GRATTAN Institute

Critical minerals: delivering Australia's opportunity

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Overview

Australia can be a 21st-century green energy superpower. Climate change provides the imperative; our vast renewable energy and mineral resources provide the opportunity.

Meeting global and domestic emissions-reduction targets will impose transformative change on Australia's heavy manufacturing and mining sectors – change for which we are ill-prepared. Despite the current geopolitical energy challenges, global and domestic demand for Australia's coal and gas will decline over the next few decades.

The production of already important commodities such as steel, aluminium, and ammonia will need to be transformed to low-emissions alternatives. Extracting and processing of minerals critical in a low-emissions world and materially present in Australia hold the prospect of new export growth and job creation.

European countries reduced their emissions by de-industrialising and outsourcing their emissions to China. Australia can follow a different path that will lead to a hugely positive outcome – economic, social, and environmental.

Achieving this vision will require the concurrent, coordinated mobilisation of effort: clear policy development, supportive government agencies, cooperative partnerships with industry, international linkages via revitalised trade and co-operation agreements, and consideration of how we avoid early mover disadvantage.

Transforming Australian heavy manufacturing and mining for strong growth and a highly profitable low-emissions future will have consequences, both postive and negative, for Australia's regions. Federal and state governments should establish, fund, and work with regional transition authorities and local communities to catalyse action on both the challenges and the opportunities at a local level.

The elements for an effective critical minerals strategy are in place. The challenge is to stitch them together and deliver. This is a once-in-a-century opportunity.

1 Introduction

This submission is made by Tony Wood, Alison Reeve, and Esther Suckling of the Energy and Climate Change Program at Grattan Institute. Grattan Institute is an independent think-tank focused on Australian domestic public policy. It aims to improve policy by engaging with decision-makers and the community.

In December 2022, the Department of Industry, Science, and Resources released a Discussion Paper, 'Australia's Critical Minerals Strategy'. This submission supports the central thesis of that paper, which is that Australia has a narrow window to capitalise on the opportunity represented by global demand for critical minerals and the dual comparative advantages of a material resources base of such minerals and the capability to add value to that resource via renewable energy for processing. The submission builds on a recent Grattan Institute submission to the Joint Standing Committee on Trade Investment and Growth[1] and two full Grattan Institute reports:

- The next industrial revolution : Transforming Australia to flourish in a net-zero world (2022)
- Start with steel: A practical plan to support carbon workers and cut emissions (2020)

Australian industries that extract resources and add value through manufacturing currently contribute more than $200 billion to GDP annually[2] and employ 1.1 million people.[3] But they also contribute about 30 per cent of our domestic greenhouse gas emissions. And the emissions from our exported coal and gas add to the climate responsibilities of other nations. A serious global commitment to net-zero emissions has profound economic, social, and environmental implications for Australia.

Activities such as coal mining will be essentially incompatible with a net-zero economy. Activities such as steel-making may be able to transform through economic, low-emissions technologies. And activities such as low-emissions extraction and processing of critical energy minerals, which are relatively modest today, are where Australia could capitalise on globally significant comparative advantages.

The challenge for Australia is to phase out the first set of activities while identifying and implementing the strategies, policies, and investments to realise the opportunities inherent in the second and third. The Discussion Paper and this submission specifically address Australia's critical energy minerals challenge. We should not ignore a broader minerals strategy for building on our traditional strengths such as in iron/steel and alumina/aluminium.

1. https://grattan.edu.au/wp-content/uploads/2022/12/Green-energy-superpower-submission-Grattan-Institute.pdf.
2. ABS (2019).
3. ABS (2022).

2 Discussion questions

In the following section, we address the Discussion Questions raised in the Discussion Paper. We have not responded to questions where we cannot add value.

2.1 A golden economic opportunity

As the world decarbonises, global demand for critical energy minerals is expected to grow dramatically. As Figure 2.1 shows, demand for lithium is expected to grow by up to 41 times by 2040. The value of both the nickel and cobalt markets is expected to be 30 times higher than now by 2040. In 2050, the cobalt market is expected to be worth US$214 billion, making it the biggest of the critical minerals.

These three minerals – lithium, nickel, and cobalt – are particularly promising for Australia, which has 27 per cent of the world's known lithium resource, 22 per cent of nickel, and 21 per cent of cobalt.

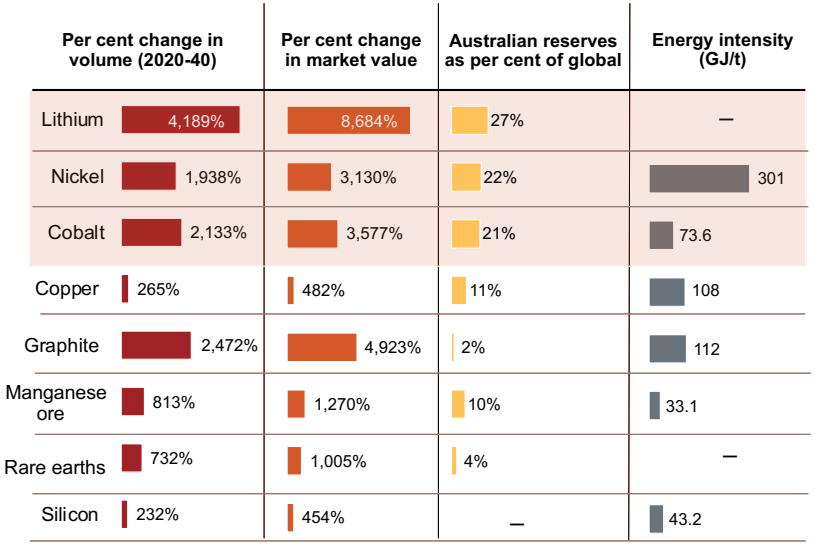
This represents an enormous economic opportunity. If Australia maintains a constant share of the critical minerals market as it grows, by 2050 this market will be worth roughly double what coal is worth today (Figure 2.2). These benefits should be shared by all Australians.

2.1.1 Widening the opportunities for all

State governments should reform royalty regimes for mining and establish sovereign wealth funds so that the benefits of the coming mining boom can be shared with future generations. The federal government can encourage the states in this by making investment in infrastructure that supports the critical minerals sector conditional on states reforming their royalty regimes.

Governments of resource-intensive economies are usually advised to save the windfall, at least in the initial years of a boom. Along

Figure 2.1: Demand for critical energy minerals could fuel Australia's next mining boom



Notes: Energy intensity is the amount of energy required to produce a tonne of refined metal. Energy intensity of rare earths production varies. Energy intensity for lithium varies and the dominant form of production in Australia is more energy-intense than the dominant form of production in competitor countries. Dashes indicate unavailable data.

Sources: Grattan analysis of IEA (2021a) (volume), IEA (2021b) (value), Geoscience Australia (2020) (share of global reserves), Surovtseva et al (2022) (energy intensity of graphite), Voet et al (2018) (energy intensity of copper, manganese, and nickel), Dai et al (2018) (energy intensity of cobalt), and Maldonado (2020) (energy intensity of silicon).

with benefiting future generations, saving instead of spending keeps government spending smooth over time. It also reduces the risk that governments will run up future deficits when they are committed to a high level of spending and aren't willing to reduce services or raise taxes.

2.1.2 Developing the regions

In contrast with minerals such as iron and steel, where Australia focused on mining, for critical minerals, our renewables energy resource means the optimal location of mining, minerals processing, and downstream manufacturing can deliver significant economic benefits to Australia and particularly to the regions.

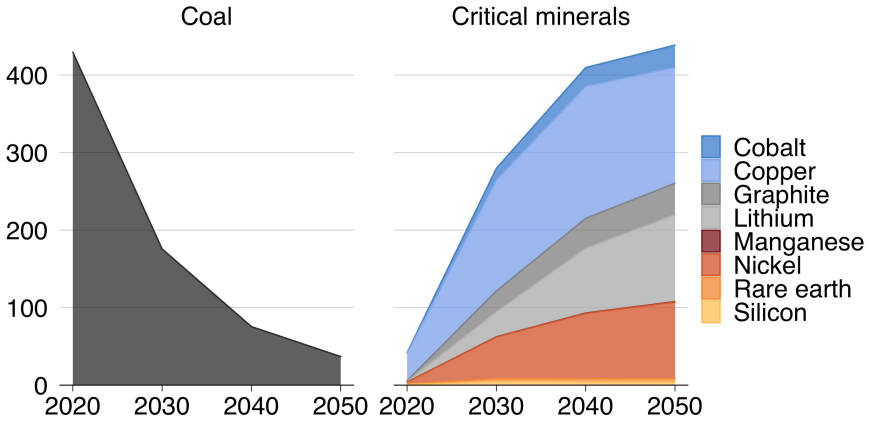
Mining is increasingly mechanised and automated, and workers are increasingly fly-in-fly-out, especially in the remote areas where many of these deposits are found. On the other hand, regional jobs will be created if Australia moves up the value chain into processing or manufacturing.

Figure 2.3 on the next page shows that there is little overlap between existing coal mining hot-spots and critical mineral deposits. The existence of critical minerals is one, albeit an important one, of the criteria that will determine whether a region can support sustainable economic activity. Other criteria, including human capital, and other physical infrastructure may mean the best answer is to transport the mined mineral to another regional centre.

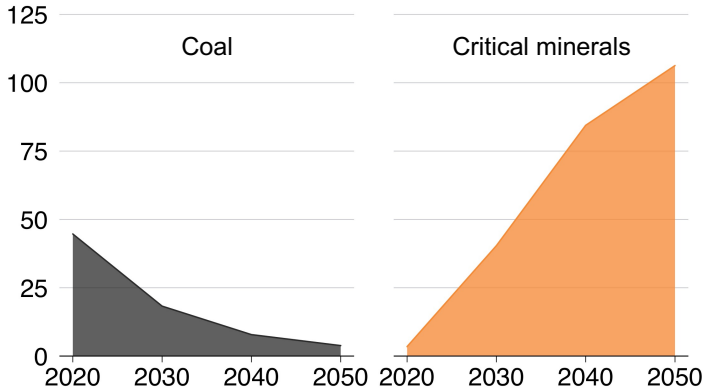
Grattan Institute has previously recommended that state governments establish regional transition authorities. They should start with the coal regions of central Queensland and the Greater Hunter, where 40,000 jobs are likely to disappear over the coming decades. These organisations should work with those communities to develop alternative economic activities to take over from coal mining. For

Figure 2.2: Critical minerals could contribute more to GDP than coal

Global market value (US$billion, inflation-adjusted to 2019)



Australian revenue assuming constant market share (A$b)



Notes: Includes total revenue for coal and for selected critical minerals used in clean energy technologies. The prices of critical minerals are based on conservative assumptions about cost increases (about a 10-to-20 per cent increase from current levels to 2050). Australia's share of the global coal market is taken from IEA (2020), and minerals from Bruce et al (2021). Exchange rate is assumed to be 0.73 USD per AUD.

Source: Grattan analysis of IEA (2021b, p. 163).

as long as coal mining continues, the royalties from coal should be directed to diversifying the economic base of these regions.

Grattan's previous work on developing regional Australia showed that economic benefits result when governments increase the priority for service infrastructure and funding in fast-growing regions, rather than trying to induce additional growth and relocation of activity back to slower-growing regions.[4]

It doesn't end there. There may be negative knock-on effects from uncoordinated regional construction booms. Competition for labour drives up wages, which in turn drives up rents and property values, pricing locals out of the housing market. The impact of the central Queensland LNG boom on communities in Gladstone and surrounding areas is instructive.[5]

Governments must invest in health services, access to education opportunities, and infrastructure to connect regions to cities. Without such investment, the positive impacts on regional communities from a future critical minerals mining boom are likely to be blunted, and negative ones may arise for people who already live there.[6]

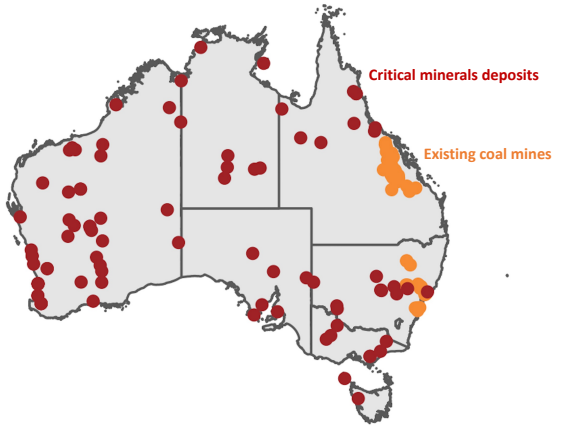
Grattan Institute's report, 'The next industrial revolution' (Chapter 5) contains more detailed analysis of regional engagement and lessons from previous transitions.

2.2 Developing new sovereign capabilities and industries

Specific downstream opportunities

Australia has the opportunity to move up the value chain to make the end-products the world will need. This could be economical where

Figure 2.3: Critical minerals deposits



Notes: Critical minerals deposits includes publicly announced, feasible and committed projects. Includes only coal mines currently subject to the Safeguard Mechanism.

Source: Safeguard-data-2022.

4. Daley and Lancy (2011).
5. Reid and Cann (2016).
6. Minifie et al (2013, pp. 36–37).

minerals processing is energy-intensive (notably nickel processing), because Australia has abundant low-cost wind and solar energy.

There are also opportunities to move into metals processing, such as producing green steel. Australia could replace metallurgical coal used in steel production with renewable hydrogen based on our renewable energy resources.[7]

In both cases, a complete strategy will require cooperative industry policy, targeted financial support, complementary infrastructure, sustainable mining and manufacturing practices, and alignment with energy and regional development policies.

Beware of moving too far downstream

We should support downstream minerals processing and manufacturing only as far as we can create and maintain a competitive advantage. This is a fundamental principle that should underpin the role of government in supporting industries to move up the global value chain.

An abundance of raw materials does not necessarily translate into an advantage as a manufacturer. A comprehensive value chain economic assessment is essential.

A case in point is the Federal Government's plan to kickstart battery manufacturing in Australia.[8] As Figure 2.4 on the following page shows, Australia's advantages in energy and materials are maintained when turning ores to metals and metals to active materials, but shrink on turning active materials to cells. In the case of energy, this is because energy is a smaller percentage of overall cost. For materials, it is because one quarter of the materials required at this stage (representing 20 per cent of input cost) would need to be imported.[9]

Australia has 50 per cent of the world market for the raw materials required for battery manufacture, but less than 1 per cent of the market for the next stages in the chain: metallurgy to turn ores into metals and then producing active materials; followed by cell manufacturing and assembly. And the battery market is highly fragmented across applications and technologies, implying some upfront choices will required.

Moving beyond cell manufacture to battery assembly further dilutes Australia's comparative advantages, because at that stage, labour costs would make up a greater percentage of costs or the process would need to be highly automated.[10] There is no fundamental reason why highly automated manufacturing should not be pursued in Australia, although we have few successful examples to build on.

Before subsidising manufacturing of complex products that use Australian critical minerals, the Government should commission independent, rigorous assessment of the costs of the full value chain, such as tax, logistics, labour, and imported materials, compared to competitor countries. Any policy to promote moving up the value chain can then focus on areas where Australia truly has a competitive advantage.

We note the national security concerns that China's dominance of parts of the supply chain endangers Australia's access to materials and products.

But the best way to mitigate this risk is not necessarily to manufacture something ourselves. We should also explore diversifying supply,

7. **start-with-steel**.
8. https://anthonyalbanese.com.au/media-centre/powering-the-nation-with-australian-made-batteries.
9. Grattan Institute analysis of Directorate for Internal Policies (2018) and Frith (2021).
10. Accenture (2021a).

stockpiling, signing agreements with friendly allies to allow access to reserves, and making an effort to switch to products, practices, or technologies that are less vulnerable to supply chain disruptions.[11]

Coordination is key

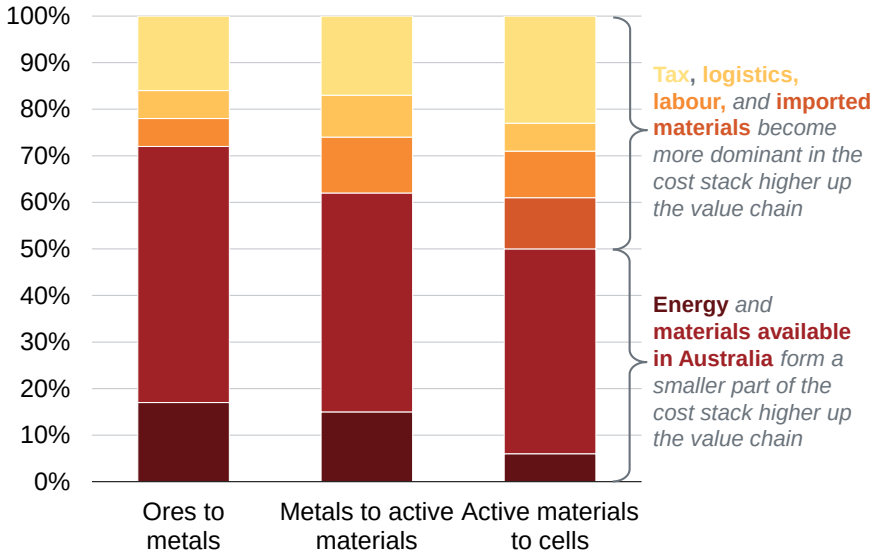
The most likely obstacles to delivering the opportunity are inadequate cooperation between government and industry, and lack of coordination between a critical minerals strategy and other, related policies, such as the national battery plan, the National Reconstruction Fund, and funding through the Clean Energy Finance Corporation (CEFC) and the Australian Renewable Energy Agency. The governance structure is critically important.

Government policy and cooperative engagement with industry have the potential to address the key risk concerns faced by investors at different stages in critical minerals development and deployment. As described in Grattan Institute's report, *The next industrial revolution*, a new approach to industry policy that utilises direct investment via bodies like the CEFC should be structured and funded to provide such support.[12]

Governments, industries, and researchers can work cooperatively to develop key technologies through Cooperative Research Centres (CRC). The Heavy Industry Low-carbon Transition (HILT) CRC is an example covering the more traditional minerals, iron and bauxite.[13] There is no CRC currently focused on the critical minerals sector.

Figure 2.4: Australia's advantage reduces further along the battery value chain

% of battery unit cost by component



Source: Grattan analysis of Accenture (2021b) and Frith (2021).

11. Hellyer (2020).
12. Wood et al (2022).
13. One of the authors of this submission, Tony Wood, is a member of the HILT CRC Board.

2.3 Building supply chains

International markets for critical minerals are likely to grow rapidly as global companies seek commercial advantages across national borders and governments attempt to mitigate supply chain risks and unintended consequences.

Rapid growth and conflicting objectives can lead to real problems: the poor design of the Petroleum Resource Rent Tax is one example; the impact of LNG exports on east coast domestic gas markets is another. If poorly managed, international carbon price linkages and exposure to carbon border adjustment mechanisms could repeat these mistakes.

The Federal Government should actively monitor these developments and prepare strategic responses that could be used in the national interest. At the least, such forward thinking may avoid knee-jerk reactions that have unintended consequences.

2.3.1 Better-informed policy design

Transparency should be a guiding principal. For example, data relevant to the clean energy and critical minerals supply chains should be collected and published. We note the *Resources and Energy Quarterly* now tracks lithium as well as traditional metals, but it does not track others; and it does not provide the sort of detailed data that are collected for coal, gas, and iron ore.

2.4 Supporting clean energy technologies

Australia's once-in-a-century opportunity arises from the combination of our critical minerals and clean (low-emissions) energy resources. Australia has not done a great job integrating our climate change and energy policies; that task remains work-in-progress. This has slowed the pace of change and almost certainly added unnecessarily to the cost and risks of the energy transition.

Critical minerals projects, particularly those that embrace downstream processing, will rely on clean energy supply. That demand is likely to grow rapidly alongside demand to produce green hydrogen and at the same time as the energy system is itself electrifying and decarbonising. Policies and infrastructure planning will need to be aligned to avoid a host of problems. Also needed will be a strong signal via the Safeguard Mechanism that new facilities must be built as low-emissions as possible. This means meeting and beating world's best practice. Australia will squander its advantage if it continues to lag behind other countries in producing low- and zero-emissions minerals, metals, and energy intense products.

2.5 Supporting sustainable critical minerals development

2.5.1 Achieving environmental, social, and governance best practice

Development and processing of critical mineral resources must not add to Australia's emissions, and this needs to be addressed via climate change policies. But extra emissions are not the only environmental effects from new mines or minerals processing.

Poorly regulated industrial and mining development can pose a threat to water quality and availability, air quality, visual amenity, and biodiversity. The health effects of poor air and water quality have been a constant concern for people in industrial regions. For example, elevated lead levels in Port Pirie and Mount Isa;[14] air pollution in the Hunter Valley and Gladstone;[15] and water pollution from manganese and lithium mines in Tasmania and Western Australia.[16] The previous mining boom in the early 2000s caused localised but severe habitat

14. Munksgaard et al (2010).
15. Nichols (2021), Layt (2021).
16. ABC Four Corners Program (2022).

loss and degradation,[17] as well as a larger threat to biodiversity from the cumulative impacts of extensive development.[18]

Facilities that close can leave a degraded legacy, and often the cost of dealing with this is shifted onto governments.

For example, the federal government found itself responsible for decommissioning and rehabilitating the Northern Endeavour oil and gas platform north-west of Darwin after the owners declared bankruptcy. The clean-up could cost up to $1 billion.[19] At a state level, the NSW Government is spending $10 million a year to rehabilitate abandoned mines,[20] and bore part of the cost of cleaning up the former BHP steelworks site in Newcastle.[21]

As well as creating budget burdens and leaving host communities with a degraded environment, failure to properly clean up can also impose future costs by making it more difficult to reuse sites. The Westgate Tunnel project in Melbourne is a good example: the discovery of contaminated soil on the route caused a $3 billion cost blow-out.[22]

Continue to strengthen environmental and planning laws

Australia has stricter laws to minimise environmental impacts from development than some competitor countries, and more regimented planning regimes. But our laws, and the bureaucratic processes associated with them, can still fall short of community expectations. When this happens, community opposition to new development can arise.

17. State of the Environment Report (2016a, p. 36).
18. State of the Environment Report (2016b, p. 22).
19. Fitzgerald (2021).
20. NSW Government (2022).
21. BHP paid the NSW Government $100 million to be released from responsibility for the clean-up. The final cost was more than $110 million. Sources: Atteridge and Strambo (2021), Hunter and Central Coast Development Corporations (n.d.).
22. Jacks (2021).

Strong, trusted, and transparent environmental and planning laws represent prudent risk management. They reduce the chances that industrial transformation and new industries are stymied by bottlenecks at the approval stage. They give host communities more control over what happens in their neighbourhoods. They mean future generations will not be left with a degraded environment when the boom is over. And they protect future governments from future costs.

It is short-sighted to argue that stronger laws will make Australia less attractive for new investment. International customers for commodities are increasingly concerned about the environmental and social impacts of supply chain activities. Tesla, for example, is giving priority to greener nickel for its batteries.[23] Other car-makers are seeking to eliminate environmental harm and human rights abuses from their cobalt supply chains.[24] International investors are increasingly concerned with environmental, social, and governance (ESG) performance and disclosure.

Strong and transparent environmental protection and planning laws, in line with community expectations, and whose administration is properly funded, make investing in Australia more, not less, attractive.

2.5.2 Engagement with First Nations peoples

Deep and sincere engagement with First Nations peoples should be standard practice for mineral exploration, development, operation, and clean-up. There are countless example of where engagement has failed, or been missing, which have resulted in profound anguish for traditional owners on country on which mining is taking place. It is imperative that companies find better ways to engage with First Nations peoples before extraction, to ensure consent and appropriate respect

23. Dean (2021).
24. Noble (2019).

for country, and to secure economic opportunity and participation (among other things).

The issues arising from mine closure should get more attention. The economic consequences of mine closure can be felt more keenly in remote Indigenous communities where infrastructure, community services, and employment are heavily dependent on the mine. As well, where mines are located on land that is handed back to Indigenous owners, the failure to properly provide for clean-up (see Section 2.5.1) has economic and cultural consequences.

but what should governments do?

3 Integrated Critical Minerals Strategy

Australia's critical minerals strategy must be a comprehensive approach to realising a once-in-a-century opportunity and ensuring its benefits are widely shared. It must be based on real, not wished-for, competitive advantage, and sit alongside complementary policies and other government initiatives.

In summary, the strategy should encompass:

- An in-depth assessment of opportunities and imperatives based on economic analysis of global supply chains for each of the critical minerals.
- Identification of the barriers and risks to realising the opportunities and what actions fall to government, working collaboratively with industry.
- A review of the relevant minerals resource rent taxes to ensure they are fit-for-purpose.
- Development of a targeted industry policy that includes funding support for projects (both debt and equity) and funding structures that ensure transparent funding allocation.
- Alignment with the federal government's Powering the Regions initiative, including establishment of and support for regional transition authorities.
- Alignment with energy and climate change policies, including electricity transmission planning, electricity capacity schemes, and the reformed Safeguard Mechanism.

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