frontier economics

Climate related expenditure and frameworks

A report for Aurizon Network | 13 December 2022

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1 Introduction

1.1 Background

The Queensland Competition Authority (QCA) is reviewing whether existing regulatory frameworks are sufficiently responsive to support prudent expenditure in an environment of climate change, and how best the QCA can support expenditure by regulated entities in response to climate change. The QCA has published a discussion paper seeking comments on matters including: [1]

- Climate-related risks and drivers;
- The effectiveness of existing regulatory frameworks to accommodate and create appropriate incentives to manage climate change risks; and
- Corporate and regulatory insights on how climate-related risks are managed by other organisations.

This review is occurring against a backdrop of increased occurrence and intensity of extreme weather events in Queensland, which have been underpinned by long term changes in temperature and rainfall.[2] Increasingly, climate-related and broader Environmental, Social and Governance (ESG) risks are driving government policy[3] and private sector investment expectations.

The QCA has proactively recognised these trends, stating that:[4]

> *Given these considerations, we think it is timely to consider whether our regulatory frameworks are sufficiently robust and flexible to support appropriate climate change related expenditures by entities and to provide the right incentives for such expenditures to be undertaken in a prudent and timely manner.*

As a result of this climate change expenditure review, the QCA intends to develop a framework that provides guidance to regulated entities about how the QCA will assess climate change related expenditure and to create incentives for entities to act prudently and in a timely manner when undertaking such expenditure.

The QCA's release of its discussion paper and its intention to review the regulatory framework against current and emerging climate-related risks represents best regulatory practice.

1 Queensland Competition Authority 2022, *Discussion paper Approach to climate change related expenditure*, October.

2 Queensland Government 2020, *State of the Environment Report 2020*, https://www.stateoftheenvironment.des.qld.gov.au/climate/climate-observations

3 Queensland Government 2021, *Queensland Sustainability Report 2021*, https://www.treasury.qld.gov.au/programs-and-policies/esg/

4 Queensland Competition Authority 2022, *Discussion paper Approach to climate change related expenditure,* October, p. 2.

1.2 Our instructions

Aurizon Network has asked Frontier Economics to provide advice on the following three issues:

- **ESG and financial markets**: How financial debt markets are approaching fossil fuel exposed sectors in terms of access and cost of finance, including how rating agencies are factoring this into their own assessments.
- **Physical risk of climate change and Review Events**: Climate change may result in increased frequency and magnitude of natural disasters in Queensland, presenting increased physical risk exposure for the central Queensland coal network. In a scenario of greater and more frequent natural disasters how should willingness to pay for resilience expenditure be assessed and what options are there for addressing high consequence events as an alternative to cost pass through (review events).
- **Transition risk and uncertainty in future demand**: How policy changes domestically and internationally could alter the outlook for coal demand, and how this in turn increases the long-term demand uncertainty faced by Aurizon Network. We have been asked to explore:
  - The relevance of reserve estimates as a basis for assessing economic lives;
  - Conceptual models for managing long term demand risk (e.g., the Windows Of Opportunity PaST (WOOPS) framework) considered by regulators in other jurisdictions; and
  - The information and evidentiary requirements required to demonstrate impact of asset stranding risk and the efficacy/impacts of any relevant mitigation measures.

We understand this work may support Aurizon Network's submissions in relation to the QCA's climate change expenditure review 2022–23.

1.3 Key findings

We have identified several high priority issues that the QCA may consider as it develops guidance for regulated entities about how it will assess climate change related expenditure:

- There is a growing body of evidence documenting the increasing difficulty that coal-exposed businesses are experiencing in obtaining insurance and finance. A growing set of investors are withdrawing from coal-related investments, many insurance companies have also withdrawn from that market, and credit rating agencies are increasingly factoring the risk of coal exposure into their ratings. This has direct and indirect implications for Aurizon Network and its customers who are coal-exposed entities. To the extent that regular channels of finance and insurance become less available to these customers, there are implications for their long-term financial viability and for the form in which they are held (e.g., a privately owned mine is likely to be less credit-worthy than a publicly listed entity). These are important developing risks that were not contemplated when the current regulatory framework was designed.
- It is possible that natural disasters could occur more frequently and be more severe in magnitude in the future due to climate change increasing the direct an indirect costs of network disruption for Aurizon Network's customers. Under this scenario, the current Review Event mechanism may contribute toward and asset stranding risk for Aurizon Network. Further, given the increased costs of disruption, customers may prefer alternative

arrangements to complement or replace the Review Event mechanism. We consider the relative merits of Aurizon Network investing in network resilience to reduce the impact of future Review Events, the recovery of direct Review Event costs over an extended time period, and the advanced recovery of expected direct Review Event costs. The relative merits of each of these options are influenced by customers' risk preferences and the degree of uncertainty in long-term demand for Aurizon Network's assets.

- The QCA should take a proactive approach to manage any potential stranding risk. Failure to act early has the potential to lead to large price shocks for customers in the future and create inter-generational inequity.

2 ESG and financial markets

Trends in global financial markets present new and emerging issues for coal-exposed businesses, particularly as they relate to current and future debt costs. This section discusses themes and issues related to:

- The emergence of ESG as a mainstream consideration for businesses, their investors and other stakeholders, and the communities in which they operate;
- How the financial markets are approaching fossil fuel exposed sectors; particularly in relation to credit ratings and the cost of debt; and
- How financial market trends may continue to evolve, with implications for regulated infrastructure businesses.

2.1 ESG is a significant influence in financial markets

There was a time when environmental, social and governance (ESG) issues were a niche concern of a select group of stakeholders. That time has long since passed, and now the consideration of ESG risk factors, particularly those relating to climate, has become an integral part of investment analysis and decision-making processes. Investors now recognise that climate risks can manifest in two ways:

- Physical Risks: Physical risks arise from climate and weather-related events that damage or otherwise impact a firm's assets. Specific weather events can be considered as acute risks (e.g., a section of track is washed out during a cyclone), and the longer-term shifts in climate patterns as chronic risks (e.g., more frequent extreme temperature days result in more frequent volume constraints being imposed); and
- Transition Risks: Transition risks arise from the process of adjusting toward a lower-carbon economy. This transition can be driven by changes in government policy, technology or behaviour. For example, a change in government policy may cause an increase in energy costs, or a decrease in the volume of thermal coal shipments. These transition risks can impact the value of assets and liabilities, thereby altering the risk profile of the firm.

The sixth Inter-Governmental Panel on Climate Change (IPCC) assessment report highlights the increasing trend of both acute and chronic physical risk in Australasia. The assessment makes specific reference to the impacts on ecosystems, critical infrastructure, essential services, food production, the national economy, valued places and employment due to extreme weather events such as of heatwaves, droughts, floods, storms and fires.[5]

Financial market recognition of ESG and climate risk is mainstream

Recognition of climate risks has become increasingly important in global financial markets, particularly since the signing of the Paris Agreement in 2015. The understanding of how climate risks impact businesses has largely been driven by a growing trend of reporting and disclosure of climate related risks. The Taskforce on Climate-related Financial Disclosure (TCFD) has played a large role in catalysing this shift. The TCFD was established by the Financial Stability Board (FSB) to

[5] IPCC, 2022, *Fact sheet – Australasia*, https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Australasia.pdf.

"develop voluntary, consistent climate-related financial disclosures that would be useful to investors, lenders, and insurance underwriters in understanding material risks". [6] The TCFD's final recommendation report, published in June 2017, outlines a framework for voluntary disclosure of climate related risk and has been used by companies, investors and regulators worldwide.

Figure 1: Climate-related risks, opportunities, and financial impact

Source: Task Force on Climate-related Financial Disclosures.

In November 2021, APRA released its CGP229 Prudential Practice Guide designed to assist the Australian financial sector on managing the financial risks of climate change. APRA cited the importance of disclosing climate related risks to investors and considered it is "better practice for any disclosures to be produced in line with the framework established by the TCFD".[7] Furthermore, in December 2022 the Australian Treasury released a discussion paper seeking input on the development of an Australian climate risk disclosure framework.[8] Announcing the release of the discussion paper, the Treasurer stated:[9]

> *As more countries move towards global best practice, and as investors demand higher-quality disclosures, it's important that Australia now establish a framework for consistent, credible,*

6 TCFD, 2017, *Recommendations of the Task Force on Climate-related Financial Disclosures,* 15 June, https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf.

7 APRA, 2021, *Prudential Practice Guide CGP 229 Climate Change Financial Risks,* November, https://www.apra.gov.au/sites/default/files/2021-11/Final%20Prudential%20Practice%20Guide%20CPG%20229%20Climate%20Change%20Financial%20Risks.pdf.

8 Treasury 2022, *Climate-related financial disclosure*, 12 December, https://treasury.gov.au/consultation/c2022-314397

9 Commonwealth Treasury 2022, *More transparency and more investment in cleaner and cheaper energy* [media release], 12 December, https://ministers.treasury.gov.au/ministers/jim-chalmers-2022/media-releases/more-transparency-and-more-investment-cleaner-and#:~:text=Australian%20businesses%20are%20already%20leaders,for%20Climate%2Drelated%20Financial%20Disclosures.

internationally-comparable disclosures. … These reporting requirements are expected to be mandatory for large entities and phased in over time.

Physical risks of climate change are already having a large impact on the insurance industry's ability to underwrite economic activity. This is due to the increasing size and frequency of insured losses for climate-related natural disasters.[10]

In managing transitional risk, many insurers have begun phasing out their exposure to coal (see **Table 1** below for Australian examples). The 2022 'Insure Our Future' report stated that globally, "41 insurers have withdrawn or reduced cover for coal, representing 39.3% of the market for primary insurance and 62.1% of the market for reinsurance."[11]

The RBA's 2021 bulletin on Climate Change Risks to Australian banks notes that banks are exposed to physical risks in their household lending activities and to transitional risks in their business lending activities.[12]

Credit rating agencies are incorporating ESG and climate risks into their advice

Credit rating agencies are also recognising ESG and climate risk factors as part of their rating processes. The three largest credit rating agencies—Moody's, Standard & Poor's (S&P), and Fitch—have begun making specific reference to ESG considerations in the latest versions of their credit-rating methodologies. For example:

- Moody's has started incorporating ESG as an 'Other consideration' in their rating process. Transition risk, stranded asset risk and physical risk were all cited as environmental considerations in the 2022 rating methodology update for Regulated Electric and Gas Networks.[13] In the updated rating methodology for Independent Exploration and Production, Moody's recognised the limitations in quantifying carbon transitions risks:

The long-term nature of carbon transition risks may mean that they are not fully reflected in our published scorecards. Forward-looking published scorecards are typically based on our near-term projections, in part because we may not have sufficient visibility into an issuer's future results beyond this horizon that would enable us to accurately score these factors…. As a result, carbon

10 RBA, 2022, https://www.rba.gov.au/speeches/2022/sp-so-2022-08-24.html.

11 Insure Our Future, 2022, *2022 Scorecard on Insurance, Fossil Fuels and the Climate Emergency,* October, https://insure-our-future.com/wp-content/uploads/2022/11/SP-IOF-2022-Scorecard-v0.8-online-1.pdf.

12 RBA, 2021, *Climate Change Risks to Australian Banks,* 16 September, https://www.rba.gov.au/publications/bulletin/2021/sep/climate-change-risks-to-australian-banks.html.

13 Moody's, 2022, *Rating Methodology: Regulated Electric and Gas Networks,* https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_1322720.

transition risks may over time. Cause our ratings to be lower than scorecard-indicated outcomes for some companies in this sector.[14]

Fitch provides more granularity with its ESG considerations. Fitch assigns an ESG Relevance Score (ESG.RS) to communicate how ESG factors affect their credit ratings. ESG.RS scores are expressed on a scale of '1' to '5', where a rating of '5' indicates the ESG factor is a key rating driver and is highly relevant to the credit rating, while a rating of '1' indicates the factor is irrelevant.[15]

- Governance issues represented the most important ESG factor of the 1,650 corporate issuers rated in 2021 by Fitch. The minimum ESG.RS for governance-related issues was '3', with 11.6% of rated corporate issuers having one elevated governance score ('4' or '5'). Social and environmental issues had a comparatively lower impact on corporate credit ratings with elevated scores of only 4.6% for social and 2.5% for environmental. As at year-end 2021, carbon-intensive industry sectors such as oil and gas predominantly had scores of '3' – indicating minimal impact on credit ratings.[15]

Increased disclosure on ESG and climate risk has seen the rise of sustainable and ethical investing practices. Sustainable investment broadly uses ESG screening methods to screen out companies that don't meet certain ESG criteria. Asset managers globally are expected to increase their ESG related assets under management to US$33.9 trillion by 2026, from US$18.4 trillion in 2021.[16]

2.2 Aurizon Network and climate risk

Aurizon Network is exposed to climate change related risks relating to climate change and ESG investment trends:

- Physical risk to assets across AN's various systems resulting from natural disasters associated with a changing climate;
- Transitional risk, whereby AN's operations are impacted by changes in government and other policies. Such policies may affect the demand for AN's regulated services, potentially involving future stranding of some assets, including a potentially higher cost of debt than would apply to an otherwise identical business that is not associated with coal or other fossil fuels.

Aurizon recognises the impact of both physical and transition risks in its 2022 Sustainability Report:

Transition risks relate to a wide set of changes in policy, law, markets, technology, and prices that are necessary to achieve the transition to a low-carbon economy, and will affect the demand for the commodities we haul or is railed across our network. Acute physical risks related to extreme

14 Moody's, 2022, *Rating Methodology: Independent Exploration and Production*, https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_1284973.

15 Fitch Ratings, 2022, *Where ESG Matters for Corporate Ratings*, https://www.fitchratings.com/research/corporate-finance/where-esg-matters-in-corporate-ratings-17-05-2022.

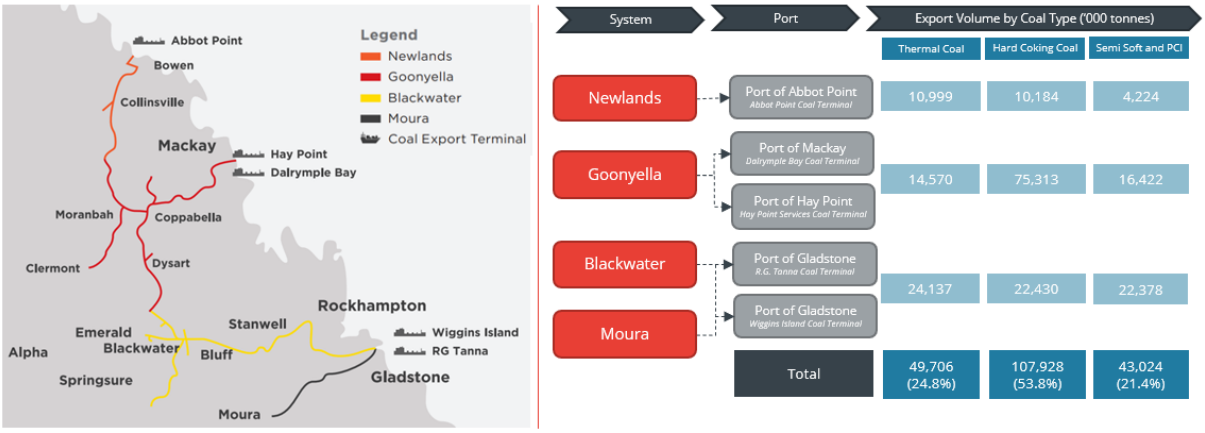
16 PwC, 2022, *Asset and wealth management revolution 2022*, https://www.pwc.com/gx/en/financial-services/assets/pdf/pwc-awm-revolution-2022.pdf.

weather events will also continue to affect our business through supply chain disruptions. In the longer term, (chronic) trends, such as average summer temperature increases and extended periods of high temperature, have the potential to disrupt the supply chain through heat stress and associated precautionary measures, such as track speed restrictions.[17]

Aurizon Network's CQCN is comprised of four main systems, presented in **Figure 2** below:

- **Newlands:** Located at the northern end of the Bowen Basin, the Newlands system connects to the Goonyella system, allowing for additional CQCN customers to access the Port of Abbot Point.[18] Major customers of the Newlands system include Glencore, Jellinbah Resources and QCoal.[19]
- **Goonyella:** The Goonyella system connects to export terminals at Hay Point and Dalrymple Bay in Mackay and Abbot Point in Bowen (through the Newlands system). Major customers of the Goonyella system include BMA, Glencore, Anglo American and Peabody.[20].
- **Blackwater:** The Blackwater system connects to the RG Tanna Coal Terminal and the Barney Point Coal Terminal at the Port of Gladstone. Major customers of the Blackwater system include BMA, Jelinbah Resources, Coronado and Glencore.[21]
- **Moura:** The Moura system runs from Moura to Gladstone and connects to the two terminals at the Port of Gladstone. The major customer of the Moura system is Anglo American.[22]

Figure 2: Key features of Aurizon's CQCN supply chain



Source: Aurizon[23]*, export volume sourced from Aurizon's 2018 submission to the QCA.*

17 Aurizon, 2022, *2022 Sustainability Report,* https://www.aurizon.com.au/sustainability

18 Now called North Queensland Export Terminal.

19 Aurizon, *Newlands rail corridor fact sheet*

20 Aurizon, *Goonyella rail corridor fact sheet*

21 Aurizon, *Blackwater rail corridor fact sheet*

22 Aurizon, *Moura rail corridor fact sheet*

23 Aurizon 2022, *2022 Sustainability Report,* https://www.aurizon.com.au/sustainability

All of these systems are subject to both physical and transitional risk in relation to climate change, albeit to potentially different degrees given their different geographic locations and their relative mix of thermal and metallurgical coal. For example, around 85% of volume hauled across the Goonyella system is coking coal and is considered a lower transition risk when compared with thermal coal based upon the ability to substitute using current technologies.

2.3 The cost and access to debt for fossil fuel exposed businesses

Fossil fuel exposed projects, in particular thermal coal mining and coal-fired generation are the most exposed to transitional risk and are beginning to face tighter financing conditions as investors and financial institutions place restrictions on their lending and investment activities.

For example, in his 2020 letter to CEOs, BlackRock's Larry Fink warns of the speed at which climate risk factors will influence the allocation of capital:

> *Because capital markets pull future risk forward, we will see changes in capital allocation more quickly than we see changes to the climate itself. In the near future – and sooner than most anticipate – there will be a significant reallocation of capital.*[24]

Globally, there have been increased commitments from the private sector to achieve 2050 net zero targets and phase out exposure to fossil fuels. Major investor-led activist initiatives have emerged in response to climate risk, including:

- Climate Action 100+: *"an investor-led initiative to ensure the world's largest corporate greenhouse gas emitters take necessary action on climate change*". As of November 2022, Climate Action 100+ engaged 700 investors managing a total of US$68 trillion in assets.[25]
- The Net Zero Asset Managers initiative (NZAMI): *"an international group of asset managers committed to supporting the goal of net zero greenhouse gas emissions by 2050 or sooner"*. As of November 2022, NZAMI has 291 signatories with US$66 trillion in assets under management. [26] The world's three largest asset managers: Blackrock, Vanguard and State Street Global Advisors are all signatories to NZAMI.[27]
- The UN-convened Net Zero Asset Owners Alliance: *"a member-led initiative of institutional investors committed to transitioning their investment portfolios to net-zero GHG emissions by*

[24] BlackRock, 2020, *Larry Fink's 2020 Letter to CEOs,* https://www.blackrock.com/corporate/investor-relations/2020-larry-fink-ceo-letter.

[25] Climate Action 100, *Global investors driving business transition,* https://www.climateaction100.org/.

[26] Net Zero Asset Managers initiative, https://www.netzeroassetmanagers.org/.

[27] Investor Group on Climate Change, 2021, *Submission to the Joint Standing Committee on Trade and Investment Growth inquiry into the prudential regulation of investment in Australia's export industries,* April *Accessed: https://igcc.org.au/wp-content/uploads/2021/04/300421_IGCC-Submission_Exports.pdf.*

2050".[28] As of 31 August 2022, the Net Zero Asset Owners Alliance had 74 members with US$10.6 trillion assets under management.[29]

Pressure from investor groups, as well as concern about climate risk, has seen asset managers reduce their investment in fossil fuels globally. In 2020, Blackrock—the world's largest asset manager with almost US$9 trillion of assets under management—announced that it would exclude from its discretionary actively-managed portfolio companies that generate more than 25 per cent of their revenues from thermal coal production.[30] That is not to say that all access to fossil fuel funding has been restricted entirely. As of 2022, Blackrock's passively managed funds still have equity and bond holding positions of over US$133 billion in fossil fuel exposed investments, ranking above all other global asset managers.[31]

Governments and state-backed financial institutions are also increasingly reviewing their financing of coal projects. South Korea and Japan have historically been major financers of coal-fired power plants in Bangladesh, Indonesia, Philippines and Vietnam.[32] In April 2021, South Korea terminated public overseas coal financing.[33] Two months later, Japan—along with the other G7 countries—committed to "an end to new direct government support for unabated international thermal coal power generation by the end of 2021, including through Official Development Assistance, export finance, investment, and financial trade promotion".[34]

Until recently, China was the lender of last resort for new coal financing but announced, at the UN General Assembly in 2021, that it would cease funding for overseas coal projects. Three days later, the Bank of China pledged to end funding for new overseas coal power and coal mining projects.[35]

Institutional investors are also restricting their coal financing. In May 2021, the Asian Development bank—one of the region's biggest energy financiers—announced it would withdraw from financing new coal power and heat plants.[36]

Within Australia, a growing number of financial institutions are restricting or phasing out financing or investing in fossil fuel projects—particularly those with exposure to thermal coal. Some examples of these commitments are summarised in **Table 1** below.

28 UN environment program, *UN-convened Net-Zero Asset Owner Alliance*, https://www.unepfi.org/net-zero-alliance/.

29 United Nations Environment Programme, 2022, *The Second Progress Report of the Net-Zero Asset Owner Alliance: Advancing Delivery on Decarbonisation Targets*
Accessed: https://www.unepfi.org/wordpress/wp-content/uploads/2022/09/AOA-Progress-Report-2022-3.pdf.

30 S&P Global Market Intelligence, 2021, *Blackrock heading to net zero holds large fossil fuel investments for now*, 12 February, viewed 28 November 2022, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/blackrock-heading-to-net-zero-but-holds-large-fossil-fuel-investments-for-now-62628334.

31 Reclaim Finance, 2022, *Asset Manager Climate Scorecard 2022*. April
https://www.profundo.nl/download/asset-manager-climate-scorecard-2022.

32 Global Energy Monitor, 2020, *South and Southeast Asia's Last Coal Plants*
https://globalenergymonitor.org/wp-content/uploads/2021/01/South-and-Southeast-Asias-Last-Coal-Plants.pdf.

33 US Department of State, 2021, *Leaders Summit on Climate: Day 1*, 22 April,
https://www.state.gov/leaders-summit-on-climate/day-1/.

34 G7, 2021, *Carbis Bay G7 Summit Communique*
https://www.consilium.europa.eu/media/50361/carbis-bay-g7-summit-communique.pdf.

35 Reuters, 2021, https://www.reuters.com/business/sustainable-business/bank-china-stop-financing-new-coal-mining-power-projects-overseas-q4-2021-09-24/.

36 Asian Development Bank, 2021, *Energy Policy Supporting Low-Carbon Transition in Asia and the Pacific,* September
https://www.adb.org/sites/default/files/institutional-document/737086/energy-policy-r-paper.pdf.

Table 1: Restrictions on fossil fuel financing by major Australian financial institutions.

Institution	Type	Assets/ market cap	Restrictions
Aware Super	Asset Manager	A$145 billion (assets)	Divested from companies that derive more than 10 per cent of their revenue from thermal coal by October 2020.
UniSuper	Asset Manager	A$102 billion (assets)	Divested from companies that derive more than 10 per cent of their revenue from thermal coal.
Macquarie Group	Asset Manager/ Bank	A$70 billion (market cap)	Will fully divest from the coal sector by 2024.
HESTA	Asset Manager	A$68 billion (assets)	Will fully divest from companies deriving more than 15 per cent of revenue from thermal coal.
ANZ	Bank	A$73 billion (market cap)	Will not finance new builds of conventional coal-fired power plants.
Commonwealth Bank of Australia	Bank	A$181 billion (market cap)	Zero thermal coal exposure by 2030.
National Australia Bank (NAB)	Bank	A$99 billion (market cap)	Effectively zero thermal coal exposure by 2030 (aside from residual performance guarantees on existing coal mines)
NAB	Bank	-	Will not finance oil/tar sands extraction projects or oil and gas projects in the Arctic or Antarctic.
Westpac	Bank	A$83 billion (market cap)	Zero exposure to companies with >%5 of their revenue derived from thermal coal mining by 2030.
Export Finance and Insurance Corporation	Export Credit Agency	-	Excludes coal power unless Ultra Super Critical with emissions <750g CO_2/kWh.
IAG	Insurer/ Reinsurer	A$12 billion (market cap)	Ceasing underwriting entities predominately in the business of extracting fossil fuels and power generation using fossil fuels by 2023.
QBE of Australia	Insurer/ Reinsurer	A$19 billion (market cap)	Zero thermal coal exposure by 2030.

Institution	Type	Assets/ market cap	Restrictions
Suncorp	Insurer/ Reinsurer	A$15 billion (market cap)	Zero thermal coal exposure by 2025.
Suncorp	Insurer/ Reinsurer	-	Phase out direct investment in oil and gas exploration and production by 2040 with interim targets for 2025 and 2030.

Source: Frontier Economics.

There is a growing literature on the link between the restrictions on coal financing and the cost of borrowing. This literature explores the extent to which the reduction in the supply of finance to coal-exposed companies has the effect of increasing the cost of that debt finance and/or an impact on credit ratings. This literature provides some evidence that fossil-fuel exposed firms may have lower credit ratings and/or a higher cost of debt relative to other comparator firms. For example:

- Jung et al. (2016) observe a positive and significant association between the cost of debt and carbon risk (defined as total scope 1 greenhouse gas emissions divided by sales revenue) for 78 Australian companies listed on the ASX over the period 2009-2013;[37]
- Seltzer et al. (2022) observe that of bonds issued by U.S. public non-financial companies over the 2009-2017 period, poor environmental performance, including having a more significant carbon footprint, is associated with lower credit rating and higher bond yield spreads; [38]
- Apergis et al. (2022) observe that a better ESG rating is associated with lower cost of unsecured debt in the primary market for companies listed on the S&P over the period 2010-2019;[39]
- Ehlers et al. (2021) observe that pricing of carbon risk in the syndicated loan market is mixed. Risks premiums were charged to borrowing firms with higher carbon intensities since the Paris Agreement, but the level of the premium was small relative to the material risks. Furthermore, the premiums predominantly only captured scope 1 emissions;[40]
- The Hong Kong Monetary Authority (2021) finds, for syndicated loans originated in the Asia Pacific region, that banks in the region have started to price-in carbon risks for loans to emissions-intensive sectors (scope 1 and 2 emissions to revenue) since the Paris Agreement. On average, banks are estimated to charge a higher lending spread to a high emitting firm by 23 basis points; [41]

37 Jung, Herbohn and Clarkson, 2016, *Carbon Risk, Carbon Risk Awareness and the Cost of Debt Financing.*

38 Seltzer, Starks and Zhu, 2022, *Climate Regulatory Risks and Corporate Bonds.*

39 Apergis, Poufinas and Antonopoulos, 2022, *ESG Scores and Cost of Debt.*

40 Ehlers, Packer and de Greiff, 2021, *The Pricing of Carbon Risk in Syndicated Loans: Which Risks Are Priced and Why?*

41 Hong Kong Monetary Authority, 2021, *Research memorandum 06/2021 Effect of climate-related risk on the pricing of bank loans: Evidence from syndicated loan markets in Asia Pacific,* 13 August, https://www.hkma.gov.hk/media/eng/publication-and-research/research/research-memorandums/2021/RM06-2021.pdf.

- An Oxford Sustainable Finance Programme study analysed loan information from 12,072 loan deals between 2000 and 2020. They observed that the loan spreads for coal mining companies increased by 54% from 2007-2010 to 2017-2020;[42]
- Mastouri et al. (2022) observe that when controlling for credit rating, sector exposure, size, and economic output, utilities, materials, and energy firms do not currently face a statistically significant higher cost of borrowing – despite their higher climate policy risk. The same was observed for physical climate risk;[43] and
- Cornell and Damodaran (2021) found weak evidence that a company being 'good' (showing positive ESG signs) improved operating performance, however found stronger evidence that being 'bad' (showing lower ESG signs) can make funding more expensive in both debt and equity.[44]

The literature provides a range of different estimates of the magnitude of the 'coal effect'. This is because the various studies examine different samples of cross-sectional data and employ different estimation methods. It is also likely that the magnitude of any 'coal effect' depends on business-specific factors such as:

- Geographical location: This will inform the level of physical risk that is present.
- Product composition: Companies that are exposed to thermal coal are likely to experience transition risk earlier than those exposed to metallurgical coal.

It is also likely that the magnitude of any 'coal effect' would change over time as regulatory and reporting standards evolve (e.g., if TCFD becomes mandatory or as ISSB disclosures become standard, etc.).

Credit rating agencies are also increasingly recognising these market dynamics. Fitch and Moody's have provided recent ratings updates on Queensland-based coal infrastructure companies. ESG considerations are cited in all updates, specifically around the increased transition risk in the thermal coal market. For example:

- Newcastle Coal Infrastructure Group (NCIG)
  - As at 18 August 2022, Fitch revised its outlook on NCIG to positive, and affirmed their 'BBB-' rating. Fitch makes specific reference to NCIG's highly concentrated exposure to the thermal coal market, which it considers *"having greater risk due to the global political and environmental pressures on power generators"*. [45]
  - Furthermore, Fitch assigned an elevated ESG.RS score of '5' for Management Strategy, citing that the:

> *Bullet amortisation debt structure compounds the risk of limited refinancing options. This is due to rising pressure on lenders to stop financing coal assets, as we have observed at other ports that*

[42] Oxford Sustainable Finance Programme, 2021, *The Energy Transition and Changing Financing Costs.*

[43] Mastouri, Mendiratta and Giese, 2022, *Corporate Bonds and Climate Change Risk*, 3 October.

[44] Cornell and Damodaran, 2020, *Valuing ESG: Doing Good or Sounding Good?*, 19 March.

[45] Fitch Ratings, 2022, *Fitch revises outlook on Newcastle Coal Infrastructure group to positive; Affirms Ratings at 'BBB-'*, 18 August, https://www.fitchratings.com/research/infrastructure-project-finance/fitch-revises-outlook-on-newcastle-coal-infrastructure-group-to-positive-affirms-ratings-at-bbb-18-08-2022.

focus on coal. This has a negative impact on the credit profile, and is relevant to the rating in conjunction with other factors. [46]

- Dalrymple Bay Finance Pty Ltd, as the ultimate financing vehicle for the Dalrymple Bay Terminal (DBT)
  - As at 18 February 2022, Fitch revised its outlook on Dalrymple Bay Finance Pty Ltd to stable, and affirmed their 'BBB-' rating. Fitch assigned an elevated ESG.RS score of '4' for Management Strategy, citing that:

Refinancing risk associated with the bullet debt structure is compounded by investors increasing concerns over the environmental impact of coal-related assets, which has a negative impact on the credit profile, and is relevant to the rating in conjunction with other factors. [47]

  - However, when comparing to industry peer NCIG, Fitch makes the distinction that DBT and NQXT's throughput of metallurgical coal is a "more stable commodity [than thermal coal] with greater predictability of price and long-term demand".
- North Queensland Export Terminal Pty Ltd (NQXT)
  - As at 14 March 2022, Moody's confirmed the backed senior secured rating on NQXT's notes of Ba2. In their considerations, they noted that the terminal's financial strengths are counterbalanced by:

The rising exposure to ESG risks associated with thermal coal-related assets, reflecting the demand erosion over time in the context of the carbon transition" and "continuing exposure to refinancing risk, albeit reduced with our understanding on NQXT's refinancing plan, and the increasingly reducing appetite of lenders to fund coal-related issuers. [48]

  - As at 12 September 2022, Fitch revised its outlook on NQXT to stable, and affirmed their 'BB+' rating. Fitch assigned an elevated ESG.RS score of '5' for Management Strategy, citing that:

46 Fitch Ratings, 2022, *Fitch revises outlook on Newcastle Coal Infrastructure group to positive; Affirms Ratings at 'BBB-'*, 18 August, https://www.fitchratings.com/research/infrastructure-project-finance/fitch-revises-outlook-on-newcastle-coal-infrastructure-group-to-positive-affirms-ratings-at-bbb-18-08-2022.

47 Fitch Ratings, 2022, *Fitch affirms Dalrymple Bay Finance Pty Limited at 'BBB+'; Outlook stable*, 18 February, https://www.fitchratings.com/research/infrastructure-project-finance/fitch-affirms-dalrymple-bay-finance-pty-limited-at-bbb-outlook-stable-18-02-2022.

48 Moody's, 2022, *Moody's confirms North Queensland Export Terminal's senior secured rating of Ba2; outlook negative* https://www.moodys.com/research/Moodys-confirms-North-Queensland-Export-Terminals-senior-secured-rating-of--PR_463655.

The elevated score reflects the company's bullet-amortisation debt structure, which compounds the risk of limited refinancing options. This is due to rising pressure on lenders to stop financing coal assets, as we have observed at other ports that focus on coal. This has a negative impact on the credit profile, and is relevant to the rating in conjunction with other factors. [49]

It is evident that the transitional risks surrounding thermal coal are a contributing factor in the credit assessment for the above three companies. While social and governance factors have typically had a larger influence on ESG-related rating downgrades,[50] Fitch expects a greater focus on environmental risks over the next five years as regulation and the cost of non-compliance rise. Furthermore, as data becomes increasingly disclosed and standardised, credit rating agencies may be able to provide a more informative assessment of climate risks. The European Central Bank's report into climate change risk disclosure[51] provides one such framework which credit rating agencies could follow a uniform approach in assessing climate risk.

In summary:

- Fossil fuel exposed projects, in particular thermal coal mining and coal-fired generation are the most exposed to transitional risk and are beginning to face tighter financing conditions as investors and financial institutions place restrictions on their lending and investment activities.
- The literature identifies that this tightening of lending and investment to coal-exposed businesses is having two effects:
  - It has an impact on borrowing rates as the supply of debt finance contracts; and
  - It is being incorporated as part of the credit rating process.
- The magnitude of any effect is case-specific, depending upon the circumstances and characteristics of each business.

2.4 The regulatory implications of continued ESG trends

We have noted above that the literature and the observed commercial practice of banks, investment firms, and credit rating agencies establishes the possibility of a 'coal effect.' This could potentially manifest as a reduction in available debt and equity financing, an increase in the cost of capital, and/or an impact on credit ratings.

It is important to note that the nature and magnitude of any such effect is likely to:

- Be case-specific, depending upon the circumstances and characteristics of each business; and

[49] Fitch Ratings, 2022, *Fitch revises North Queensland Terminal's outlook to stable, affirms at 'BB+' on planned refinancing*, 12 September, https://www.fitchratings.com/research/infrastructure-project-finance/fitch-revises-north-queensland-terminal-outlook-to-stable-affirms-at-bb-on-planned-refinancing-12-09-2022.

[50] Standard & Poor's, 2022, *Credit Trends: ESG Factors Influence Close To 1 In 4 Potential Downgrades As 2022 Unfolds*, 3 February https://www.spglobal.com/ratings/en/research/articles/220203-credit-trends-esg-factors-influence-close-to-1-in-4-potential-downgrades-as-2022-unfolds-12262601.

[51] European Central Bank, 2022, *Disclosure of climate change risk in credit ratings,* September, *https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op303~eaa6fe6583.en.pdf?26d23c18fd6af8516a0d3b1c86384422*

- Change over time with changes in government policy and the practices of banks, investment firms, and credit rating agencies.

This has two immediate implications for the regulatory framework:

- Regulated entities with significant coal exposures should not be treated as generic infrastructure firms. That is, the QCA should not automatically adopt the same BBB+ credit rating and the same generic BBB+ yield that it applies to other regulated firms such as water utilities. Rather, the QCA should be open to the possibility that a 'coal effect' might have an impact on regulatory parameters such as the benchmark credit rating, benchmark gearing, and allowed cost of debt.
- It would not be appropriate for a regulator to adopt a single set of parameters for all coal-exposed businesses – because the magnitude of any such effect is likely to be case-specific. For example, in the near term, there may be material differences between exposure to thermal versus metallurgical coal.

These two observations suggest that it should be open to each firm to provide evidence of the existence and magnitude of any 'coal effect.' It is important to note that the case would have to be made from the perspective of a benchmark efficient firm providing the regulated service, and not from the perspective of the regulated firm itself. For example, it would not be sufficient to establish that XYZ Ltd actually has a higher cost of debt than the standard regulatory allowance—because any premium being paid by XYZ Ltd may be due to individual financing choices and other factors unrelated to the firm's coal exposure. Rather, what would have to be established is that an efficient firm providing the regulated services would, in the circumstances, incur a higher cost of debt – due to its coal exposure.

We also note that one of the primary drivers of any such 'coal effect' is the possibility of stranding such that lenders will not be fully repaid. The risk of standing is largely within the control of the QCA, with methods available to address stranding risk (discussed in section 4 of the report). To the extent that the QCA is able to address stranding risk satisfactorily, there would be less reason for a premium to be applied to the allowed return on debt or for any adjustment to the benchmark credit rating. However, we note the above evidence that, even in the absence of any stranding risk, there is a growing class of investors unwilling to finance coal-exposed assets. That is, there is a class of investors that is unwilling to invest in coal assets because they are coal assets – not because they are subject to stranding risk. Thus, addressing stranding risk is an important consideration for the QCA, but it will not eliminate the reduced pool of capital available to coal-exposed businesses.

It is also important to recognise that the Central Queensland rail system assets generally have an expected engineering life that extends beyond the life of many individual mines. Thus, the full recovery of invested capital depends not only on the continued viability of existing mines, but on the development of new mines into the future. To the extent that the pool of capital available to new coal mines is even more limited than that available to existing mines, the issues set out in this section are likely to be exacerbated in the future.

In November 2022, APRA released its Climate Vulnerability Assessment Results report where it found:[52]

[52] APRA 2022, *Climate Vulnerability Assessment Results*, 30 November, https://www.apra.gov.au/sites/default/files/2022-11/Information%20Paper%20-%20Climate%20Vulnerability%20Assessment%20Results.pdf

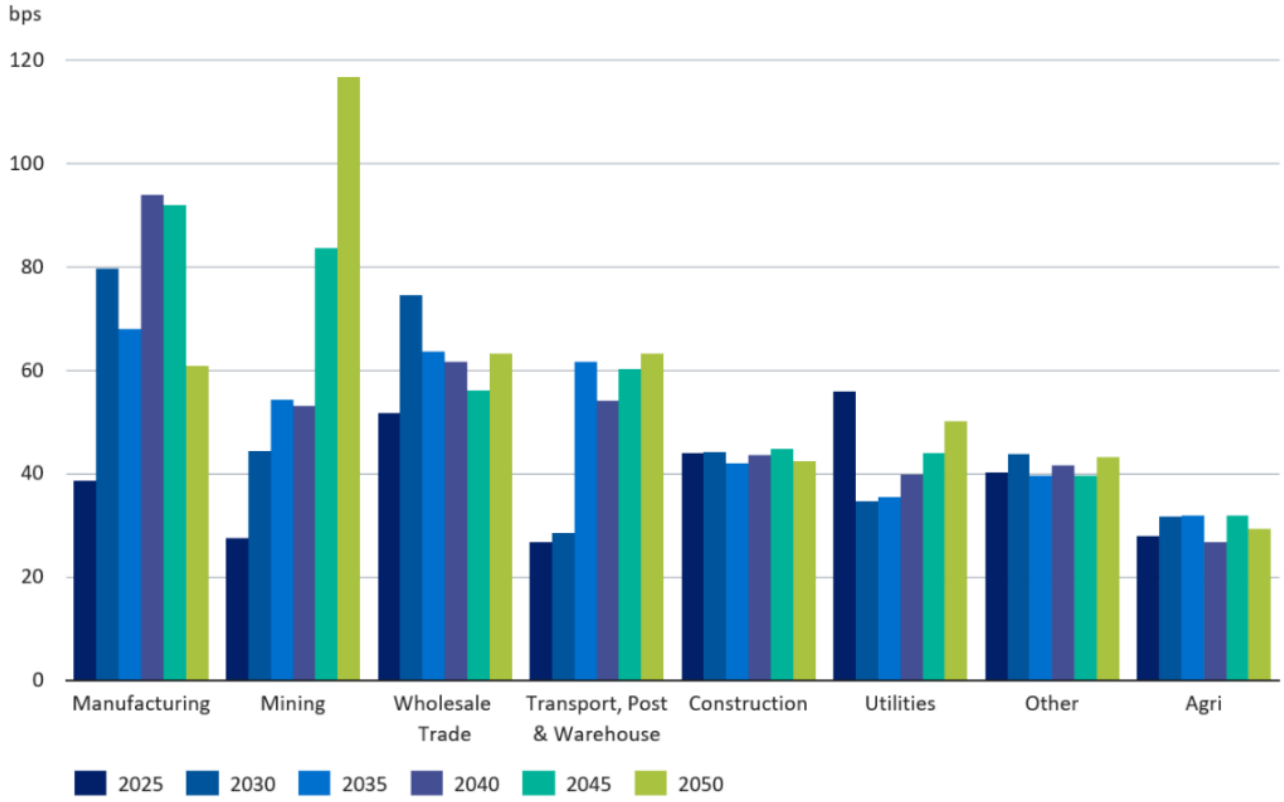
- Climate risk impacts are likely to be concentrated in specific industries, such as coal mining; and
- Banks project adjustments to their lending practices, including reduced exposures to higher risk industries.

This report was conducted by Australia's five largest banks—Australia and New Zealand Banking Group, Commonwealth Bank of Australia, Macquarie Bank, National Australia Bank and Westpac Banking Corporation—and assessed the exposure of their lending practices to the physical and transitional risks of climate change. The modelling was conducted under a 'Delayed Transition Scenario', whereby decarbonisation policies are delayed until 2030, followed by a rapid decarbonisation thereafter. Under this scenario:

> *the banks projected that they may respond by changing the composition of their business lending portfolios, particularly through significant reductions in their exposures within the mining sector, where the impact of transition climate risks were most acute. In aggregate, this reduced exposure to Coal Miners (90 per cent) and Oil & Gas Extractors (72 per cent).*

Figure 3 below shows the modelled annualised loss rates (non-recoverable debt as a proportion of the loan book) to various ANZSIC sectors. Importantly, the mining sector is the only one that exhibited a consistent increase in expected loss rates through to 2050. This is an indication that credit risk of businesses within this sector may increase as a result of transition risk.

Figure 3: Annualised loss rates in business lending from transition climate risks, by ANZIC division



Source: APRA.

3 Physical risk and Review Events

Rail infrastructure can be disrupted significantly by extreme weather events, and those disruptions could be amplified and exacerbated by future climate change. There is significant uncertainty about which climate scenario might play out in the future so the regulatory framework needs to be robust to the range of plausible future climate scenarios. This section discusses:

- The current regulatory approach to managing climate-related physical risks;
- The regulatory implications of increased frequency and severity of natural disasters; and
- Options to address increased climate-related physical risks.

3.1 Current mechanisms to manage the impact of natural disasters

Aurizon Network's regulated assets are exposed to damage by weather events, including natural disasters. These events are beyond Aurizon Network's control. It would be impractical and/or too costly to completely eliminate the impact of these events on Aurizon Network's regulated assets. Therefore, Aurizon Networks seeks to manage the risk associated with these weather events through a combination of:

- ex ante asset resilience expenditure incorporated into design standards for asset renewals (e.g., culverts);
- external insurance for key critical infrastructure (e.g., major bridges, ports, and substations), where such insurance is available and economic;
- self-insurance for minor events; and
- cost pass-through to customers via the Review Event mechanism for major events, such as natural disasters.

Aurizon Network's uninsured risks primarily relate to tracks and associated infrastructure that commercial insurance markets typically do not have an appetite to underwrite, either due to the frequency or the size of losses (and the uncertainty about those things) or because the provision of insurance against those risks would be cost prohibitive. As noted above, these risks are currently managed through the regulatory framework via the Review Event mechanism.

The Review Event mechanism and direct and indirect costs

Aurizon Network's UT5 contains a Review Event or 'cost pass-through' provision associated with the occurrence of a particular defined force majeure event (such as a fire or flood) affecting Aurizon Network to the extent it has or will incur incremental costs greater than $1 million per event.[53]

Aurizon Network may submit a proposal to the QCA to vary its reference tariffs in order to recover approved costs from users. The QCA will assess whether the review event has occurred and

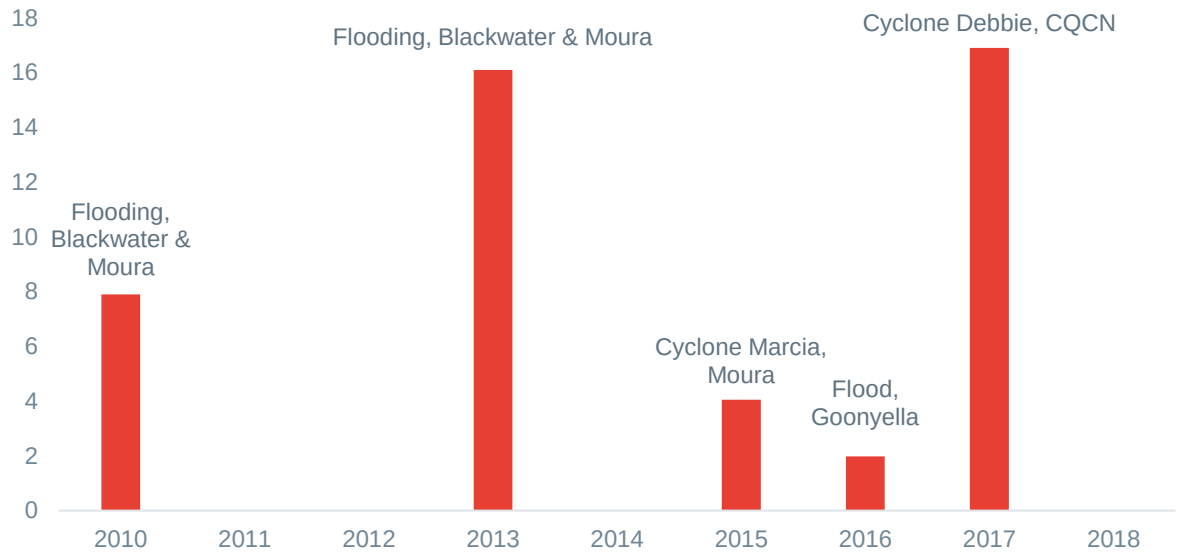
[53] Schedule F, Part 5, UT5, https://mc-71bd5e2a-aade-4067-a0ad-8402-cdn-endpoint.azureedge.net/-/media/project/aurizon/files/what-we-do/network/network-downloads/undertaking/20221129-ut5---fy23-ec-daau---qca-approved.pdf?rev=510fd7d017c945578b2f318bcf062e89&hash=CC4C3ADBE3E3ACCC2A3A163FFE8459AF

whether the costs are incremental (i.e., are costs of providing access), additional (i.e., would not have occurred absent the review event) and efficient (i.e., are those that would be reasonably expected to be incurred by a railway manager adopting efficient work practices), and have not previously been recovered through reference tariffs.[54]

Figure 4 summarises historical QCA approved amounts for weather related force majeure events under the Review Event mechanism. Review Events result in two types of costs being borne by Aurizon Network's customers:

- **Direct Costs**: The costs of remediation to the network—i.e., the QCA approved amount to be recovered via amendments to the reference tariffs; and
- **Indirect Costs**: These costs (not shown in the figure below) would include lost coal sales, the costs faced by mine owners in remediating their own mine assets (to the extent the mines have also been damaged by the Review Event) and increased future insurance costs.

Figure 4: Aurizon Network Review Events – event, system, approved amount $M



Source: Aurizon Network, Queensland Competition Authority. Note: Excludes amounts associated with the reinstatement of the Rolleston Branchline which were funded directly by the customer and are subject to Commercial in confidence.

The Review Event framework was established in 2010, however as Queensland experienced the Millennium Drought from 1997 through to the 2010-11 floods, it is unlikely Review Event claims would have been made if such arrangements were in place over that period.

Review Events have occurred relatively frequently since 2010 with direct costs being less than $20 million on each occasion. Typically, major events are associated with network outages of between 7–14 days and this relatively short duration acts to limit indirect costs imposed on customers as they may be able to reroute or defer shipments or because they are not in an immediate position to produce coal in any event if they are also impacted by the natural disaster.

Notwithstanding this, historically, the indirect costs of Review Events have typically far exceeded the direct costs. For example, the Queensland Government estimated that lost coal exports as a

[54] For example, the QCA's most recent review event decision under UT4: QCA 2018,

result of cyclone Debbie alone were upwards of $1.5 billion.[55] The quantum of these costs far exceeded the $16.9 million of direct costs to remediate the network.

Table 2 summarises the dates of the Review Events since 2010, the date of regulatory approvals to recover the associated direct costs and the year of cost recovery of each Review Event.

Table 2: Review Event year of cost recovery and $/NT impact

Event	Date of approval	Cost recovery	$/NT impact
March 2017 – Cyclone Debbie	May 2019	FY2018	Blackwater – 0.04; Goonyella – 0.11; Newlands – 0.06 GAPE – 0.07; Moura – 0.08
February 2016 – Flood	May 2017	FY2018	Goonyella – 0.02
February 2015 – Cyclone Marcia	December 2016	2017	Moura – 0.36
January 2013 – Flood	July 2014	2015 & 2016	Moura FY15 – 0.23; Blackwater FY15 – 0.15; Moura FY16 – 0.46
December 2010 – Flood	October 2012	2013	Blackwater – 0.12; Moura – 0.07

Source: Aurizon Network, Queensland Competition Authority

Table 2 demonstrates that, under the Review Event mechanism, direct remediation costs are recovered approximately two years after the expenditure is made, with Aurizon Network bearing the cash flow impact over that period.

Table 2 also demonstrates that the impact on reference tariffs has tended to be small when direct remediation costs have been small or moderate and/or when costs were spread over several users with large volumes. The tariff impacts have been larger when the Review Event impacts a single user and/or where volumes are smaller. For example, the Moura reference tariff increased by 36 cents per tonne in relation to Cyclone Marcia and by 46 cents per tonne in relation to the January 2013 flood.

This highlights the risks to both Aurizon Network and customers in relation to the current Review Event mechanism. In the case where a costly and prolonged outage occurs within a small system, there is potential for:

[55] Inspector-General Emergency management 2017, *The cyclone Debbie review lessons for delivering value and confidence through trust and empowerment*, 21 August, p. 6, https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjv-_306OP7AhVXyzgGHd9lDBYQFnoECA8QAQ&url=https%3A%2F%2Fwww.igem.qld.gov.au%2Fsites%2Fdefault%2Ffiles%2F2019-02%2FCyclone%2520Debbie%2520Review%2520Rpt1-17-18_PUBLIC_WEB.pdf&usg=AOvVaw1E4HvcO-f-SYVOfmMT7hWK

- Aurizon Network to carry the cash flow risk of a substantial repair cost that will not be recovered for some years, and which may have to be recovered from a single user; and
- The customer to also be experiencing cash flow stress due to an inability to produce and sell coal, and due to its own remediation costs if the mines have also been affected by the same Review Event (e.g., if the mine has been flooded).

These risks may be exacerbated to the extent that climate change results in more frequent and/or more costly Review Events in future. More frequent and higher-cost events would tend to compound the effects of price shocks to customers.

3.2 Is the existing Review Event mechanism still fit for purpose?

It is possible that natural disasters could occur more frequently and be more severe in magnitude in the future due to climate change. The Intergovernmental Panel on Climate Change has warned that global increases in temperatures could reach by 1.5°C or more over the next twenty years,[56] with the potential for increased heavy rainfall, increased frequency of severe cyclones, and more intense heatwaves in Australia.[57] As the QCA notes:[58]

> *Climate change is leading to more adverse weather events and more unpredictability in these events. While rainfall and streamflow has increased in some parts of Australia, and decreased in others, heavy rainfalls are becoming more frequent and intense. There has also been an increase in extreme fire weather and in the length of the fire season. compound events are also occurring more frequently when extreme weather and climate events occur consecutively within a short time, or when multiple types of extreme events occur.*

Consequently, Aurizon Network's regulated assets could be subject to more frequent and severe natural disaster damage, as well as longer outages. Aurizon Network has identified these risks in its 2022 Sustainability report (Box 1). In these circumstances, Aurizon Network's customers are likely to face an increase in the costs associated with Review Events:

- **Direct costs**: The direct costs of remediation via the Review Event mechanism are likely to become more frequent and larger in magnitude as an outcome of physical risk exposures, such as more severe cyclones, floods and bushfires; and
- **Indirect costs**: The increased frequency and duration of network outages is likely to result in an increase in indirect costs to customers. This could include lost coal sales, business interruption and remediation costs for the mine operation, and demurrage will be less likely to be offset by rerouting options and shipment deferrals as the duration of the interruption grows.

56 IPCC 2021, *Climate change widespread, rapid and intensifying – IPCC*, https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/.

57 IPCC 2021, *Fact sheet – Australasia climate change impacts and risks*, https://www.ipcc.ch/report/ar6/wg2/about/factsheets.

58 QCA 2022, *Approach to climate change related expenditure*, October, p. 1.

Box 1: Aurizon Network's 2022 Sustainability report: Climate change resilience and adaptation

In its 2022 Sustainability Report, Aurizon Network recognises the physical risks related to climate change, in particular the operational disruption and damage arising from more extreme weather and related events, such as flooding, erosion, bushfires and annual average summer temperature increases.

Aurizon Network has identified that such events:

- May result in loss of revenue due to extreme weather events affecting mining operations/production volumes, transport and port activities across the supply chain; and
- May result in higher costs associated with remedial actions to ensure asset availability.

In response to these risks and potential impacts, Aurizon Network has sought to manage these risks through various means including:

- Designing infrastructure to recover quickly from extreme weather events, including positioning inventory such as ballast, flood rock, rail and formation materials;
- Annual seasonal planning for extreme weather events; and
- The use of robust climate models to complete forward-looking assessments of climate-related factors to understand potential impacts on climate change on the capacity and availability of the CQCN and other fixed assets.

Source: Aurizon Network 2022, 2022 Sustainability Report, p. 23–26.

If climate change increases the frequency and scale of future Review Events, that could create a number of challenges for both Aurizon Network and its customers:

- As noted above, each Review Event places cash flow demands on Aurizon Network, since there is typically a delay between Aurizon Network undertaking the remediation work and recoupment of the associated direct costs. These cash flow demands are manageable if the Review Events occur reasonably infrequently and/or are typically small. However, the cash flow pressures on Aurizon Networks would become more difficult to manage if the events become more frequent and larger over time.
- More importantly, more frequent and larger Review Events would also increase the cash flow demands on Aurizon Network's customers—particularly if the Review Events also damage mine sites, thus resulting in customers bearing the cost of remediating mines as well as Aurizon Network's rail assets in order to restore the production and transportation of coal. This could result in Aurizon Network's customers bearing more volatility in reference tariffs (to fund the remediation of rail assets following Review Events) and consequently in cash flows. It could also result in a lengthening of the period over which remediation costs are reimbursed.

Whilst the existing Review Event mechanism appears to have worked well to date, the possibility of more frequent and extreme Review Events as a consequence of climate change—and the associated impact on both Aurizon Network and on customers—suggests that it would be timely to reconsider the existing Review Event arrangements. In particular, to the extent that Review

Events become more frequent, the indirect costs to customers would increase. This would increase customers' incentive to fund resilience works designed to prevent damage to the network. However, the current regulatory framework does not create strong incentives for Aurizon Network to make such resilience investments. Thus, there is a need to consider how the regulatory framework can assist in aligning the incentives of the network owner and users in this regard.

3.3 Options to address more frequent and severe Review Events

The QCA explains that the purpose of its present review is to, "consider whether our regulatory frameworks are sufficiently robust and flexible to support appropriate climate change related expenditures by entities and to provide the right incentives for such expenditures to be undertaken in a prudent and timely manner."[59] This goal is aligned to promoting the Object of Part 5 of the QCA Act set out in Box 2.

Box 2: Object of Part 5

The object of this part is to promote the economically efficient operation of, use of and investment in, significant infrastructure by which services are provided, with the effect of promoting effective competition in upstream and downstream markets

Source: Queensland Competition Act 1997.

There are three possible responses to the risk of more frequent and severe Review Events induced by climate change:

1. Aurizon Network could undertake more adaptation expenditure to increase the resilience of its regulated rail assets—as a way of reducing indirect costs to its customers of future Review Events;
2. The recovery of direct Review Event costs could be spread over a longer period of time than currently occurs; and/or
3. The expected direct costs associated with future Review Events could be collected up front from customers by Aurizon Network (e.g., through an industry levy) and set aside in a separate fund that could be drawn down once Review Events occur to remediate rail network assets. This would effectively smooth the direct costs of addressing Review Events by allowing the recovery of at least some of those costs in advance.

Of course, these approaches are not mutually exclusive; a combination of these approaches could be implemented as a way of reducing or smoothing the cost of Review Events. For example, an industry levy could be used for the dual purposes of adaptation work and providing for future remediation work.

We discuss each of these options in turn below.

[59] QCA 2022, *Approach to climate change related expenditure*, October, p. 2.

3.3.1 Investment in network resilience to reduce the impact of future Review Events

Customers may be willing to fund adaptation expenditure by Aurizon Network ahead of the occurrence of natural disasters to increase the resilience of the rail network and to minimise the risk of supply disruptions. Customers' willingness to pay for such adaptation expenditure may be high particularly while demand coal remains strong. Such resilience expenditure could involve a combination of:

- investment to increase network reliability and availability; and
- investment in supply chain capacity to increase peak capacity for throughput recovery railings.

The purpose of these investments would focus on reducing the direct and indirect costs borne by customers as a consequence of future Review Events.

Assessing ex-ante expenditure

A key challenge associated with assessing the need for adaptation expenditure is the uncertainty over the level of resilience required by regulated businesses against future climate change related events, and over the appropriate timing of such investments.[60] This uncertainty derives from the difficulty associated with forecasting accurately, over the relatively long lives of infrastructure assets:

- The nature, frequency, and timing of extreme climate change events;
- The impact of such events on regulated assets, and the extent to which supply may be disrupted; and
- Whether the proposed adaptation expenditure will prove to be adequate.

Such forecasting is challenging because the nature of future climate change means there is very little historical information or experience that would be useful in informing the optimal extent of investment in future resilience.

In assessing prudent and efficient ex ante resilience expenditure the QCA should encourage regulated entities to pragmatically incorporate the uncertainty inherent in climate change related risks into their proposals for adaptation expenditure. Aurizon Network is likely to be best placed to undertake this analysis, as it does as part of its *Strategy In Uncertainty* approach to enterprise strategic planning.[61]

Making this resilience adaptation expenditure is likely to reduce the direct and indirect costs to customers of future Review Events. However, it is very unlikely that ex ante resilience expenditure will be able to entirely eliminate the risk of Review Events disrupting supply. This means that a Review Event mechanism would need to continue to operate to enable Aurizon Network to restore supply following Review Events that turn out to be more severe than anticipated when the investment in resilience was undertaken.

Uncertainty over long-term demand and the ability of future users to pay

Aurizon Network is subject to uncertainty in long term demand across an array of coal demand scenarios. There may be a scenario in which current customers (operating in a relatively firm

60 QCA 2022, *Approach to climate change related expenditure*, October, p. 7.

61 Aurizon Network 2022, *2022 Sustainability* Report, p. 42.

market for coal) support more adaptation expenditure to increase the resilience of the network. Once those investments have been made, that capital expenditure would enter Aurizon Network's RAB and be recovered over relatively long horizons. However, future customers who may be operating in a declining coal market (e.g., because decarbonisation policies and initiatives have reduced global demand for coal) may be unwilling or unable to continue to pay for adaptation expenditure incurred by Aurizon Network in the past.

By way of example, the Queensland Government recently released a discussion paper to identify options to refine and improve the efficiency of the State's Financial Provisioning Scheme.[62] In that paper, the Queensland Government acknowledged that the global energy transition and decarbonisation trends are expected to impact the demand for thermal and coking coal:[63]

> *A range of global decarbonisation scenarios have been explored by the International Energy Agency (IEA) including conservative scenarios that project a 20-25% reduction in fossil fuel use by 2050. However, there has been significant increase in global commitments to achieve net zero in the last 12 months, and as a result, it is likely that more aggressive scenarios will play out. The most aggressive IEA scenario is the NZE2050 scenario which outlines a "narrow but achievable" pathway to achieving net zero emissions by 2050. This scenario projects global thermal coal reduction of roughly 50% by 2030, oil reduction of 50% by 2037, coking coal reduction of 50% by 2040 and gas reduction of 50% by 2050. …*
>
> *… Energy transformation and decarbonisation trends are expected to impact the demand for all fossil fuels: thermal and coking coal as well as oil and gas. The extent of this change, the timeframe over which it will occur, and the potential impact on the FPS is very dynamic and thus difficult to predict.*

That is, the transition risks faced by Aurizon Network's customers could create the risk of Aurizon Network being unable to recover historical investments in resilience—even if those investments were judged by the QCA and customers at the time to be prudent and efficient. This potential stranding risk may disincentivise Aurizon Network from investing in resilience expenditure, even if those investments are supported by its current customers—unless the regulatory framework can address those stranding risks appropriately.

Allowing the opportunity for full recovery of prudent and efficient expenditure

Current customers may have a relatively high willingness to pay for ex ante resilience expenditure. However, in order to invest, Aurizon Network must expect that it will fully recover the sunk costs related to climate adaptation.

Much of the discussion paper focusses on how the QCA should assess future proposals for climate change related expenditure. The discussion paper notes correctly that responses to climate change may mean that regulated businesses that are exposed to the coal industry in particular may face

62 Queensland Government 2022, *Financial Provisioning Scheme,* July-2022-Financial-Provisioning-Scheme-Discussion-Paper.pdf (treasury.qld.gov.au).

63 Queensland Government 2022, *Financial Provisioning Scheme,* p. 23, July-2022-Financial-Provisioning-Scheme-Discussion-Paper.pdf (treasury.qld.gov.au).

a risk of being unable to recover over the long-term capital costs that were prudently and efficiently incurred in the past.[64]

We agree with the QCA's observation that the existing regulatory framework is (in principle) capable of addressing such risks—for, instance, by allowing the adjustment of depreciation profiles. However, we think the interests of customers would be promoted if the QCA could set out clearly, as a matter of principle, that:

- its regulatory framework should provide regulated businesses with a realistic opportunity to recover past prudent and efficient expenditure over the long-term—as a means of incentivising future prudent and efficient investment that would benefit consumers;
- regulatory allowances should be set such that resilience expenditure that is deemed to be prudent and efficient at the time it was made may be recovered over the expected economic life of the regulated assets;
- the expected economic life of the regulated assets is the period over which the assets are expected to generate economic returns to investors (which may be shorter than the design life of those assets); and
- the expected economic life of the regulated assets should be reassessed periodically (since market circumstances can change over time), using up-to-date information available at that time. This assessment should include consideration of climate-related risks and other relevant criteria.

Section 4 provides further analysis on options to address increasing uncertainty and residual asset stranding risk, including adjustments to the allowed rate of return and regulatory depreciation profile.

3.3.2 Recovery of direct Review Event costs over longer horizons

As **Table 2** showed, the direct costs associated with Review Events have typically been recouped within two years of Aurizon Network incurring that expenditure. This may be feasible going forward if Review Events are relatively small, infrequent and do not contemporaneously create mine remediation costs for Aurizon Network's customers. However, if climate change results in larger direct and indirect Review Event costs falling on customers—due to more frequent or larger events that potentially also damage mine sites—then Aurizon Network's customers may be unable (e.g., because of cash flow constraints) to bear all of those costs if they are to be recouped immediately.[65]

One potential approach in these circumstances would be to allow Aurizon Network to spread the recovery of rail network remediation costs over several years. From customers' perspective, this would smooth at least the direct costs associated with Review Events over a period of time, thus reducing the cash flow burden associated with such events.

However, this approach would also have a number of consequences on Aurizon Network, which would need to be taken into account:

- If the recovery of Review Event costs is spread over several years, Aurizon Network would need to be compensated for financing those costs over the expected recovery period. This

64 QCA 2022, *Approach to climate change related expenditure*, October, pp. 27-28.

65 There may be a scenario in which global transition and decarbonisation pressures arise to incentivise shifting assets from financially sound coal producing entities to those that are less so, resulting in future customers being less resilient to financial shocks.

could be done by including the Review Event costs into Aurizon Network's Regulatory Asset Base (RAB) in the same way ordinary capital expenditure is treated. Aurizon Network would then be permitted to earn a return on that capital invested. The Review Event costs would then be recovered through Aurizon Network's regulatory depreciation allowance over the expected economic life of that investment or some other shorter recovery period.

- Spreading the recovery of direct Review Event costs over multiple years would expose Aurizon Network to greater stranding risk (for the same reasons explained in section 3.3.1). The extent of asset stranding that could be suffered by Aurizon Networks would be compounded if a series of frequent Review Events were to occur and/or if the events were very large. Given the scope for stranding to occur under this approach, the recovery period would need to be selected carefully to ensure that Aurizon Network has a realistic opportunity to recover prudently and efficiently incurred Review Event costs.

The approach described above mirrors the approach applied to electricity networks regulated by the Australian Energy Regulator. If an electricity network suffers damage following a natural disaster such as storm or flood, the regulated business incurs the capital expenditure associated with restoring the network. That capital expenditure is included in the RAB, the business is permitted to earn a return on that investment, and is allowed to recover the expenditure through its regulatory depreciation allowance. However, a key difference between regulated electricity networks and Aurizon Network is that regulated electricity networks do not face any material stranding risk at the present time.

3.3.3 Advance recovery of expected direct Review Event costs

A key disadvantage of spreading the recovery of direct Review Event costs over a long time period is the greater exposure to stranding risk that approach would impose on Aurizon Network. That approach also does not eliminate the volatility in prices that would be incurred by customers affected by material Review Events.

An alternative option would be for customers to make ex-ante payments to Aurizon Network as a means of provisioning for at least some of the direct Review Event costs that might arise in future. Such approach would have the advantage of smoothing the direct Review Event costs borne by customers, without increasing stranding risk to Aurizon Network.

Under this approach, Aurizon Network's customers would pay an 'industry levy' that would be collected by Aurizon Network over time and set aside in a ringfenced 'Review Event fund' that could be drawn down by Aurizon Network to undertake rail network remediation work following Review Events.

There is some regulatory precedent for such an approach. For example, as explained in Box 3, the Independent Pricing and Regulatory Tribunal (IPART) recently used a self-provisioning approach when setting regulated bulk water charges for WaterNSW's rural valleys network. Whilst the precise mechanism adopted by IPART differs in some respects from the way in which a Review Event fund might operate, the two mechanism share a common idea: the regulated business would be allowed to collect additional revenues in advance in order to smooth future outcomes that would otherwise result in significant price volatility to consumers.

Box 3: Regulatory self-provisioning arrangements to manage revenue volatility

WaterNSW supplies rural bulk water services to customers in 13 rural valleys across NSW. IPART currently sets WaterNSW's prices using two-part tariffs, where customers pay an annual fixed charge ($ per ML of entitlement) and usage charges ($ per ML of water used). These tariffs are determined using a forecast of WaterNSW's water sales over each regulatory period. The volume of water sales can fluctuate very significantly from one year to the next, making accurate forecasting of volumes very challenging. This exposes WaterNSW to significant revenue volatility.

In order to allow WaterNSW to manage this revenue volatility, IPART introduced a self-provisioning mechanism for the 2021-25 regulatory period, whereby:

- An account would be kept of any under/over-recovery of allowed total revenues (i.e., across all valleys) arising as consequence of any difference between the actual tariff structure applied and the 'target' tariff structure adopted by IPART.
- The business would borrow to finance any revenue shortfalls and would use any surplus revenues that have accumulated to repay the debt.
- The business would be provided with a regulatory allowance that would be sufficient to recoup from customers in advance the efficient cost of any such debt facility over the regulatory period.

Source: IPART, Review of Water NSW's rural bulk water prices from 1 October 2021 to 30 June 2025, Final Report, September 2021.

For the avoidance of doubt, the introduction of provisioning for future remediation work via an industry levy arrangement would not obviate the need for a Review Event mechanism that would allow Aurizon Network to recoup some direct costs after the occurrence of weather-related force majeure events. This is because it would be impossible to forecast with accuracy the direct costs of all future Review Events—not least because of the significant uncertainty surrounding the precise future impact of climate change on rail network infrastructure.

Hence, a Review Event mechanism would need to continue to operate to ensure that Aurizon Network can recoup the full costs of any future remediation work. However, Aurizon Network would first utilise the Review Event fund to meet the cost of any such remediation work, and only seek additional contributions from its customers following a Review Event if the Review Event fund turned out to be inadequate to complete the remediation work.

The principal purpose of the industry levy and Review Event fund would be to smooth the direct costs of Review Events over time. If more smoothing is desired by customers, then a larger levy would need to be paid up front. Conversely, if less smoothing is desired, then customers would contribute a smaller levy. In our view, the size of the levy (and, therefore, the degree of smoothing achieved) should be a matter for commercial negotiation between Aurizon Network and its customers. We understand that Aurizon Network has a well-developed customer engagement process for assessing the prudency of expenditure, including resilience expenditure. A similar process could be used to negotiate the size of the levy that would be collected. The levy amount could be reviewed at the time of each access undertaking by Aurizon Network.

One question that would need to be addressed in relation to this approach is whether any Review Event fund should be maintained at a system level, or whether all the levies collected from Aurizon

Network's customers should be pooled together into a Review Event fund that is maintained at a total network level. The operation of a Review Event fund at a total network level would allow for risk pooling and diversification benefits. However, the operation of separate Review Event funds at a system level may be more appropriate if customers' circumstances vary significantly. For instance, if customers using one system have funded higher levels of resilience expenditure, then those customers may expect to make lower contributions to a Review Event fund than customers using a different system that have chosen to fund less resilience investment.

Again, the question of whether the Review Event fund should be maintained at a total network level or at the system level would, in our view, be best determined through consultation between Aurizon Network and its customers.

4 Transitional risk and demand

The ability of customers to pay for access to the network may be constrained under certain long-term scenarios of international coal demand. This section discusses:

- Recent domestic and international policy changes could alter the outlook for coal demand, and how this in turn contributes to long term demand uncertainty;
- The merits of adopting a proactive approach to managing long run demand uncertainty;
- Regulatory precedent for accelerating cost recovery in response to long-run demand uncertainty; and
- Some approaches that have been considered or used by regulators to determine the economic life of regulated assets affected by transitional risk.

4.1 Transitional risk and uncertainty in long term demand

Fossil fuel exposed firms are exposed to transition risk, or risks arising from the process of adjusting towards a lower-carbon economy. This transition can be driven by changes in policy, technology or consumer behaviour. This can impact forecasted demand, the value of assets and liabilities, and thereby the risk profile and viability of the firm.

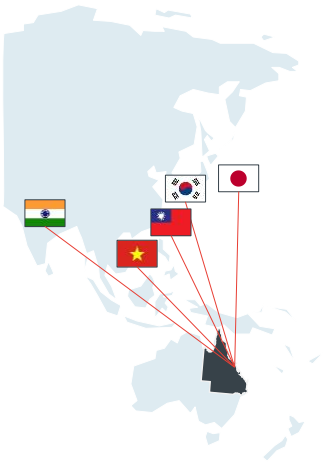
A key driver of transition risk for coal exposed companies is policy change. Namely, the majority of major coal importing countries have net zero targets in place, which could reduce demand for coal. However, targets vary in status, development and expected achievement date.[66] This uncertainty, in combination with uncertainty around technological development and carbon abatement costs, makes future demand for coal similarly unclear.[67]

Most of Queensland's coal exports are to Asian markets, with the top five countries – India, Japan, Korea, Vietnam and Taiwan – accounting for 81.6% of total 2021-2022 export volume. A breakdown of Queensland's coal export destinations by product type is provided below in **Figure 5**, alongside each country's various net zero commitments.

[66] For instance, South Korea and Japan have legislated net zero targets for 2050, Taiwan and China have in policy documents targeting net zero in 2050 and 2060 respectively, while India has pledged to net zero by 2070.

[67] RBA, *Towards Net Zero: Implications for Australia of Energy Policies in East Asia*, September 2021, p. 34.

Figure 5: Queensland's coal export markets



Destination	Hard Coking	Thermal	Semi-soft / PCI	Total	Decarbonisation Commitments
Japan	34.4	4.6	10.3	**49.3 (25%)**	In law: net zero by 2050
India	17.8	16.5	14.1	**48.4 (25%)**	Pledge: net zero by 2070
South Korea	12.1	14.2	8.6	**34.9 (18%)**	In law: net zero by 2050
Vietnam	4.6	7.7	2.1	**14.4 (7%)**	Pledge: net zero by 2050
Taiwan	5.0	4.9	1.8	**11.7 (6%)**	Pledge: net zero by 2050
Others	27.0	5.0	3.9	**35.9 (18%)**	Various
Total	**100.9**	**52.9**	**40.8**	**194.6 (100%)**	

Export volumes in Megatonnes (Mt)

Source: Frontier Economics & export volumes from Queensland Treasury.[68]

This uncertainty over future demand has led to the development of a range of long-term demand scenarios. For instance, the International Energy Agency (IEA) recently released its 2022 World Energy Outlook,[69] which projects demand to 2050 under three scenarios:

- Stated Policies Scenario (STEPS), based on what governments are actually doing;
- Announced Pledges Scenario (APS), based on what governments say they will do; and
- Net Zero Emissions by 2050 Scenario (NZE), based on reaching net zero by 2050.

IEA projections highlight that, 'the outlook for coal is heavily dependent on the strength of the world's resolve to address climate change.' [70] It also highlights that demand for metallurgical coal is much less likely to fall than thermal coal,[71] reflecting that cleaner technologies are more readily available for energy production then for steelmaking.[72] Specifically, IEA forecasts that:

- Under the STEPS, global thermal coal production falls by 35.2% between 2021 and 2050, while global metallurgical coal production falls by 28.5%;
- Under the APS, global thermal coal production falls by 74.2% between 2021 and 2050, while global metallurgical coal production falls by 63.0%; and
- Under the NZE, global thermal coal production falls by 91.1% between 2021 and 2050, while global metallurgical coal production falls by 88.3%.[73]

68 Queensland Treasury 2022, *Queensland's Coal Industry and Long-Term Global Coal Demand*, Table 3.1, November https://s3.treasury.qld.gov.au/files/Queensland%E2%80%99s-Coal-Industry-and-Long-Term-Global-Coal-Demand_November-2022.pdf.

69 IEA, *2022 World Energy Outlook*, available at: https://www.iea.org/data-and-statistics/data-product/world-energy-outlook-2022-free-dataset, accessed December 2022.

70 IEA, *World Energy Outlook 2022*, October 2022, p. 409.

71 IEA, *World Energy Outlook 2022*, October 2022, p. 420.

72 RBA, *Towards Net Zero: Implications for Australia of Energy Policies in East Asia*, September 2021, p. 34.

73 Queensland Treasury, *Queensland's coal industry and long-term global coal demand,* November 2022, p. 21.

Queensland's coal industry may be better placed that others internationally, reflecting its geographic location and the quality of its coal compared to global competitors, and the volume of metallurgical coal available.[74] That is, Australian producers have a low cost of supply relative to other producers and there is likely to be strong demand for high-quality coking coal in steelmaking until low carbon alternatives become more widespread.[75]

This significant uncertainty around changes in policy, technology or behaviour influences the expected economic lives of assets. That is, for Aurizon Network, the economic life of its assets is a function of end user demand for coal, as the ability of customers to pay for access to the network may be constrained under certain long-term scenarios of international coal demand.

4.2 A proactive approach is required to balance risks

If the period over which demand for a regulated business's services is shorter than the horizon over which the business is permitted to recover its prudent and efficient costs (including capital costs), then its investment in the regulated assets would become stranded.

A regulatory framework that allows the stranding of regulated assets is likely to:

- Deter efficient investment in the regulated assets used to deliver regulated services. This could result in a deterioration in service quality to consumers; and/or
- Increase the return required by investors to compensate for the risk of their investments in regulated assets becoming stranded. This would raise the cost of supplying services and would ultimately result in consumers paying more than they would if stranding were prevented by the regulator.

Regulatory frameworks that seek to promote prudent and efficient investment require a proactive approach to stranding risk

Delaying action until there is certainty around when an asset may become stranded can result in large price increases being imposed on future generations of customers, in order to ensure the full cost of the regulated assets is recovered before the asset becomes stranded. This would cause two key problems:

Firstly, if demand is declining over time (the impetus for increasing stranding risk), then the regulated business would need to recover its costs from fewer and fewer customers over time. The cost burden that would fall on each remaining customer would grow over time as demand declines. If the regulator delays action to increase prices (to facilitate faster cost recovery), those price increases would need to be larger in future than if they were implemented earlier since:

- There would be less time (before stranding occurs) for the firm to recoup costs fully; and
- There would be fewer customers from which the firm may recover its prudent and efficient costs.

Large price increases may accelerate the decline in demand, requiring even more aggressive price increases to avoid stranding. That in turn may hasten the decline in demand even further, and so on. This process, where action to accelerate cost recovery perversely hastens stranding (when the customer base is too small to support full cost recovery) is sometimes referred to as the 'death

[74] Queensland Treasury, Queensland's coal industry and long-term global coal demand, November 2022, p. 4.

[75] RBA, *Towards Net Zero: Implications for Australia of Energy Policies in East Asia*, September 2021, p. 34.

spiral.' The best means of preventing a death spiral is for regulators to act early to accelerate cost recovery, when there is a sufficiently large customer base from which the business may recoup its costs.

Secondly, delaying regulatory action may create intergenerational equity problems, whereby future customers may be asked to bear a disproportionately high cost (compared to customers today), in order to allow the regulated business to recoup its prudent and efficient costs. Acting early would result in only modest price increases being borne by all generations of customers and would avoid the detriment to consumers that would arise as a consequence of regulated assets becoming stranded.

Falling demand for coal, rather than falling supply, is the key driver of climate change related stranding risk

In the past, when regulators have assessed the stranding risk faced by regulated businesses involved in the transportation of coal, the key consideration has been the expected economic life of the regulated assets. In those determinations, regulators assumed that the main determinant of expected economic life was the supply of coal from mines, and that the main source of stranding risk was the uncertainty over future coal supply. For instance:

- In previous access undertaking determinations by the QCA for the Dalrymple Bay Coal Terminal (DBCT), the expected economic life of DBCT's regulated assets was determined by reference to expected coal reserves in DBCT's catchment area;[76] and
- IPART's assessments of the expected economic life of the Hunter Valley Coal Network (HVCN) was informed by IPART's assessment of the remaining mine life of Hunter Valley coal mines using the HVCN.[77]

However, the climate change related stranding risks that are faced by regulated businesses involved in the transportation of coal will be driven by:

- uncertainty over future *demand* for coal from end-users, rather than uncertainty over future supply from customers involved in the mining and extraction of coal; and/or
- future government interventions designed to restrict coal use or production.

While uncertainty over future coal production and the ability to finance new coal projects will remain, it is end users' demand or specific government policies that will likely determine the expected economic life of regulated assets involved in the transportation of coal.

Therefore, in order to understand the exposure of regulated businesses such as Aurizon Networks to climate change related stranding risk, the QCA would need to monitor the evolution over time of:

- demand for coal;
- Counterparty credit considerations and market participants; and
- government climate change policies aimed at coal users and producers.

[76] For instance: QCA, DBCT 2019 draft access undertaking, March 2021.

[77] For instance: IPART, Rate of return and remaining mine life 2019-24, Final Report, July 2019.

Given the high degree of uncertainty over future coal demand and government climate change policies, the QCA should consider scenario analysis informed by plausible and reputable projections of:

- future coal demand; and
- future coal production, taking into account government climate change policies targeted at the coal mining industry.

It is important that the QCA sets out clearly the types of information and evidence it would require from regulated businesses to demonstrate, ex-ante, the potential impact of asset stranding risk and any impacts of relevant mitigation measures. The QCA may also need to take into consideration a larger range of plausible future scenarios, rather than focusing on just the expected future profile of demand at a given point in time, reflecting the significant uncertainty faced by the coal industry.

QCA framework in Aurizon Network's 2017 draft access undertaking

The discussion paper notes that whilst asset stranding risk may become a significant issue for some regulated business, the QCA considers that its existing regulatory framework is capable of addressing stranding risk effectively.

In its 2018 decision on Aurizon Network's 2017 draft access undertaking, the QCA set out a number of mechanisms that exist in its regulatory framework to manage stranding risk. These included:

- Accelerated depreciation and truncated asset lives;
- The ability for Aurizon Network to seek access conditions for expansion projects, which could consider above-regulated returns to compensate for asset stranding risks; and
- Security requirements and relinquishment fees for access holders, which limit the impact of an access holder reducing its access rights. [78]

However, it considered that given the medium-to long-term market outlook for coal, and the highly competitive position of Queensland coal producers, Aurizon Network's asset stranding risk was minimal at the time of that determination.[79]

As outlined in Section 4.1, there have been a number of other developments since the 2017 draft access undertaking decision in relation to environmental targets and the potential for rapid decarbonisation. These developments have increased the uncertainty of future coal demand, with any changes to forecast demand only likely to decrease future demand for coal products, particularly thermal coal. This has potentially created residual asset stranding risk that may not be accounted for under Aurizon Network's current access undertaking, and which may require a reassessment of the expected economic life of Aurizon Network's regulated assets.

The 2017 draft access undertaking assumed a 4-year term with an expiry in 2021, which was then extended to 2027. At the time the next draft access undertaking is being considered the market conditions and expectations will likely materially differ to those prevailing in 2018 with the 2017 draft access undertaking was decided.

78 QCA (2018), Aurizon Network's 2017 draft access undertaking Decision, December 2018, pp. 25-26.

79 QCA (2018), Aurizon Network's 2017 draft access undertaking Decision, December 2018, p. 26.

4.3 Addressing uncertainty and residual asset stranding risk

There are two main approaches that regulators may take to address asset stranding risk:

- Allow compensation for stranding risk through the allowed return **on** capital; or
- Adjusting the return **of** capital (i.e., regulatory depreciation).

4.3.1 Adjustments to the allowed rate of return

One option would be for a regulator to provide ex-ante compensation for stranding risk by adding risk premium for stranding risk to the rate of return that regulated businesses are allowed to earn (which does not include compensation for stranding risk) on capital invested.

Fair bet approach

One approach that has been developed to estimate the rate of return premium that would be required to compensate investors for stranding risk is the 'fair bet' approach.

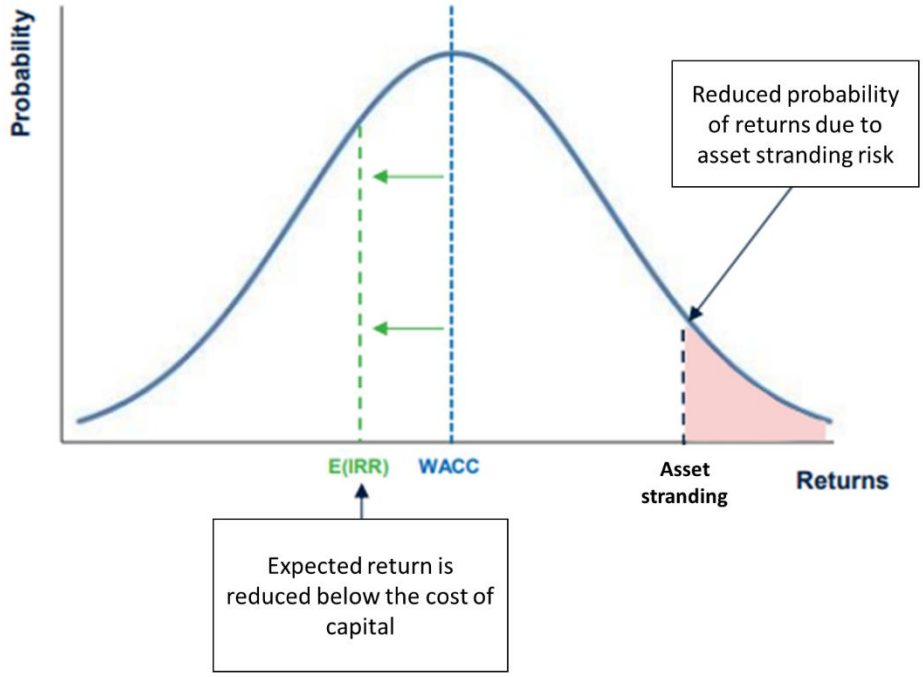
The usual approach adopted by regulators is to set the allowed rate of return for a regulated business equal to the regulator's best estimate of the firm's weighted average cost of capital (WACC). The WACC represents the minimum return required by the firm's investors to compensate them for the risks they would bear when committing capital to the firm.

An implicit assumption made by regulators when setting regulatory allowances (which includes an allowance for the return on capital) is that the firm will be able to recover all of its efficient costs (including operating expenses and capital invested) and generate sufficient revenues to meet its efficient tax obligations. This is sometimes referred to as the NPV=0 principle.

When setting regulatory allowances in this way, regulators typically assume that the firm faces no stranding risk. In these circumstances, the internal rate of return (IRR) of the regulated business's cash flows would be expected to equal the firm's WACC, and the NPV=0 principle would be satisfied.

However, if the business does face some stranding risk, then setting the allowed rate of return equal to the regulator's estimate of the WACC would result in an IRR that is *lower* than what the regulator estimates to be the minimum rate of return required by investors (i.e., the IRR < WACC), and the expected NPV of the firm's regulated cash flows would be *negative*. This scenario is illustrated in **Figure 6**.

Figure 6: Distribution of returns in the presence of asset stranding risk



Source: Oxera report for Chorus Fibre adapted by Frontier Economics.

In these circumstances, the allowed rate of return would need to be set *above* the regulator's estimate of the WACC, such that, given the expected value of stranding faced by the business, the IRR of the firm's expected regulatory cash flows is just equal to the regulator's estimate of the WACC.

The fair bet principle involves solving for the premium over and above the regulator's estimate of the WACC that would ensure that the NPV=0 principle is satisfied, given estimates of:

- The probability of stranding; and
- The value of the regulated business's assets that could be stranded.[80]

Some regulators have rejected this approach on the grounds that the allowed rate of return should only compensate investors for systematic (i.e., non-diversifiable) risk, and because stranding risk is firm-specific, compensation for this risk should not be provided through the allowed rate of return. For example, the Australian Energy Regulator (AER) has recently stated that:

[80] The product of the probability of stranding and the value of the business's assets that could be stranded would give the expected stranding amount.

We don't view stranded asset risk as systematic, so we do not consider it appropriate to compensate this risk via increasing the rate of return.[81]

This appears to be a misunderstanding of the approach. Inclusion of a premium within the allowed rate of return to compensate for the risk of stranding does not result in investors being compensated for non-systematic risks. Indeed, the whole point of the fair bet approach is to ensure that the expected returns to the firm are just sufficient to provide compensation to investors for bearing the systematic risk associated with committing capital to the firm—no more, and no less.

Regulatory use

In principle, the effect of compensating investors through an increase in the allowed rate of return (over and above the regulator's estimate of the firm's WACC) should, in expectation, produce an outcome that is identical to approach of adjusting the depreciation profile—since both approaches seek to achieve an NPV=0 outcome. However, the difficulties involved in estimating the probability of stranding and the value of assets that could become stranded mean that, in practice, the fair bet approach could produce outcomes that are either NPV<0 or NPV>0. That is, the regulated business could end up recovering more/less than the efficient capital invested and, consequently, consumers could end up paying more/less than would be efficient for the regulated service, over the life of the regulated assets.

Mainly for this reason, the approach of providing compensation for stranding risk via the allowed rate of return has generally not been the preferred approach adopted by regulators in Australia. The AER has argued that allowing ex-ante compensation for stranding risk via a premium to the standard allowed rate of return may result in over/under-compensation to regulated businesses because the size of the premium required to compensate the firm properly for this risk is difficult to estimate ex-ante:

There can be material windfall gains or losses if the estimated compensation for stranded asset risk is inaccurate, or if the risk eventuates earlier or later than anticipated or does not occur at all.[82]

There are some examples of regulators overseas that have sought to provide compensation for stranding risk through the allowed rate of return. The fair bet principle has been implemented by Ofcom in the UK when regulating the investment made by BT in upgrading its copper network to fibre to the cabinet (FTTC) in 2008 and reinforced that commitment its approach to future regulation.[83]

In 2010 the European Commission provided guidance to national regulatory authorities within the European Union on making decisions for regulated access to Next Generation Access (fibre) networks (NGAs). The European Commission recommended that the rate of return allowances

81 AER, *Regulating gas pipelines under uncertainty – Information Paper,* November 2021, p. 33.

82 AER, *Regulating gas pipelines under uncertainty – Information Paper,* November 2021, p. 32.

83 Ofcom, *Ofcom's approach to future regulation*, 24 July 2018, p. 7.

provided by national regulatory authorities should include an investment risk premium to accommodate amongst other things stranding risks (arising from, for example, uncertainty relating to technological progress, evolving competition and future demand).[84] The purpose of this investment premium was to provide firms rolling out these NGAs a sufficient return to compensate for future uncertainty, including the risk of stranding, thereby encouraging the investments to proceed. We understand that some national regulatory authorities (e.g., in Germany and the Netherlands) followed the European Commission guidance and allowed an investment premium on top of the standard WACC allowance.

The approach was also proposed by Chorus, the largest fibre network operator in New Zealand, in a submission to the New Zealand Commerce Commission.[85]

4.3.2 Adjustments to the depreciation profile

The more common approach that regulators in Australia have adopted to address stranding risk is to adjust (front-load or accelerate) the regulatory depreciation allowance. This results in more recovery of costs early, when there is relatively high demand for the regulatory services. Spreading more cost recovery over a larger customer base allows the price increases per unity of demand or per customer to be minimised, while still increasing the costs that the regulated business is able to recoup.

The key benefit of this approach is that it involves reprofiling regulatory cash flows in an entirely NPV-neutral way. This means that there is no scope for windfall gains or losses to the regulated business; the firm will (in expectation) recover the efficient capital invested—no more, and no less.

Methods for sculpting the depreciation profile under a fixed asset life assumption

The most common method used by regulators to calculate regulatory depreciation allowances is the straight-line method. Under this approach, the regulated business is allowed to recover a fixed depreciation amount annually until the value of the regulated assets has been depreciated fully. The amount to be recovered each year is determined by dividing the initial asset value by the expected economic life of the asset.

However, there are a number of alternative ways in which depreciation may be 'sculpted' to better align with the profile of demand over the economic life of the assets. Some examples include the following approaches:

- **Sum-of-year digits depreciation** adds up all the years over the asset's expected life (i.e., for a four year asset would be 1 + 2 + 3 + 4 = 10), and then calculates the depreciation rate for each year by dividing the remaining life at the start of the period by the sum of all years (i.e., year 1 for a four year asset would be 4/10 = 40%, year 3 would be 2/10 = 20%, and so on).
- **Double declining balance** uses a depreciation rate double that of straight-line depreciation, so that the asset value is recovered twice as fast.

84 European Commission, Official Journal of the European Union, Commission Recommendation on regulated access to Next Generation Access Networks (NGA), 20 September 2010, 2010/572/EU, section 6.

85 Chorus, *Compensation for asymmetric type 2 risks*, 15 July 2019. https://comcom.govt.nz/__data/assets/pdf_file/0028/161929/Oxera-for-Chorus-Fibre-emerging-views-submission-Compensation-for-asymmetric-type-2-risks-report-15-July-2019-updated-31July-2019.pdf.

- **Diminishing value** uses a rate that is a constant percentage of asset's value, so that when the asset has a higher value there is larger depreciation than later when the asset has a lower value.
- **Hybrid approaches,** which combine non-linear accelerated depreciation (e.g., diminishing value) early in the asset's life and straight-line depreciation later in the asset's life.

Shortening of asset lives

The most common approach used by regulators in Australia to accelerate or frontload the depreciation allowance in response to emerging stranding risk is to alter the remaining assumed asset life used to set the depreciation allowance. The AER recently stated that:

> *the expected economic life of an asset should reflect the period over which the asset can be reasonably expected to be in use economically. In the case of long-lived assets, this would mean a shortening of asset lives if demand is expected to end before the technical life ends.*[86]

This approach has been used recently by a number of regulators, including IPART, the ERA and the AER. Section 4.4 provides several such examples of regulators shortening assumed asset lives as a way of addressing climate change related stranding risk. Section 4.54.5 summarises two conceptual approaches that have been adopted or considered by regulators to determine the extent to which asset lives should be shortened.

Adjusting the depreciation profile in response to new information

A key advantage of addressing stranding risk via the depreciation allowances is that the depreciation profile can be adjusted as new information emerges in future periods regarding the likelihood of assets becoming stranded. For instance, if new information becomes available that suggests the assets might become stranded sooner than initially anticipated, the QCA could front-load the depreciation profile further, thus accelerating cost recovery even more. Conversely, if it transpires that the stranding might occur later than initially expected, then the depreciation profile could be adjusted to slow down cost recovery. In either of these scenarios, the adjustments to the regulatory depreciation profile would be NPV-neutral, and the recovery of costs would be spread over the expected economic life of the assets.

The AER recognised these benefits associated with the approach of adjusting regulatory depreciation profile to address stranding risk in a recent paper that discussed how gas pipelines could be regulated in an environment of significant uncertainty over future gas demand.

> *Adjusting depreciation offers us the greatest flexibility in responding to new information in the future if the natural gas substitution pathways or actual demand turn out to be different than expected. Unlike other options under consideration, accelerating depreciation does not lock in a price change permanently, which avoids providing a material windfall gain or loss to either the*

86 AER, *Regulating gas pipelines under uncertainty – Information Paper,* November 2021, p. 30.

regulated businesses or consumers if actual gas demand differs markedly from our assumption made under uncertainty. [87]

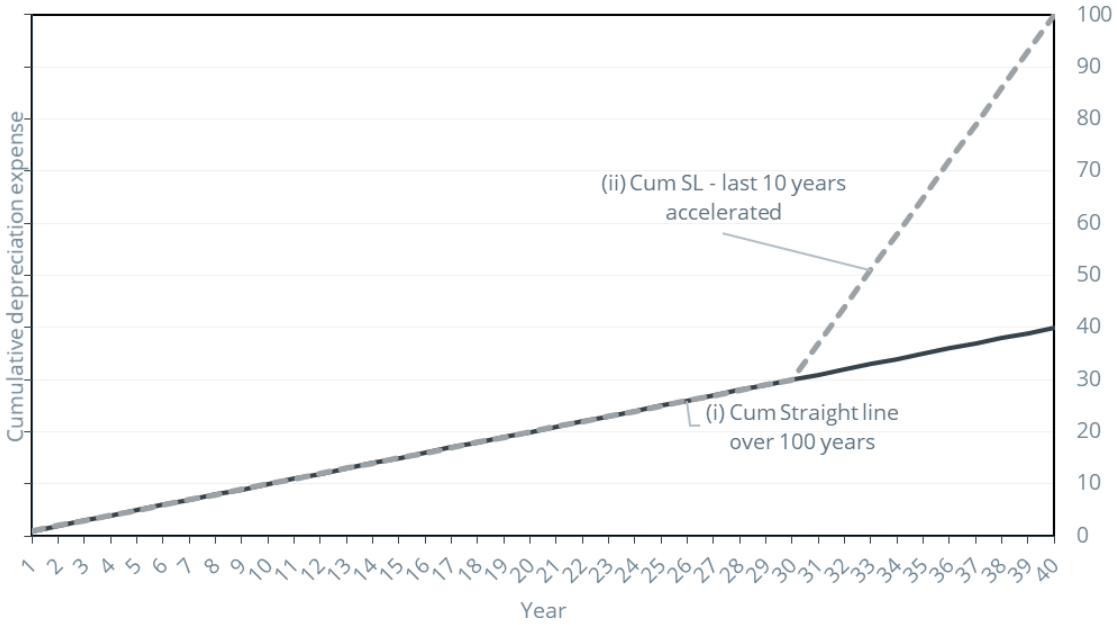
The QCA has formalised this approach in the approach it has used to set Aurizon Networks' depreciation allowance. Specifically, the QCA allows Aurizon to depreciate its post-2009 capex using a "rolling" 20 year asset life. Under this approach, the asset life is set at 20 years and is revisited at the next regulatory review - it either remains at 20 years less the elapsed (4 year) regulatory period, or reverts to 20 years if the asset is expected to have a life at least that long.

This depreciation approach allows for a middle ground between fixed asset lives of shorter and longer vintage, and for new information to be taken into account at regulatory review points.

To illustrate this concept, we take an example of an asset with a value = $100, and a technical service life of 100 years.

For comparison purposes, straight line depreciation over 100 years is shown (case (i)). Case (ii) highlights a situation where the regulator maintains an asset life of 100 years until year 30, at which point the regulator accepts the stranding risk and sets the asset life to 40 years (increased recoveries last 10 years).

Figure 7: Straight line depreciation - 100 years, and with acceleration after 30 years (40 yr life)



Source: Frontier Economics

For the rolling 40-year asset life, three further cases are shown assuming regular 5-ear reviews by a regulator:

87 AER, *Regulating gas pipelines under uncertainty – Information Paper,* November 2021, p. 44.

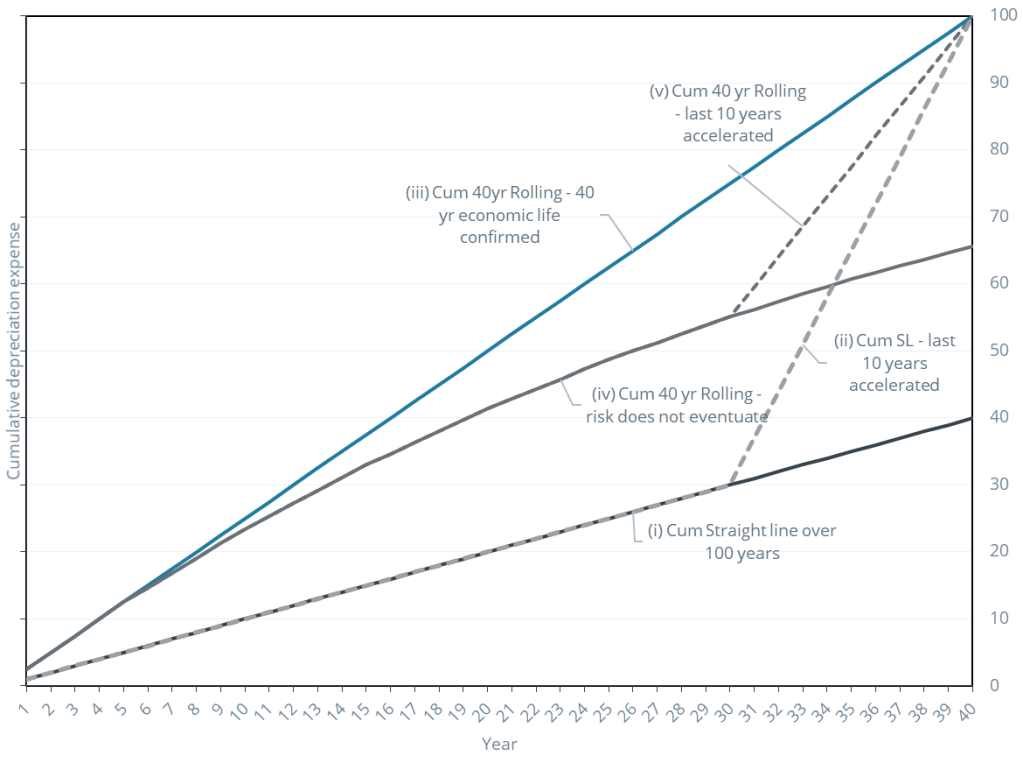
(iii) The stranding risk smoothly reduces the asset life to 40 years, as confirmed at each 5 year review – which produces depreciation equivalent to a straight line fixed life of 40 years

(iv) There is no stranding risk that eventuates, so the asset life is confirmed to remain at 40 years at each review point, including at year 40.

(v) Stranding risk is not immediately observable, meaning that asset life remains at 40 years for the first six periods (30 years), but becomes apparent in year 30 and the regulator allows for increased recoveries in last 10 years

These examples are overlaid on the first two cases.

Figure 8: Examples of depreciation allowances under rolling 40-year asset lives



Source: Frontier Economics

Note that:

- In cases (ii) and (v) we assume that stranding is avoided. However, the recovery path shown by the dotted lines in cases (ii) and (v) are not equal. Case (ii) requires a much sharper increase in depreciation after 30 years (by around 7x compared to 3x for case (v)) and this may not be feasible (e.g., because it induces bypass). The probability of stranding is higher.
- In case (iv) – stranding is expected but does not arise - depreciation is accelerated compared to the straight line over 100 years, but is well below the 40 year fixed asset life. There is no difference in expected NPV over the life of the asset.

4.4 Regulatory precedent for the use of accelerated depreciation

Regulators across a number of jurisdictions have been considering the best approach to manage the significant future uncertainty around climate change and the associated stranding outcomes. Many of these regulators consider that it would be prudent to accelerate cost recovery now—even if there is significant uncertainty over whether and when regulate assets may become stranded—given that delaying action could result in sharp price increases in the future and potentially exacerbate stranding outcomes.

Regulators generally agree that:

- It is prudent for regulators to act early to mitigate adverse customer impacts;
- Assumed asset lives should be linked to the useful economic life of the assets;
- Asset lives should be updated regularly based on the latest available information; and
- Asset lives can vary across different sections of a network to match stranding risks.

It is prudent for regulators to act early to mitigate adverse customer impacts

The AER considers it prudent to act early to ensure that costs are recovered when more customers are still in the market. This reduces the chances that a smaller number of customers, some who might be 'captive' to using the assets are forced to pay a larger share of costs.

> *To enable different generations of consumers to pay network charges broadly in proportion to the value of network services they receive, it may be better to front-load depreciation such that a higher portion of costs can be recovered earlier in time, when there are more customers in the market to share the costs.*[88]

The potential price shock from delayed action is also acknowledged by IPART in a recent decision for the HVCN:

> *There may be more certainty when we next undertake this review in 2024. At that stage, we can adjust the estimated remaining mine life and depreciation schedule to reflect the longer or shorter remaining life. However, if we wait until our next review, in 2024, when there may (or may not) be*

88 AER, *Regulating gas pipelines under uncertainty – Information paper*, November 2021, p. 46.

more certainty about the future of coal-fired generation, we would create substantial price shocks for access seekers if we reduce our terminal date.

Alternatively, reducing our estimate of the remaining mine life now spreads the price increase over a longer period. If we find at the next review that the power stations are likely to continue beyond the terminal date then we can adjust the depreciation schedule at that time.[89]

Asset lives should be linked to their useful economic life

In recognition of growing demand uncertainty, a number of regulators have sought to adjust expected economic lives to reflect possible future demand for the services delivered by the regulated business and (implicitly) demand for fossil fuels.

The QCA has previously chosen to use economic life as the basis for determining depreciation allowances in a number of instances including in its 2019 Dalrymple Bay Coal Terminal (DBCT) Draft Access Undertaking. The QCA noted:

Determining a regulatory depreciation profile requires an estimate of the period over which an asset is expected to remain economically productive. The initial investment in the asset is then returned to the asset owner over this period through a regulatory depreciation allowance.[90]

The QCA also noted that the economic life of regulated assets may be shorter than the design or physical life of the asset:

Depreciation allowances are typically determined such that the value of the initial capital investment is returned to the asset owner over the useful or physical life of the asset. However, we consider it appropriate to apply an economic constraint to the depreciation profile where it can be demonstrated that an asset's economic potential is likely to be depleted prior to the end of its useful

89 IPART, Rate of return and remaining mine life 2019-24, Final Report, July 2019, pp. 24-25.

90 QCA, DBCT 2019 draft access undertaking, March 2021, p. 168.

or physical life. When applying a constraint, individual assets are depreciated over the shorter of their useful life, and the life implied by the economic constraint.

As we concluded in previous investigations, the coal resources that ship through DBCT, while significant, are finite and will likely constrain the economic life of the Terminal to a term somewhat shorter than the potential physical life of the assets.[91]

Regulators for rail assets in the Hunter Valley, which are predominately used to transport coal, are moving away from conducting assessments of economic life based on remaining mine life, and are instead refocussing on projections of future demand for coal as the key driver of stranding risk. For instance:

- In the recent 2021 Hunter Valley Access Undertaking variation accepted by the ACCC, the variation removed the remaining mine life methodology based on remaining coal reserves (clause 4.7(b)), that had previously been used to calculate asset lives on the network. Remaining mine life was instead agreed upon in a negotiation process between Australian Rail Track Corporation (ARTC) and the Hunter Valley Access Taskforce (HRATF).[92]
- IPART's review of the NSW Rail Access Undertaking proposes to allow IPART to set asset lives directly and no longer use mine life as a basis for setting asset lives.

In recent years, we have found that on some lines, whether it will still be in use in the future is more likely to depend on whether a power station will still be operational than the life of the mines supplying them. Some coal mines may still have sufficient reserves to continue producing coal, but the use of the line would be discontinued if it is no longer being transported on this line to a power station. To ensure that IPART can take into account the range of factors that affect the likely time that a line will remain in use, we propose that IPART set the asset lives directly.[93]

This shift in focus by the ACCC and IPART has occurred because these regulators appear to have recognised that demand for coal is likely to cease before physical coal reserves are exhausted. The linking of asset lives to demand for coal, rather than the supply of coal, is likely to be particularly relevant for networks and facilities exposed to thermal coal.

For the 2021-25 regulatory period, the ERA accepted the Dampier to Bunbury Pipeline's (DBP's) proposal to cap the economic life of pipeline assets to 2063 (down from 2077-2081) on the grounds that there is likely to be a diminishing market for gas transmission in future, due to technological and government policy changes, that may limit DBP to recover the full efficient cost of its existing pipeline assets.

91 QCA, DBCT 2019 draft access undertaking, March 2021, p. 171.

92 ACCC, *ACCC Draft Decision: ARTC's March 2021 variation to the HVAU*, April 2021, p. 32.

93 IPART, *Draft report – Review of the NSW Rail Access Undertaking*, 18 October 2022, p. 96.

Based on the current evidence available to it, the ERA considers that there is a likelihood that the usage of the DBNGP transmission pipeline will decline over time due to technological change and policy change.[94]

The New Zealand Commerce Commission also explicitly separated the economic lives and physical lives of assets in its 2022 determination on default price-quality paths (DPP3) for gas pipeline businesses:

We have shortened the regulatory asset lives of the network to better match the period during which the network is still expected to convey natural gas. This means the period over which GPBs' investments in assets is to be recovered is shorter than previously assumed, which increases the allowance for depreciation in DPP3. This has the effect of better maintaining incentives for GPBs to invest in their networks while there is still demand for natural gas. We consider this to be in consumers' long-term interests, and have smoothed price increases over time to help reduce the impact on consumers. [95]

Asset lives should be updated regularly based on the latest available information

As noted in Section 4.3.2, a key benefit of using asset lives to account for future uncertainty is that asset lives can be adjusted at regular intervals to reflect new information about the expected future demand for the regulated services as it becomes available. This allows the asset life assumptions to better reflect the most recent expectations of the economic life of the asset. Should changes occur that decrease the risk of stranding then the asset lives can always be extended again. The ERA noted the dynamic between uncertainty and asset lives:

The ERA notes that any view on the economic life of an asset, particularly one with a possibly long technical life, implies a forecast and a level of uncertainty. Uncertainty does not prohibit the possibility of a change in economic life, nor does uncertainty remove the need to update forecasts to reflect the best available information.[96]

IPART has also decided to review asset lives on a more frequent basis. IPART has proposed to review asset lives at least every five years, while also allowing itself discretion to conduct more

94 ERA, Final decision on proposed revisions to the Dampier to Bunbury Natural Gas Pipeline access arrangement 2021 to 2025, 1 April 2021, para. 1514.

95 NZCC, Default price-quality paths for gas pipeline businesses from 1 October 2022, Final Reasons Paper, 31 May 2022, p. 12.

frequent reviews if it considered it would be in the public interest to do so, or an application is made that is able to demonstrate that:

- asset lives are likely to be different to IPART's determined asset lives; and
- there would be a substantial impact on the ceiling test as a result; and
- the information being relied upon is new information or reflects a change in circumstances that has not been considered by IPART in a previous review of asset lives.[97]

The New Zealand Commerce Commission has included provisions for energy distribution businesses (EDBs) to apply for shortening of asset lives during a price reset under its Input Methodologies:

> *"Our chosen solution mitigates the risk of potential future price shocks for consumers, … this is a precautionary measure consistent with the nature of the problem – one of increased uncertainty. By allowing EDBs the option of a more rapid time profile of capital recovery, should the risk of widespread disconnections eventuate, the amount of remaining capital to recover at that time will be less than would otherwise be the case. Not permitting asset life adjustments now would risk increasing the materiality of any potential future adjustment to asset lives, if the risk becomes more likely. The resulting price shock would be larger, and we therefore consider that acting now is a prudent way for the IMs to reflect the changed environment."*[98]
>
> *"Our solution is an NPV neutral measure that mitigates the impact to consumers should the risk eventuate, rather than compensating suppliers for bearing the risk.*[99]

Asset lives can vary across different sections of a network to match stranding risks

IPART have recently proposed changes to the NSW rail framework to allow IPART to set different asset life assumptions for different lines on the Hunter Valley coal network. IPART concludes that using different asset lives would better reflect the asset stranding risks of the various sections of the network, with shorter asset lives being applied to sections that are considered to be more exposed to stranding risk.

> *The current NSW Undertaking only refers to a single mine life estimate. We agree that the requirement to have a single terminal date for the entire Hunter Valley coal network is becoming increasingly impractical as stark differences emerge between the likely remaining lives of different lines. Therefore, we propose that the NSW rail access framework is clarified to allow IPART to set*

96 ERA, *Final decision on proposed revisions to the Dampier to Bunbury Natural Gas Pipeline access arrangement 2021 to 2025*, 1 April 2021, p. 356.

97 IPART, *Draft report - Review of the NSW Rail Access Undertaking*, 18 October 2022, p. 97

98 Commerce Commission, *Input Methodologies – final decision reasons paper, topic paper 4*, 2016, para. 88.

99 Commerce Commission, *Input Methodologies – final decision reasons paper, topic paper 4*, 2016, para.86.

different asset lives for different lines. For example, depreciation could be calculated at the beginning of each financial year, using a straight-line methodology and the estimate or estimates of the remaining useful life of the assets[100]

4.5 Models to account for climate change related risk

Traditionally, the useful economic life of assets involved in the transportation of coal have been linked to coal reserves and the estimated time it will take for those reserves to be extracted, often referred to as the remaining mine life. This remaining mine life has then been used to determine the deprecation schedule for the regulated assets. However, this type of model is unlikely to be fit for purpose, given usage of regulated assets involved in the transportation of coal is now dictated by demand-side factors rather than supply-side factors.

The following section outlines two models that may be applied to determine how the assumed economic life of regulated assets may need to be adjusted in response to changing expectations of future demand for coal:

- The Window of Opportunity Past (WOOPS) model; and
- Asset adjustment factors.

It is also worth noting that some regulators such as the IPART, ACCC and AER have decided to accelerate cost recovery but have not explicitly relied on these theoretical models. Rather, those regulators have exercised their judgment about the expected economic life of the assets given the emerging information available about expected future demand at the time of the decision.

Window of Opportunity Past (WOOPS) model

A standard WOOPS model calculates the last point in time a regulator can act before the actual price the regulated entity can charge no longer reflects the regulatory price path but is constrained by the price path of a substitute technology. A depreciation schedule can then be set to ensure full cost recovery by that particular date. Essentially, the WOOPS model is a framework for estimating the expected economic life of a regulated asset.

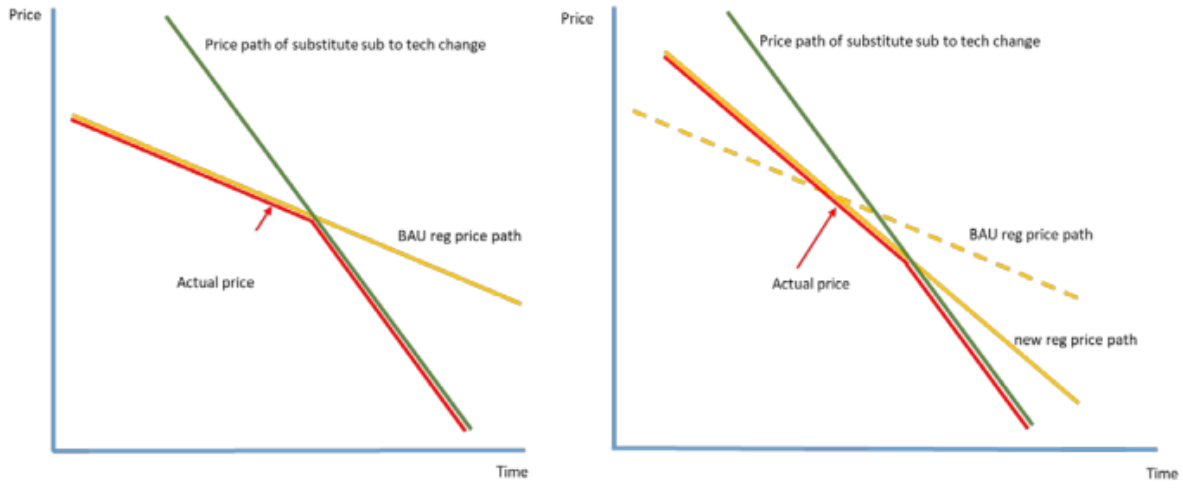
While the model calculates a 'point of no return', it also identifies the benefit of acting early. The earlier action is taken, the flatter will be the depreciation schedule, as the accelerated depreciation is spread over a longer time period—and the smaller the immediate impact on prices. This was acknowledged by Crew and Kleindorfer (1992), who developed the WOOPS model:

[100] IPART, *Draft report - Review of the NSW Rail Access Undertaking*, 18 October 2022, p. 97.

there is limited time for regulators to take remedial action, and if timely action is not taken there is no alternative but for the company to fail to recover some of its capital.[101]

The model is presented graphically below, where the left-hand panel represents the price without accelerated cost recovery and the right-hand panel with accelerated cost recovery. In the right-hand panel, the regulated business is able to compete longer with the substitute technology and recover more of its costs.

Figure 9: Theoretical WOOPS model



Source: Dampier Bunbury Pipeline submission to the ERA

Dampier to Bunbury Pipeline (DBP) undertook WOOPS modelling in its submission to the ERA for its 2021-2025 Access Arrangements. The modelling highlighted the need for DBP to recover its cost base by 2063. Previously a large amount of its pipeline assets was due to be fully depreciated between 2077 and 2081.

DBP's main reason for proposing the use of the WOOPS model was to address the diminishing market for gas transmission on the DBNGP caused by technological and policy change.

DBP faces a greater likelihood that the DBNGP's economic life will be shorter than its technical life due to the combination of technological change and environmental policies curtailing natural gas use. Given current uncertainties, the range of potential economic lives of the DBNGP is wide, and DBP's proposed economic end life of 2063 sits within a range of plausible outcomes... Accordingly,

101 Crew, M. and Kleindorfer, P. 1992, "Economic Depreciation and the Regulated Firm under Competition and Technological Change," *Journal of Regulatory Economics* 4:51-61.

the ERA finds that the adjustment of depreciation schedules to reflect economic lives capped at 2063 is consistent with the requirements of the regulatory framework.[102]

While the model was successful in establishing an end date, there are a some limitations to the model, particularly when linking the model with assets associated with the coal industry. For these assets it is more likely that the stranding date is determined by the point where there is no longer demand for coal, rather than a substitute technology. It is not immediately apparent whether the WOOPS model is able to reflect this distinction, given a price path for coal based on future expectations about demand may be difficult to establish.

Asset adjustment factors

An asset adjustment factor was introduced by New Zealand's Commerce Commission in its DPP3 regulatory decision for gas pipeline services. It is applied to the physical life of an asset to bring it in line with the asset's expected economic life. The adjustment takes into account New Zealand's commitment to net zero emissions by 2050 and its expected negative effect on demand for gas pipeline networks. The Commission noted:

Applying this factor will bring regulatory asset lives for each GPB more into line with the expected economic life of the assets, rather than continue to rely on standard physical asset lives as a proxy.

Taking this action in DPP3 enables depreciation to be recovered over a period aligned with the length of time network assets are expected, on average, to be economically viable for conveying natural gas, and not the longer period implied by the assets' physical lives. Continuing to apply existing standard physical asset lives would be to ignore that GPBs face a declining ability to recover asset related costs over time and that GPBs' economic circumstances differ from one another.

[It also] maintains expectations of capital recovery, providing incentives for GPBs to invest to serve current and future demand.[103]

Adjustment factors are determined by an Asset Stranding Model developed by the New Zealand Commerce Commission. The model has regard to two primary economic life scenarios:

- One-third weight is given to a straight-line declining maximum allowable revenue envelope to 2050 (previously adopted in the draft decision); and
- Two-thirds weight is given to a 2060 wind-down scenario. The Commission assumes continued use of some or all gas pipelines past the 2050 net zero legislative target

102 ERA, *Final decision on proposed revisions to the Dampier to Bunbury Natural Gas Pipeline access arrangement 2021 to 2025*, 1 April 2021, p. 356.

103 Commerce Commission, *Default price-quality paths for gas pipeline businesses from 1 October 2022 – Final reasons paper*, 31 May 2022, p. 96.

An adjustment factor is then set such that the total value of assets is equal in the regulator's pricing model and Asset Stranding Model. The weighted average asset lives is then multiplied by the adjustment factor. In the case that the adjustment factor is below 1, the adjustment will reduce the physical asset life to be more in line with its economic life.

The adjustment factor also allows for an extension of asset life (i.e., an adjustment factor greater than 1) if or when new information becomes available that may extend demand.

Other approaches used by regulators to estimate economic life

Some regulators have decided against using the previously described theoretical models and instead have set asset lives based on their own expectations of when asset stranding may occur. This was the case in the AER's final determination on the 2021-26 access arrangement for Evoenergy's gas distribution business, where the AER agreed to shorten the standard asset life assumptions for certain classes of Evoenergy's regulated assets.

The AER recognised that recent announcements by the ACT Government on climate change policy (an intention to prohibit new gas connections in new developments and to provide grants to households to replace gas appliances with new electric alternatives) increased the likelihood that the economic life of Evoenergy's gas network would be shorter than the technical life of the assets. The AER stated that:

> *At the time of the draft decision, we expected the ACT Government's decision on the path to net zero emissions from gas use to be made in 2024 (close to the next review) as per the timeline set out in its Climate Change Strategy 2019–2025. We expected further clarity on the impact of this pathway on Evoenergy's customers located in NSW at that time.*
>
> *However, following the October 2020 ACT election, the returned ACT Government has published an agreement which provides more certainty and clarity about its intentions and planned initiatives to phase out natural gas in the ACT. These include prohibiting new gas connections in newly developed estates and in new infill developments within existing areas in the ACT from 2023. Further, the agreement also commits to, among other measures, interest-free loans of up to $15,000 for households to help with the cost of replacing gas appliances with electric alternatives.*
>
> *We consider that the ACT Government's climate change policy has advanced considerably in the time between our draft decision and when we received the revised proposal. It is now more certain that Evoenergy's customer base in the ACT would start declining after 2023 as no new brownfield connections would be allowed. Existing customers in the ACT who have gas appliances installed in their homes would be more likely to switch to electricity once their appliances need to be replaced*

due to the rebates available to them and the marketing campaign to move away from gas use in the ACT.[104]

Consequently, the AER shortened the standard asset life assumption of high-pressure mains assets from 80 years to 50 years, and the standard asset life assumption of medium-pressure mains and medium-pressure services assets from 50 years to 30 years.

4.6 Conclusion

There are a number of options available to the QCA to proactively accommodate increasing uncertainty in future demand and the associated increase in asset stranding risk in its regulatory framework. It is becoming clearer that falling demand for coal, rather than falling supply, is the key driver of climate change related stranding risk. As discussed in this section, this is likely best addressed by:

- Allowing compensation for stranding risk through the allowed return **on** capital; or
- Adjusting the return **of** capital through accelerated depreciation and a reduction in asset lives.

In order to understand the exposure of regulated businesses such as Aurizon Networks to climate change related stranding risk, the QCA would need to monitor the evolution over time of:

- demand for coal; and
- government climate change policies aimed at coal users and producers.

Given the high degree of uncertainty over future coal demand and government climate change policies, the QCA should consider scenario analysis informed by plausible and reputable projections of:

- future coal demand; and
- future coal production, taking into account government climate change policies targeted at the coal mining industry.

It is important that the QCA sets out clearly the types of information and evidence it would require from regulated businesses to demonstrate, ex-ante, the potential impact of asset stranding risk and any impacts of relevant mitigation measures. The QCA may also need to take into consideration a larger range of plausible future scenarios, rather than focusing on just the expected future profile of demand at a given point in time, reflecting the significant uncertainty faced by the coal industry.

[104] AER, Evoenergy access arrangement 2021 to 2026, Final Decision, Attachment 4, pp. 7-8.

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