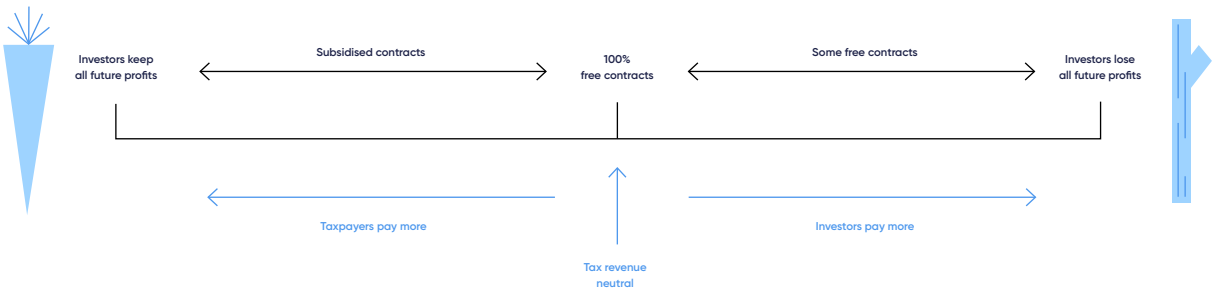

Figure 18 The Coal-Generation Phasedown Mechanism

Blueprint Institute