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Smelting Point

Australia's Critical Window for Energy Market Reform during the Energy Transition

June 2026

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- Potential policy reforms for consideration by AAC and its members, developed in consultation with AAC's members

This report does not present:

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- Legal advice on regulatory compliance
- Recommendations of specific policy settings (policy choices remain with government)
- Guaranteed economic or environmental outcomes

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Executive Summary

Building Australia's energy future is vital; but the challenges of the transition requires different thinking

Australia's aluminium supply chain is the grid's largest and most sophisticated demand-side asset. The sector spans one of the world's most complete supply chains: Australia is the world's second largest bauxite producer, second-largest alumina refiner and has four operating smelters. It directly employs over 20,000 FTEs in regional communities, generates over $19 B in gross value-add,[1] and provides more than 1 GW of dispatchable demand response. This makes the sector the grid's most developed source of demand-side flexibility.

The grid is changing in ways that are turning affordable electricity for industry into an increasingly contested resource. The transition of ageing centralised coal assets to cheaper but distributed renewables, requiring significant transmission build out, is tightening system adequacy even as new industrial loads, such as data centres, critical minerals refining and electrochemical manufacturing, compete for the same electrons. The NEM allocates access by price. That mechanism assumes the highest bidder represents the highest-value use. It does not measure dispatchable demand response, regional employment, or sovereign industrial capability.

The aluminium sector is negotiating replacement PPAs into this market without a mechanism to adequately price the grid services it already provides. Long-term agreements, struck when generators were government owned, are expiring at precisely the moment the market is least equipped to reflect the full value of large industrial demand. PPAs being signed now will miss the opportunity for a decade or more.

Figure A: Alumina and aluminium sector socio-economic contribution today

ENERGY & RESOURCES	**132.8 PJ** Energy use	**27 TWh** Electricity use	**26 GL** Water use
ECONOMIC OUTPUT	**$18.2 B** Output	**$16.0 B** Trade value	**$270 M** Tax revenue
GROSS VALUE ADD	**$1.4 B** Direct GVA	**$11.3 B** Indirect GVA	**$6.8 B** Induced GVA
EMPLOYMENT	**12,700 FTE[2]** Direct	**36,500 FTE** Indirect	**19,600 FTE** Induced
SYSTEM SERVICES	**1,100 MW** Capability	**$170 M** Demand response value	**$27 M** System services value

Notes: 1. Economic variables may vary from previous analysis by FTI, reflecting updates to the ABS Input-Output Tables and an inflationary environment. 2. Value focuses on alumina and aluminium manufacturing components of the supply chain only, excluding bauxite and extrusion steps.

Ensuring Australia's global competitiveness means acknowledging different attributes of demand in the energy system

Aluminium and alumina together deliver the highest socio-economic return per unit of electricity of any large industrial load. The combined sector produces the strongest socio-economic benefit, concentrated in regional communities where few alternatives exist.

The comparator sectors do not compete for electricity on the same terms, and the Australian government is already drawing that distinction. Large industrial users such as aluminium and alumina, electrochemicals and critical minerals are price-sensitive, while data centres are price-insensitive. Government expectations on data centres, including sustainability benchmarks and efficiency requirements under the AI data centre framework, establish that differentiated treatment of large industrial loads is not a novel policy concept. The question is whether that differentiation extends to the variables that matter for industrial incumbents.

Differentiated access requires a transparent methodology incorporating socio-economic, system flexibility, and strategic value. Applied consistently, it produces defensible access arrangements reflecting national economic priorities rather than market price signals alone.

Table B: Comparator sector socio-economic value metrics today

Thematic	Units	Aluminium Smelters	Alumina Refineries	Electro-chemicals	Data Centres	Critical Minerals
Energy Use[1]	PJ	86.8	178.9	0.4	26.3	Varies significantly by mineral
Electricity Use	TWh	23.0	3.9	0.1	7.3	6.5
Total Output	$/MWh-used[2]	260	3,110	100	890	1,360
Trade	$/MWh-used	240	2,670	-	630	1,360
Tax	$/MWh-used	4.0	46.7	1.1	10.6	20.4
Direct GVA	$/MWh-used	20	240	30	290	360
Total GVA	$/MWh-used	280	3,340	120	1,080	1,600
Direct Employment	FTE/GWh-used	0.2	2.2	0.3	0.4	1.0
Total Employment	FTE/GWh-used	1.0	11.8	0.6	3.4	4.7
Regional Employment	% direct employment	80%	60%	19%	14%	64%
Demand Response Value[3]	$/MWh-used	7.40	0.7	2.7	-	-
System Services Value	$/MWh-used	0.70	0.50	0.40	-	0.50

Notes: 1. Energy use considers all potentially electrifiable energy used today including gas and coal for heating. 2. MWh-used refers to the output divided by thematic output divided by the electricity use. 3. Demand response and system services value is determined by estimating the frequency and duration of activation events currently provided on average across all Australian smelters, price realised during those events and compared to the counterfactual of not providing the service and the opportunity cost.

Four market and policy failures are contributing to the undermining of global competitiveness of Australia's aluminium and alumina

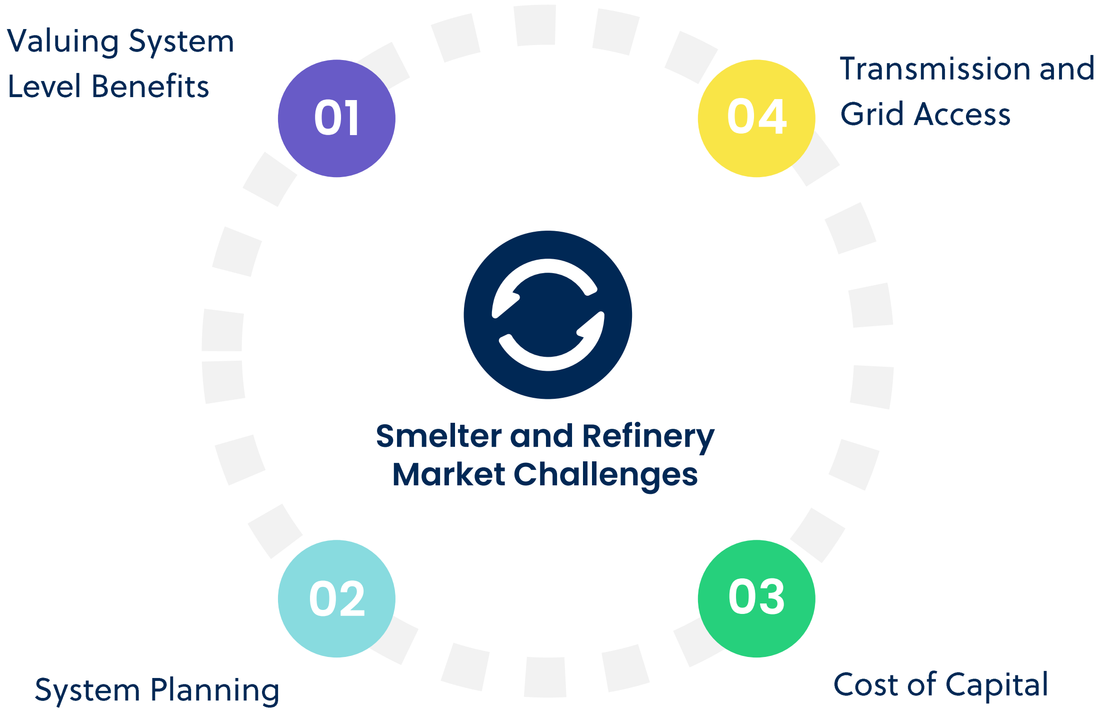
Failure 1: The system level benefits such as grid-forming capability, demand response, or system inertia of existing and new industries is either not considered or is undervalued. NEM ancillary markets were built for generators, with demand-side equivalents invisible to settlement. This analysis suggests the demand-response capability is worth $7.5/MWh-used in system services today and could reach $10.4/MWh-used by 2035.[1]

Failure 2: System planning is focused on supply not demand. The NEM ISP and WA system planning do not build infrastructure pathways ahead of industrial load commitment and therefore do not reflect the increased national and state focus around industrial precincts and industrial eco-system planning. This sees a contradiction between the Federal Government's strategic industrial policy and the optimisation being undertaken for system services.

Failure 3: No structured transition finance instrument exists. While ad hoc bilateral support, such as announced for Boyne and under negotiation for Tomago, can help to secure continuation of these assets, it doesn't establish the transition foundations to reduce the cost of capital for revitalising critical assets underpinning important industrial eco-systems. Electricity project developers cannot price PPA risk without knowing whether anchor demand survives.

Failure 4: Aluminium smelters are exposed to high network charges while price-insensitive new entrants are socialising network costs. Data centres consume 7.3 TWh at price tolerance that structurally outbids every industrial manufacturer, contributing limited system services, and until March 2026 faced no network co-investment obligation. Meanwhile, aluminium smelters have increasingly faced large and volatile network charges which further harm international competitiveness.

Figure C: Together, four market failures are amplified to create challenges for smelters and refineries



Notes: 1. Demand response and system services value is determined by estimating the frequency and duration of activation events, price realised during those events and compared to the counterfactual of providing the service and the opportunity cost.

Reform that delivers for aluminium provides a pathway to support all other energy intensive sectors

The four market failures identified in this analysis have four corresponding reform responses:

- **Reform 1** addresses the failure to value system level benefits by reforming market mechanisms to recognise and remunerate full system value.
- **Reform 2** addresses the system planning failure by embedding demand visibility, socio-economic value, and place-based delivery into grid access and energy allocation decisions to better inform transmission and supporting infrastructure planning decisions.
- **Reform 3** addresses the cost of capital failure by establishing a concessional debt facility to support electricity project developers supplying to strategically significant industry.
- **Reform 4** addresses the transmission and grid access failure by requiring new large price-insensitive loads to invest in supply and implementing tariff structures for strategic, price sensitive loads.

Together these reforms close the feedback loops that have made facility-level crises inevitable during the transition. These are not industry-specific subsidies but are instead corrections to market design failures emerging as a result of the transition for all large industrial electricity users. Left unaddressed, these failures will continue to produce outcomes that are suboptimal from a national economic perspective until electricity abundance is restored.

Aluminium presents the most immediate application but developing a policy architecture which addresses the needs of the aluminium sector provides a pathway of applicability across other energy intensive sectors.

Table D: Key market failures and the associated policy reforms

Market Failure	Reform
Valuing System Level Benefits	Reform market mechanisms to recognise and remunerate the full system value of system level benefits
System Planning	Shift the systems planning paradigm better value the demand-side and incorporate socio-economic value and place-based delivery into transmission planning
Cost of Capital	Establish a concessional debt facility to bridge strategically significant industry through the energy transition by supporting generators supplying to strategically significant regional industry
Transmission & Grid Access	Require new large price-insensitive loads to invest in supply and implement tariff structures for strategic, price sensitive loads

The need for these reforms is time-bound; restoring electricity abundance is the catalyst to re-assert efficiency principles

These reforms must be time-limited and designed from the outset to say so. They address a structural but finite market failure: the transition window during which cost-competitive electricity is scarce without coordinated management. Each reform should carry a built-in review trigger after which the intervention scales back automatically, while enabling stability for investment. That exit pathway is not a concession; it is the feature that makes the reforms politically credible and prevents them hardening into permanent subsidy.

Getting the architecture right for aluminium creates a replicable framework for every energy-intensive industry Australia needs to retain. Electrochemicals, critical minerals, and advanced manufacturing face near-identical market design failures and the same dependence on long-term competitively priced electricity. A framework designed with aluminium as the first use case is the foundational layer of a coherent Australian industrial energy policy.

The decisions made in the next five years will determine Australia's industrial shape for the following fifty.

Figure E: The key periods of the energy transition to navigate to energy abundance

Critical Window

2025 – 2035

Market failure is acute

- Coal retirements accelerate; grid capacity scarce
- Data centre demand surges
- Industrial loads at risk of displacement or delayed electrification
- Demand response value rises as reliability gap widens

Intervene: access frameworks, system level benefit reform, co-investment rules, precinct planning

Managed Transition

2035+

Constraints ease as investment lands

- ISP transmission build-out matures
- Renewable generation exceeds coal replacement
- Renewable replacements grow
- Firming capacity (batteries, pumped hydro) scales
- Industrial electrification pathways become viable

Wind down: review access frameworks, relax load-class distinctions as supply grows

Energy Abundance

2040+

Efficiency-based market mechanisms restored

- Energy is abundant and low-cost
- Grid capacity sufficient for all load types
- Industrial competitiveness secured through competitively-priced and reliable electricity

Sunset: interventions no longer needed — market competition allocates efficiently

The Australian Electricity Market Problem

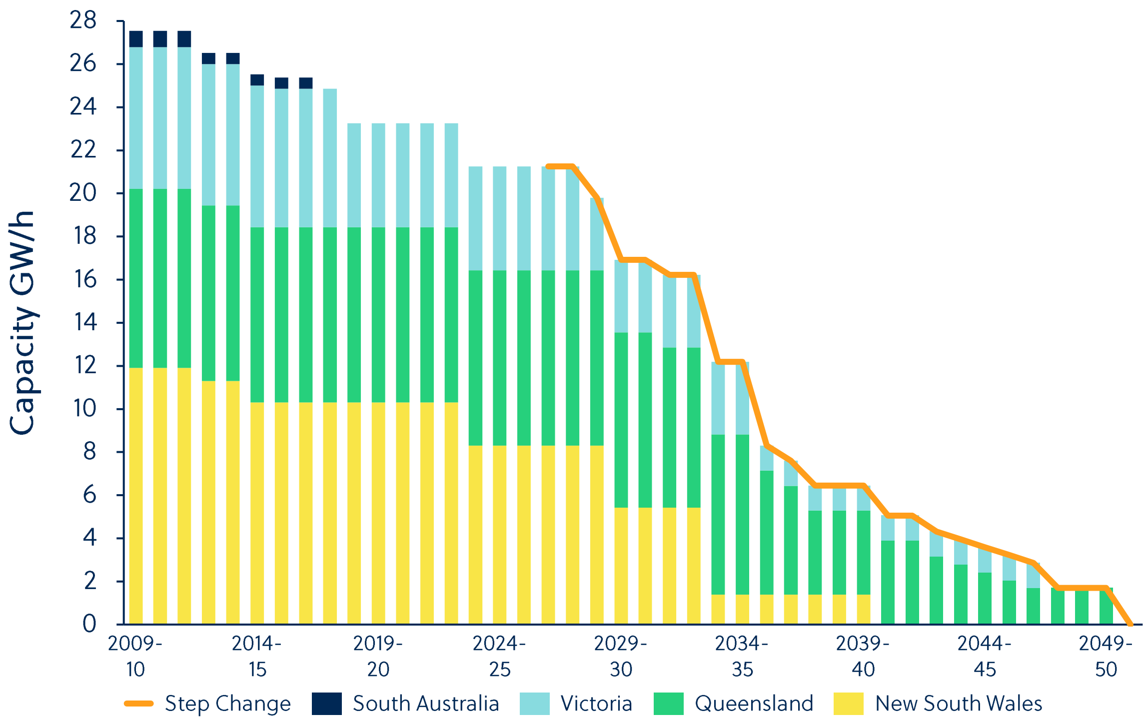
Australian smelters are finding it challenging to access competitively-priced electricity, making them increasingly uncompetitive in global markets.

Australia's electricity system is undergoing its fastest transformation in history

Coal is exiting the NEM at pace, creating both risk and opportunity for large industrial energy users. AEMO's Draft 2026 ISP Step Change scenario projects two-thirds of the NEM's coal capacity will retire by 2034–35,[1] given accelerating operating costs, reduced fuel security, and competitive pressure from renewables. Replacing this capacity requires over 5 GW of new grid-scale generation per year,[1] a deployment rate that is already outrunning transmission and firming infrastructure, creating a window of sustained upward pressure on wholesale prices at the point of maximum commercial exposure for large energy users.

A surge in competing electricity demand is coinciding with this supply-constrained period. New industrial loads, including data centres, critical minerals refining, electrochemical manufacture, are emerging. Simultaneously the decarbonisation of existing heavy industry is likely to drive further demand for electricity, including alumina refineries requiring competitive electrons to meet emissions targets and replace energy sources which currently rely on increasingly scarce and expensive coal and gas. The net effect is a material increase in aggregate demand at precisely the moment coal-fired firm capacity is exiting and new renewable generation is still ramping. Absent coordinated policy, this structural imbalance could drive wholesale prices higher across the transition window.

Figure 1.1: AEMO ISP Step Change Coal Retirement Timeline[1]



Sources: 1. AEMO, 2026 Integrated System Plan (2025).

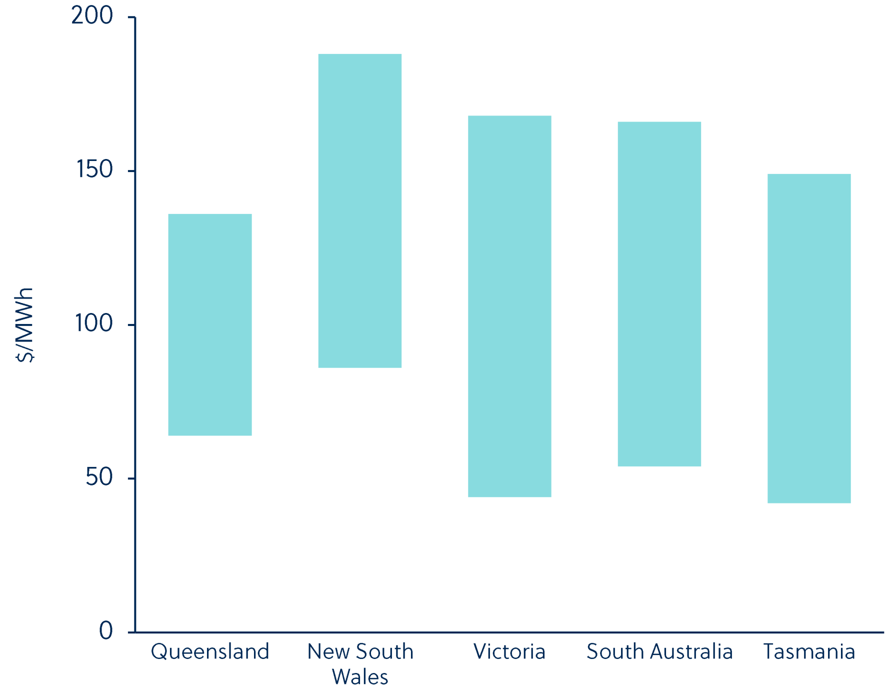
Australian smelters at the end of their legacy Power Purchase Agreements cannot access electrons at competitive cost

Legacy Power Purchase Agreements (PPAs) that gave Australian smelters electricity rates which recognised their strategic value were a product of government-owned energy markets. Historically, state-owned generators supplied smelters at preferential rates in recognition of their strategic value and grid services. With privatised generation, smelters now negotiate with commercial counterparties who have no obligation to price in system-level benefits such as grid-forming capability, demand response, or system inertia. As legacy agreements expire, the gap between what smelters can afford, and prevailing market prices is widening materially.

Australian smelters are now seeking new PPAs in a structurally higher-cost market. Smelters require long-term, low-cost electricity contracts to sustain operations. Tomago Aluminium has highlighted the risks their facility faces if they are unable to negotiate a deal.[1] Rio Tinto's Gladstone operations have secured Federal Government support to maintain ongoing operations in the near term. With Bell Bay and Portland's existing PPAs reaching their end over the next decade, further government intervention appears unavoidable if these market conditions persist.

Aluminium smelters occupy a uniquely exposed position in this transition, but also a uniquely valuable one. The risk is commercial: smelters reaching the end of legacy power purchase agreements face market pricing that excludes the system-level services they provide, including grid-forming capability, demand response, and system inertia. The opportunity is structural: smelters' flexible load profiles position them to provide system services if needed and properly valued.

Figure 1.2: State-level electricity quarterly price range over the past 5-years[2]



Sources: 1. Grattan Institute, Saving Tomago (2025); 2. AER, Quarterly Volume Weighted Average Spot Prices – Regions (2026).

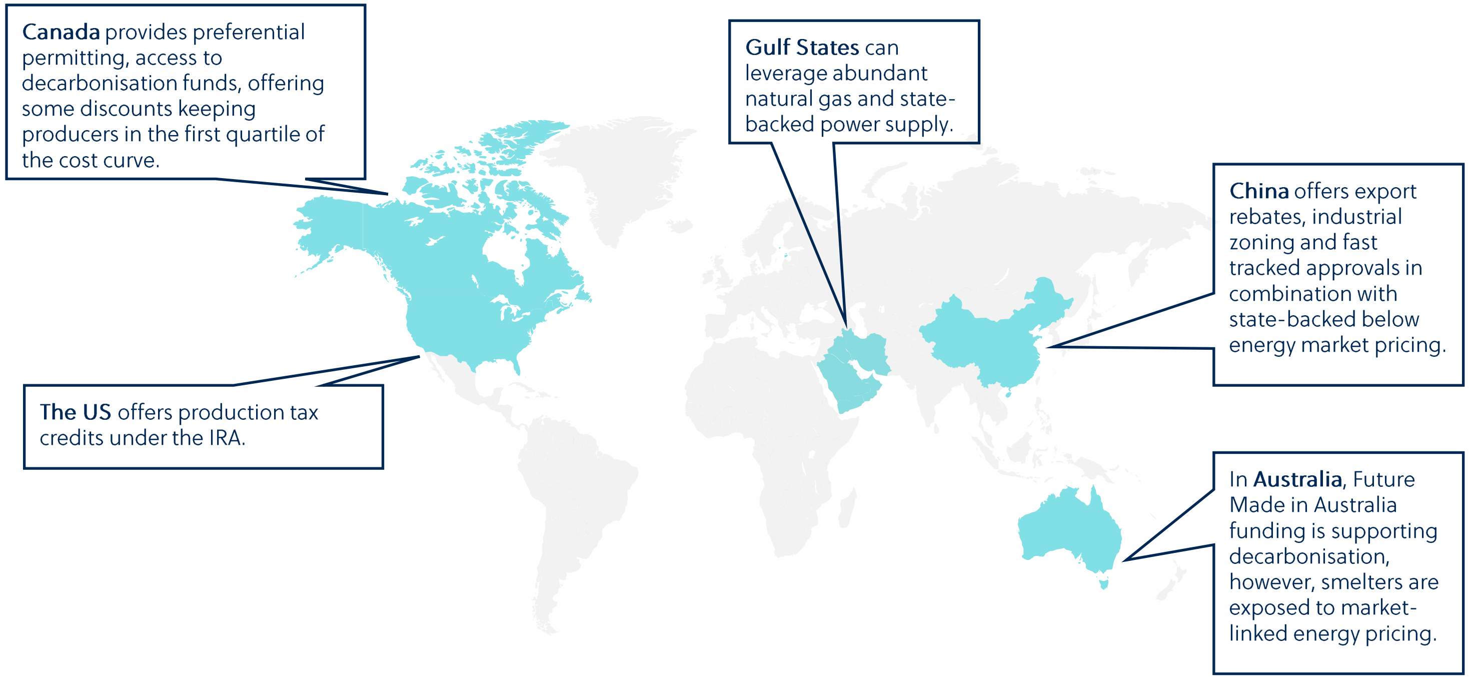
Other governments actively support local aluminium, putting Australia at a competitive disadvantage

Electricity represents approximately 40 per cent of the cost of primary aluminium production, making competitively priced power the critical input for competitive advantage.[1] Australia produces approximately 1.6 million tonnes of aluminium annually and accounts for around 10 per cent of global exports.[1] This creates a structural mismatch: Australian smelters compete on a globalised commodity price while bearing electricity costs that peer jurisdictions have deliberately managed down.

Competitor jurisdictions actively suppress industrial electricity prices through policy. Canada and Norway provide industrial electricity at preferential rates through government-backed hydroelectric contracts.[1] The United States Inflation Reduction Act has introduced a 10 per cent Advanced Manufacturing Production Credit directly applicable to domestic aluminium, alongside up to USD 10 billion in Advanced Energy Project Credits.[1]

The cost differential is not marginal; it determines long-run viability. Differences in electricity cost can exceed USD 1,800 per tonne of competitive advantage between the most and least favourably positioned smelters globally, making policy the primary determinant of whether a smelter operates or exits.[2]

Figure 1.3: International Mechanisms Supporting Aluminium Manufacturing[1]



Sources: 1. Australian Aluminium Council, Securing a level playing field (2025); 2. Al Circle, Aluminium 2026: Structural Backwardation & Market Trends (2026)

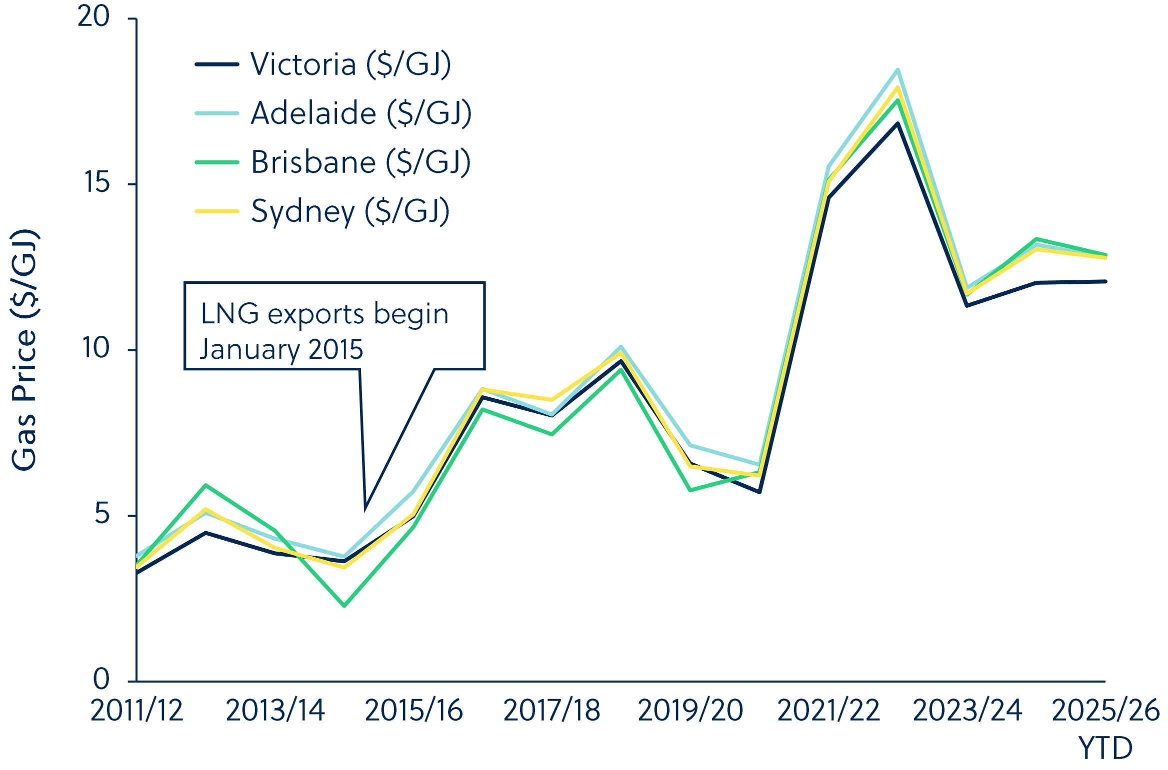
Aluminium is not alone; Australia doesn't have an industrial competitiveness challenge but instead an energy price problem

Energy market design is systematically eroding the competitiveness of Australia's energy-intensive industrial base. Aluminium is not an isolated case. Gas-intensive industries face an analogous challenge: export parity pricing has driven domestic gas prices to levels that undermine industrial competitiveness. The government has responded by recommending a national gas reservation scheme, commencing in 2027, requiring a portion of LNG production to be reserved for domestic commercial and industrial users.[1]

The Australian Government has similarly begun to respond to the challenges electricity users face. The Australian Government has announced a production credit under the Future Made in Australia Plan targeting smelters transitioning to renewable electricity,[2] committed a $1 billion package for Rio Tinto's Boyne Smelters at Gladstone,[3] and is negotiating an arrangement for Tomago Aluminium.[4] This support is not solving an uncompetitive aluminium production problem but instead an industrial electricity price challenge.

Facility-by-facility interventions are not a systematic industrial energy policy; without one, Australia risks a pattern of reactive bailouts that leaves the broader base exposed. Energy-intensive facilities are embedded in regional precincts where they function as anchor employers and economic multipliers. If industrial facilities exit during the transition without a systematic framework to retain them, the economic impact falls disproportionately on regional communities, undermining both the social compact of the energy transition and Australia's long-term manufacturing capability.

Figure 1.4: Comparative challenges in gas market are driving industrial exits[5]



Sources: 1. DISR, Gas Market Review (2026); 2. DISR, New Green Aluminium Production Credit will support the transition to green metals (2025); 3. DISR, 2 billion investment to secure Queensland's industrial future (2026); 4. Grattan Institute, Saving Tomago (2025); 5. AER, Gas Market Prices (2026)

Alumina & Aluminium's Socioeconomic Value

Australia's Aluminium industry is integral to both the electricity system and regional economies.

The alumina and aluminium sector is a key pillar of the Australian economy

Australia's aluminium supply chain holds a structurally unique position in the global supply chain, underpinned by resource endowments few peer jurisdictions can replicate at equivalent scale. Australia is the world's second largest producer of bauxite, the second-largest producer of alumina, and operates four aluminium smelters across New South Wales, Queensland, Victoria, and Tasmania. This vertical integration represents a complete industrial value chain that fewer than a handful of nations possess. The sector contributes significant GVA, direct employment, and concentrated regional economic activity in communities where it functions as the dominant commercial anchor.

The upstream smelting of alumina into aluminium provides critical electricity system services, such as grid stability, demand response, and frequency control, that current market mechanisms significantly undervalue. This undervaluation is not incidental: it is a product of market design built around generation-side assets that has not evolved to capture the full economic contribution of large, flexible industrial loads. The sector is moving from recognition of the value these system services bring in legacy PPAs to operating at a structural disadvantage within the NEM, receiving less than its full value while bearing the full cost of energy market exposure.

Figure 2.1: Alumina and aluminium sector socio-economic contribution today[1]

ENERGY & RESOURCES	132.8 PJ Energy use	27 TWh Electricity use	26 GL Water use
ECONOMIC OUTPUT	$18.2 B Output	$16.0 B Trade value	$270 M Tax revenue
GROSS VALUE ADD	$1.4 B Direct GVA	$11.3 B Indirect GVA	$6.8 B Induced GVA
EMPLOYMENT	12,700 FTE Direct	36,500 FTE Indirect	19,600 FTE Induced
SYSTEM SERVICES	1,100 MW Capability	$170 M Demand response value	$27 M System services value

Source: 1. Refer to Appendix for methodology.

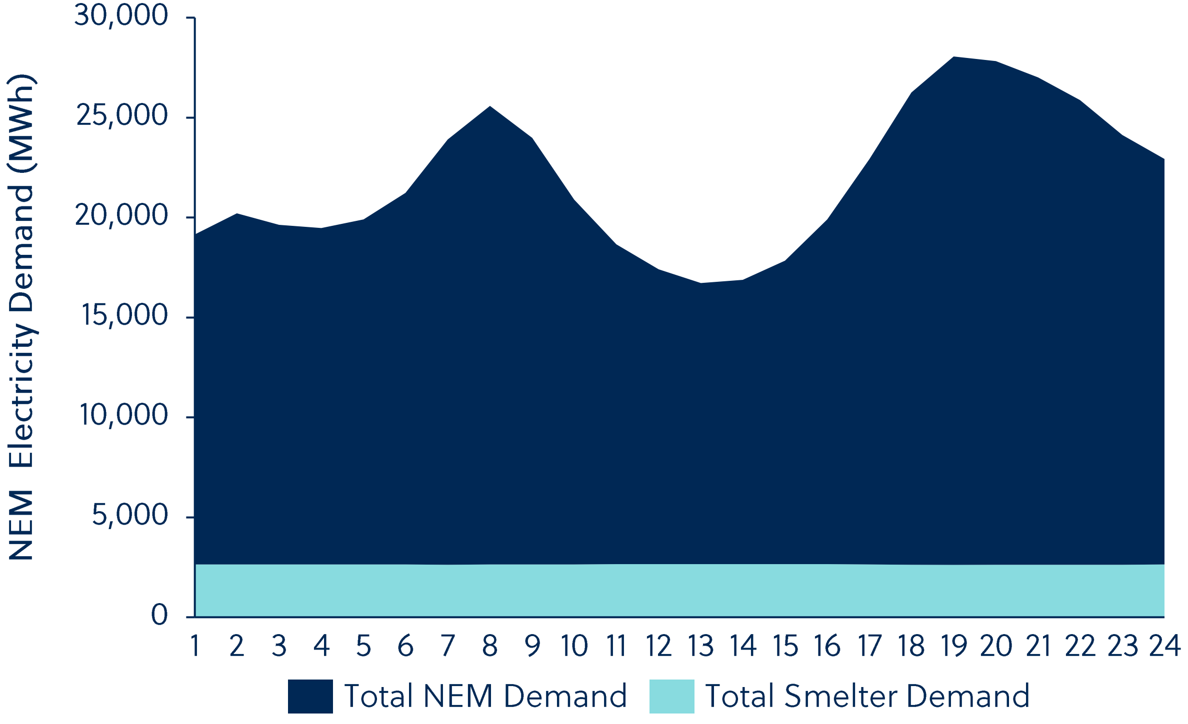
Aluminium smelters provide an anchor load that contributes to baseload stability and network efficiency

Aluminium smelters provide an anchor load to the NEM. Aluminium smelters offer large, stable, and highly predictable consumption, representing over 10% of NEM demand on average,[1] and peaking at over 30% in some states. Operating continuously at close to full capacity, 24 hours a day, 365 days a year, smelters smooth demand peaks and reduce the investment required to maintain network adequacy.[1]

This anchor load function is economically irreplaceable in network planning. In providing an anchor load, smelters reduce the variability network operators must plan and price for. In a grid increasingly characterised by the intermittency of variable renewable generation, a reliable large-scale base of industrial demand provides a system stabilisation function that carries economic value.

Closure of a major smelter would not just remove demand; it would increase per-unit network costs for all remaining consumers. Network charges are socialised across the consumer base; as large industrial loads exit, fixed infrastructure costs distribute across a smaller pool of users, driving up per-unit costs for households and businesses. This cross-subsidy dynamic is rarely accounted for in discussions of industrial support policy, yet it represents a direct cost transfer borne most heavily by residential and small commercial consumers.

Figure 2.2: Aluminium smelters as the anchor load to the NEM[2]



Source: 1. Climateworks Centre, Making Aluminium Uses 10% of Australia's Electricity (2025) 2.) Representative September day developed based upon AEMO load profiles and AAC member data.

Aluminium smelters can provide over 1 GW of demand response which is critical for managing peak loads but remains unvalued

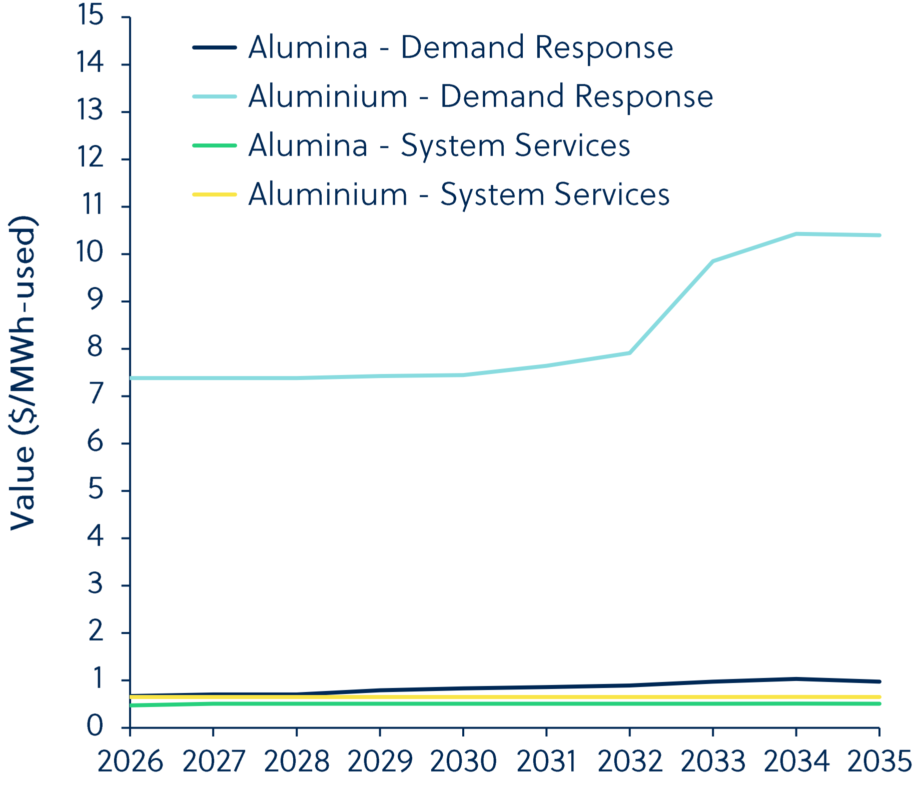
Smelters represent one of Australia's largest and fastest-responding sources of demand response, capable of collectively reducing consumption by over 1 GW within minutes. This capability requires no additional capital investment as it is inherent to the potline configuration of the electrolytic smelting process. As such, it represents the type of fast-acting, dispatchable resource grid operators need as variable renewable generation increases the frequency and severity of supply-demand imbalances, providing system strength capacity beyond daily dispatch. In a grid where coal-fired baseload is retiring and battery storage is scaling; the demand flexibility of existing large industrial assets is a critical bridge resource that Australia has systematically underutilised.

Current electricity market design does not adequately remunerate smelters for this service, creating a growing gap between the value delivered to the system for providing the capacity and the revenue received. FCAS product definitions, dispatch intervals, and settlement mechanisms were designed for generation-side assets. Demand-side resources do not fit neatly into existing product categories, meaning their full flexibility value, estimated to be over $7.5/MWh-used today and reaching over $10.4/MWh-used by 2035, is neither captured nor compensated.[2] While this value has historically been captured in PPAs with government-owned generation assets, new PPA agreements with private electricity suppliers fail to capture this value. This under-remuneration directly worsens the financial case for continued smelter operation, compounding the energy cost pressures already facing the sector.

As coal-fired generation exits the NEM, aluminium smelters are also able to provide capacity to substitute the inertia and frequency-stabilising functions coal provided. Smelters contribute to FCAS through their ability to adjust load rapidly in response to system frequency deviations, a capability that becomes increasingly critical as the NEM transitions to a generation mix dominated by inverter-based renewables with lower inherent system inertia.

Sources: 1. Australian Aluminium Council, Aluminium and the Electricity Grid (2023); 2. Refer to Appendix for methodology.

Figure 2.3: The value of demand response and system services per MWh used[2]

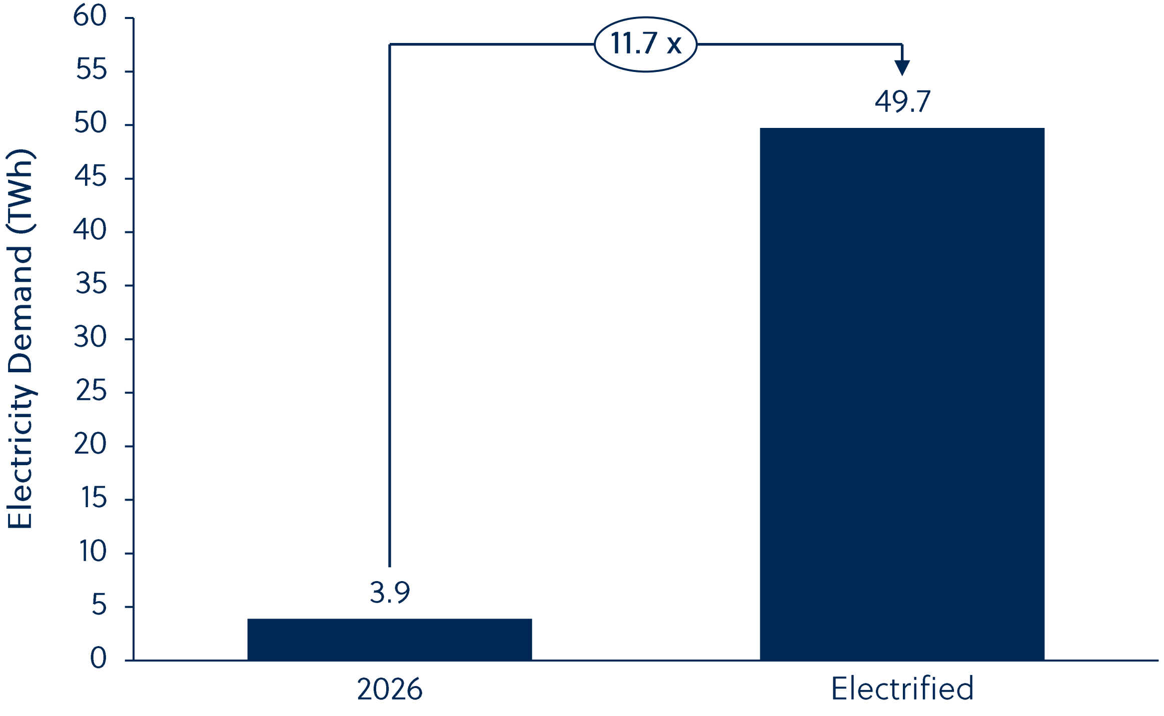


Electrification of alumina refineries will add significantly to demand while adding flexibility to Australia's electricity system

Decarbonisation of alumina refineries could make alumina production a major baseload electricity user. The Bayer process, which currently relies on coal or gas for steam generation and calcination, can be redesigned for electrification of heating; both of which need low-cost electricity. This transition would eliminate a major source of industrial emissions, while it could add significant new demand response capability. Electrification of digestion (possible in the 2030s) and calcination (likely in the 2040s) can be designed with flexible load characteristics, enabling refineries to shift consumption to periods of high renewable generation and low prices.

Electrification investment at this scale requires confidence that Australia is prepared to support industry through the energy transition. Capital expenditure on electrified alumina infrastructure runs to hundreds of millions of dollars per facility, with asset lives of 20 years or more. Investors committing to those decisions need visibility not just to electricity prices, but to the consistency of Australia's approach: that long-term access arrangements will be available, that demand flexibility will be recognised and rewarded, and that the policy settings underpinning their investment will not shift arbitrarily mid-asset-life. A consistent and demonstrated approach to industrial policy through the energy transition is what holds future investment in Australia.

Figure 2.4: Alumina electricity demand over time across Australia[1]



Source: 1. Refer to Appendix for methodology.

Benefits are hyper-localised in regional manufacturing precincts across Australia

Smelters and refineries are hyper-concentrated in regional communities where they function as the dominant employer, the anchor of local supply chains, and the principal driver of economic activity. Boyne Island, Tomago, Bell Bay, and Portland are communities built around their respective smelters. The employment multiplier is high: each direct smelter job supports multiple indirect and induced roles across logistics, professional services, and retail. Rio Tinto's Gladstone operations alone directly employ more than 4,500 people across smelting and refining, with thousands more supported through related economic activity. Given the interconnected nature of the supply chain, a decline in aluminium smelting could have spillover impacts upstream, driving a decrease in alumina refining activity.[1]

Aluminium smelters and alumina refineries have a commercial future on the other side of the energy transition, and that distinction is decisive. The energy transition buildout requires more aluminium, not less. As such, Australia's smelters and refineries are processing infrastructure with a long commercial life ahead of them. The argument for retention is not nostalgia for a passing industry; it is the case that surrendering these assets now, in the window before competitive power makes them unambiguously viable, would transfer a **future-facing sovereign capability** to other economies at the worst possible moment.

Source: 1. Centre for Future Work at the Australia Institute, Sustainable Industrial Jobs in the Hunter (2022)

Key Comparator Industrial Electricity Users

As industries electrify and new industrial loads emerge, this will create increased pressure for electrons during the transitionary period to the restoration of electricity abundance.

New electrifying and emerging large industrial loads will compete for scarce electrons as the electricity system transitions

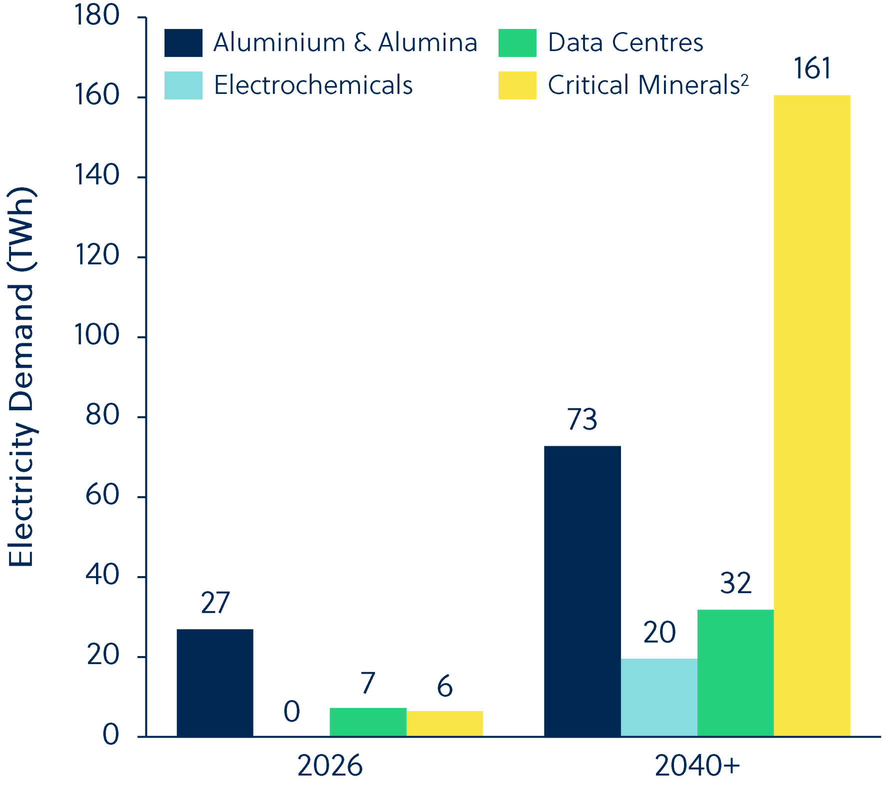
Existing and emerging large industrial users will compete for scarce electrons as the Australian grid transitions. This work compares aluminium smelters and alumina refineries to three emerging industrial comparator sectors:

- Data centres, considering hyperscale, co-locator and other archetypes.
- Electrochemicals including hydrogen, derivatives such as ammonia and metals such as steel.
- Critical minerals, including lithium, nickel, cobalt, rare earth elements, graphite, mineral sands, platinum group elements, silica and vanadium.

Each of these comparator sectors have materially different price sensitivities and socio-economic profiles. The aluminium industry, data centres, electrochemicals, and critical mineral processors are all strategically important to Australia's industrial future but are not equivalent in their relationship to the demands and benefits they provide to the grid or their socio-economic contributions. Without a framework for evaluating competing access needs on consistent criteria, decisions about who gets access to scarce electrons will default to price alone. This will systematically disadvantage industries with the greatest socio-economic value but the lowest electricity cost tolerance.

The risk of crowding out is structural, whereby price-inelastic new entrants will outbid existing price-sensitive industry for scarce electrons if no differentiated access mechanism exists. This is not a failure of market efficiency; it is market efficiency producing an outcome that is suboptimal from a national strategic perspective. A deliberate policy framework, grounded in the strategic and socio-economic value a sector brings, is a critical mechanism by which Australia can direct scarce transition-period resources to their highest national use.

Figure 3.1: Existing and potential 2040 electricity demand for key sectors[1]



Source: 1. Refer to Appendix for methodology. Analysis considers both grid and behind-the-meter electricity supply in demand projections. Estimates of system services capability reflect grid connected assets only. 2. The level of grid connection of critical minerals projects is uncertain, with future demand highly dependent upon processing capacity emerging and electrifying.

Today data centres are price-insensitive and grid-inflexible, meaning they outcompete traditional industrial users

Data centres are a critical component of Australia's digital infrastructure, but their socio-economic contribution is predominantly metropolitan-concentrated and employment-thin relative to their electricity footprint. Consuming 7.3 TWh to produce $2.1 B in direct GVA and 2,600 direct FTE, the sector's value-per-electron ratio is below the combined alumina and aluminium sector, which delivers comparable GVA from a regionally distributed employment base that anchors communities without alternatives.

Data centres impose a one-directional grid relationship: they consume at scale with a limited services contribution in return. Limited flexibility reflects uptime guarantees making curtailment commercially unacceptable. AI-driven growth amplifies the asymmetry: hyperscalers commit to contracts at price points (e.g. Microsoft's Three Mile Island at ~USD 115/MWh) that outbid every price-sensitive industrial user.[1]

Battery co-location remains nascent and uncontracted as a grid service, and future projections show limited material improvement. The policy problem is the absence of any framework that prices this asymmetry between grid-inflexible entrants and price-sensitive regional industries delivering superior community value.

Figure 3.2: Data centre sector socio-economic contribution today

ENERGY & RESOURCES	**49.7 PJ** Energy use	**7.3 TWh** Electricity use	**30.3 GL** Water use
ECONOMIC OUTPUT	**$6.4 B** Output	**$4.6 B** Trade value	**$65 M** Tax revenue
GROSS VALUE ADD	**$2.1 B** Direct GVA	**$0.5 B** Indirect GVA	**$2.3 B** Induced GVA
EMPLOYMENT	**2,600 FTE** Direct	**13,200 FTE** Indirect	**8,600 FTE** Induced
SYSTEM SERVICES[2]	**0 MW** Capability	**$0 M** Demand response value	**$0 M** System services value

Source: 1. Reuters, Microsoft to Buy Power from Restarted Three Mile Island Nuclear Plant (2024) 2. Assuming case of no grid service provision. This could shift over time with policy requirements.

Electrochemicals are embryonic today but could offer significant future grid flexibility potential

Green hydrogen, ammonia, and other electrochemical production are currently negligible but could grow significantly going forward. Production is viable only below approximately $50/MWh, placing electrochemicals in the same price-sensitivity band as aluminium.[1] Commercial scale remains policy-dependent and hydrogen and ammonia are the primary vectors for export of Australian energy into Asian markets that cannot electrify directly.

Today the grid relationship is minimal; but this reflects deployment scale, not structural incompatibility with grid flexibility. Electrolysers offer significant flexibility, allowing for ramping of production down to 15% of nameplate capacity.[1] The gap between today's negligible contribution and tomorrow's leading flexibility potential is determined entirely by deployment speed which is itself policy-dependent.

At scale, electrolysers are one of the most flexible industrial load classes, absorbing curtailed renewables and throttling during peak demand. A framework resolving access barriers for aluminium provides the direct blueprint for enabling electrochemicals: both sectors face the same market failure.

Figure 3.3: Electrochemical sector socio-economic contribution today[2]

ENERGY & RESOURCES	0.4 PJ Energy use	0.1 TWh Electricity use	0.03 GL Water use
ECONOMIC OUTPUT	$0.014 B Output	$0 B Trade value	$0 M Tax revenue
GROSS VALUE ADD	$0.004 B Direct GVA	$0.008 B Indirect GVA	$0.004 B Induced GVA
EMPLOYMENT	40 FTE Direct	30 FTE Indirect	14 FTE Induced
SYSTEM SERVICES	6 MW Capability	$1 M Demand response value	$0 M System services value

Sources: 1. IEA, Global Hydrogen Review (2024); 2. Refer to Appendix for methodology.

Critical minerals share aluminium's socio-economic value profile and price sensitivity, and face identical grid access barriers

Critical mineral processing already mirrors aluminium's defining characteristics: 6,200 direct FTE, $2.3 B direct GVA, and $10.3 B total GVA, with employment concentrated in regional communities without alternatives. The sector is fully export-oriented and competitiveness is dictated by energy cost. Critical mineral processors, like smelters, locate where long-term affordable energy contracts can be secured. Australia holds extraordinary endowments in lithium, nickel, copper, and cobalt; whether they are processed domestically turns almost entirely on the cost and availability of competitive electricity.

The sector currently provides some system services capability; however, a substantial portion of critical minerals processing is behind-the-meter. Additionally, without a differentiated access framework, price-sensitive processors face the same structural crowding-out risk as aluminium smelters.

The policy framework that retains aluminium smelting is directly replicable for critical minerals — both sectors share investment requirements, regional employment profiles, price sensitivity, and grid service potential.

Figure 3.4: Critical mineral sector socio-economic contribution today[2]

ENERGY & RESOURCES	Varies significantly by critical mineral type	**6.5 TWh** Electricity use	**25.0 GL** Water use
ECONOMIC OUTPUT	**$8.8 B** Output	**$8.8 B** Trade value	**$130 M** Tax revenue
GROSS VALUE ADD	**$2.3 B** Direct GVA	**$5.0 B** Indirect GVA	**$3.0 B** Induced GVA
EMPLOYMENT	**6,200 FTE** Direct	**15,600 FTE** Indirect	**8,600 FTE** Induced
SYSTEM SERVICES	**160 MW[1]** Capability	**$0 M** Demand response value	**$3 M** System services value

Source: 1.) This is the hypothetical capacity based upon existing electricity use 2. Refer to Appendix for methodology.

Comparing sectors today across socio-economic metrics supports evidence-based prioritisation of electron access

Aluminium and alumina together deliver the highest socio-economic return per unit of electricity of any large industrial load. This provides the quantitative foundation for a socio-economic weighting framework in energy allocation. Data centres deliver lower socio-economic value per GWh, predominantly concentrate employment in metropolitan areas, and are unconstrained by electricity price. However, these sectors access the same market on identical terms as price-sensitive regional industry with superior community value.

Differentiated access requires a transparent methodology incorporating GVA per GWh, regional employment, system flexibility value, and strategic trade significance. Applied consistently, it produces defensible access arrangements reflecting national economic priorities rather than market price signals alone.

The current comparison is only half the picture as sectors' grid profiles are not static, and the transition window will reshape who provides flexibility and at what scale. The structural argument for differentiated access does not diminish as renewable build-out proceeds - it intensifies, because more sectors compete for the same electrons. The forward view is on the following slide.

Table 3.5: Comparator sector socio-economic value metrics today[1]

Thematic	Units	Aluminium Smelters	Alumina Refineries	Electro-chemicals	Data Centres	Critical Minerals
Energy Use	PJ	86.8	178.9	0.4	26.3	Varies significantly by mineral
Electricity Use	TWh	23.0	3.9	0.1	7.3	6.5
Total Output	$/MWh-used	260	3,110	100	890	1,360
Trade	$/MWh-used	240	2,670	-	630	1,360
Tax	$/MWh-used	4.0	46.7	1.1	10.6	20.4
Direct GVA	$/MWh-used	20	240	30	290	360
Total GVA	$/MWh-used	280	3,340	120	1,080	1,600
Direct Employment	FTE/GWh-used	0.2	2.2	0.3	0.4	1.0
Total Employment	FTE/GWh-used	1.0	11.8	0.6	3.4	4.7
Regional Employment	% direct employment	80%	60%	19%	14%	64%
Demand Response Value[2]	$/MWh-used	7.40	0.7	2.7	-	-
System Services Value	$/MWh-used	0.70	0.50	0.40	-	0.50

Source: 1. Refer to Appendix for methodology. 2. Demand response and system services value is determined by estimating the frequency and duration of activation events currently provided on average across all Australian smelters, price realised during those events and compared to the counterfactual of not providing the service and the opportunity cost.

Comparing sectors in the long-run across socio-economic metrics supports the need to bridge to energy abundance

Competitively-priced electricity abundance can put all sectors on a more comparable footing; but reaching it requires navigating the transition window without losing the price-sensitive industrial base that anchors regional communities. The sectors that survive to reach energy abundance are those that policy actively supports through the transition. By supporting price-sensitive loads through the transition, the future balance between price insensitive loads and Australia's existing industrial base does not become an either/or but instead accommodates all load types.

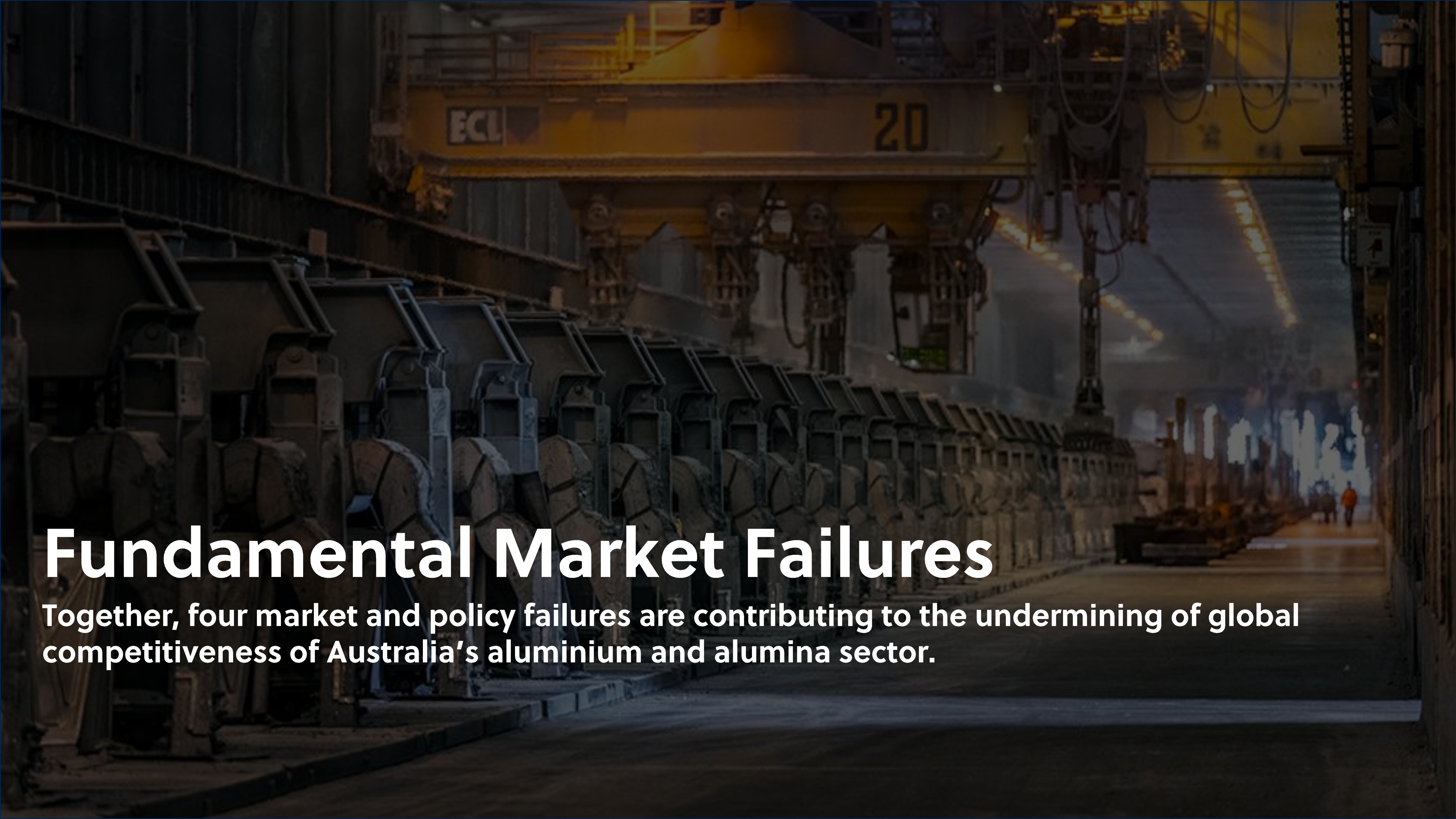
The future table reshapes the rankings: electrochemicals lead on demand response at $8.3/MWh-used; aluminium retains the highest of any existing sector at $10.4/MWh-used. Data centres remain low in this analysis; however, the opportunity could exist in the future to further expand the flexibility provided.

A framework designed with aluminium as the first use case builds the policy architecture that enables electrochemicals and critical minerals at scale. The sectors with the greatest long-run grid value face the most acute access barriers today. Resolving those barriers is a precondition for the transition, not a cost of it.

Table 3.6: Potential future comparator sector socio-economic value metrics[1]

Thematic	Units	Aluminium Smelters	Alumina Refineries	Electro-chemicals	Data Centres	Critical Minerals
Energy Use	PJ	86.8	178.9	70.2	114.5	577.8
Electricity Use	TWh	23.0	49.7	19.5	31.8	160.5
Total Output	$/MWh-used	260	230	180	890	120
Trade	$/MWh-used	240	200	120	630	120
Tax	$/MWh-used	4.0	3.4	2.5	9.3	1.8
Direct GVA	$/MWh-used	20	20	50	290	30
Total GVA	$/MWh-used	280	240	210	1,080	140
Direct Employment	FTE/GWh-used	0.2	0.2	0.5	0.4[3]	0.1
Total Employment	FTE/GWh-used	1.0	0.9	1.0	3.4	0.4
Regional Employment	% direct employment	80%	59%	19%	14%	64%
Demand Response Value	$/MWh-used	10.4	0.7	5.2	0.0[2]	3.8
System Services Value	$/MWh-used	0.7	0.6	0.8	0.0[2]	0.6

Source: 1. Refer to Appendix for methodology. 2. Increased future values for demand response arise from increasing value for the service rather than assumed increases in the provision of demand response services. 3. Newer and larger data centres are achieving lower employment direct employment. For example, the environmental impact statement from the Mamre Road Data Centre in Sydney is achieving ~0.08 FTE per GWh. This could reduce the direct employment going forward in the future, which is not included in this analysis.



Fundamental Market Failures

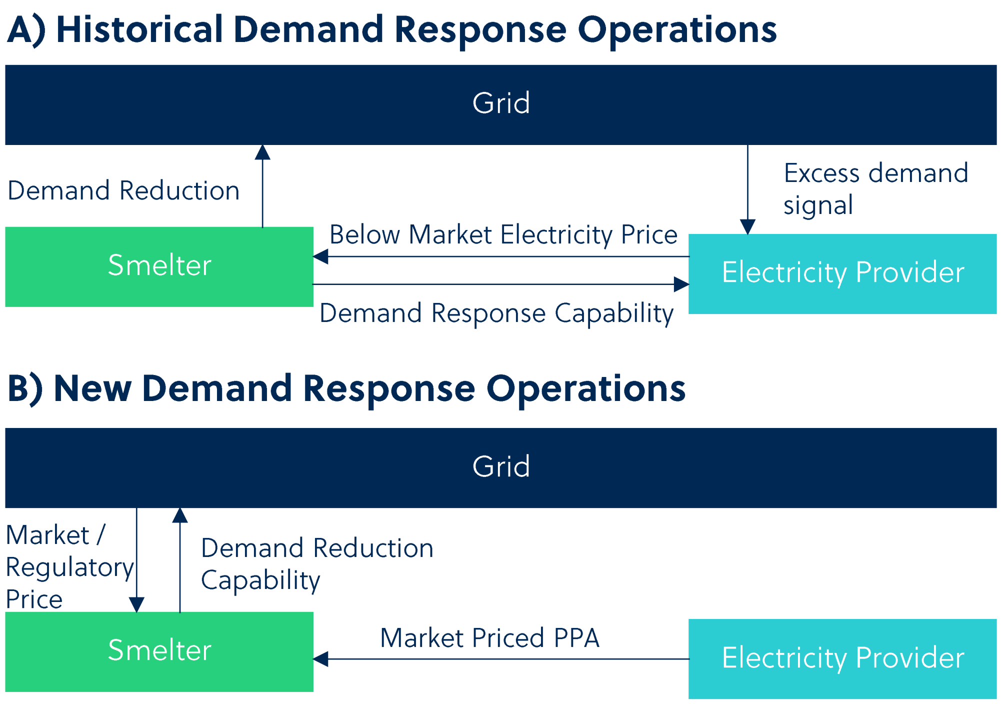
Together, four market and policy failures are contributing to the undermining of global competitiveness of Australia's aluminium and alumina sector.

Failure 1: Market design gaps mean smelter system level benefits are under-rewarded relative to the value created

Smelters provide demand response and system stability services worth significantly more than the revenue they receive for those services through current market arrangements. Aluminium smelters can provide over 1 GW of demand response and system support services, but the NEM's original market design was built primarily around generator participation. This means industrial load flexibility can be harder to value and remunerate fully. Simultaneously, the historical inclusion of demand response and system stability capability in smelter PPAs with electricity providers means the capability was not under the control of the smelters in the same way as agreements today. The end of these PPAs means that while smelters now have greater control of this capability, a market redesign is needed to efficiently compensate the smelters for this capability, aligning with the findings of the NEM Wholesale Market Setting Review.[1]

This market design failure has a direct impact on smelter financials and a clear consequence for the investment case for continued operation. As coal retires and the power system relies more on inverter-based resources, the value of fast-responding demand-side capability is rising, making better integration of industrial demand response an increasingly important regulatory issue. Electricity markets that do not adequately value and orchestrate for demand-side contributions are becoming less fit for purpose precisely as those contributions become more valuable.

Figure 4.1: The shifting role of demand response



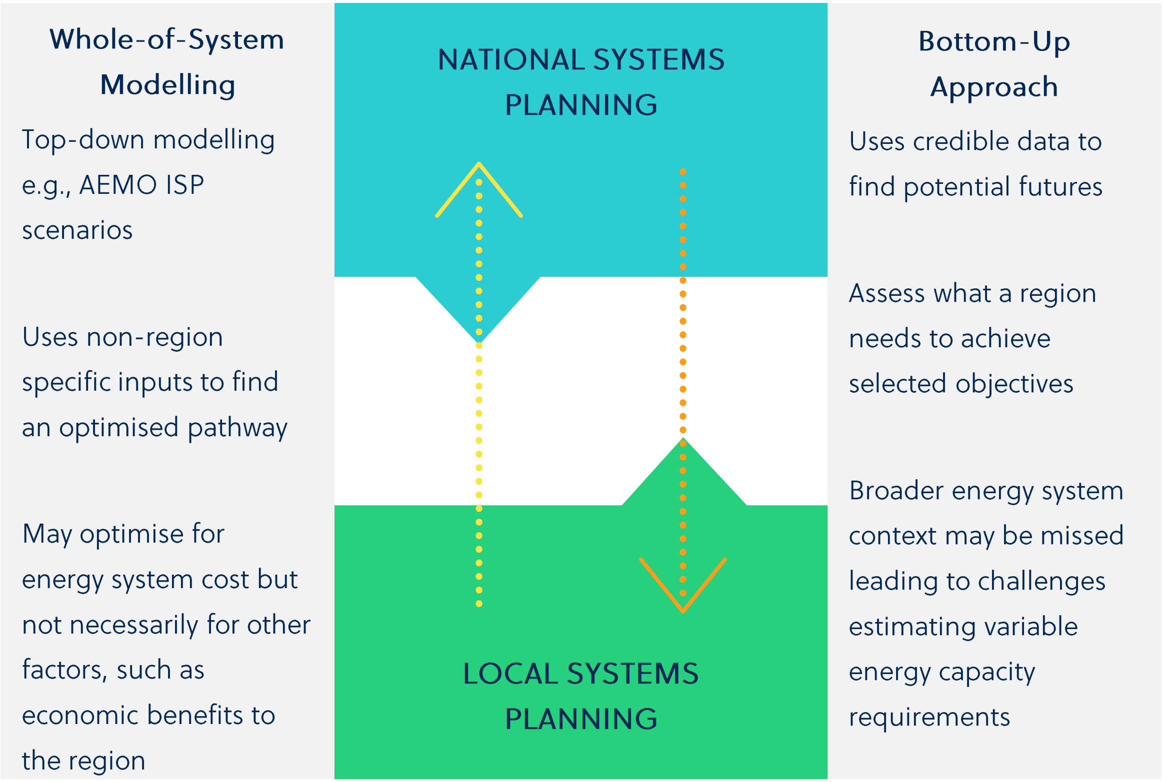
Source: 1. DCCEEW, National Electricity Market Wholesale Market Settings Review (2026)

Failure 2: System planning is failing to keep pace with rapid demand transitions and place-based industrial needs

Existing system planning is structurally a supply-side instrument: it cannot see industrial demand until that demand has already committed itself. Under AEMO's Large Industrial Load methodology, a load enters the central planning scenario only once it becomes likely it will emerge, making the planning system a follower of industrial decisions, not an enabler of them. The AEMC named this failure explicitly; its December 2024 determination requires AEMO to publish a demand-side factors statement for the first time, taking effect only in the 2026 ISP cycle.[1] Every preceding ISP was produced with this blind spot intact. As such, the ISP solves based upon a set view of demand. Furthermore, market regulators and TNSPs are designed to work with proponents of a fixed new load or generator, and they have no systems in place to work with existing alumina refineries as they seek to electrify. This is a direct contradiction of the enablement needed to unlock abundant competitive electricity supply, creating uncertainty for investors.

National planning is developed based upon an optimisation which prioritises least cost across the electricity system. The ISP cannot distinguish between an aluminium smelter closure removing twelve per cent of NSW electricity demand, with cascading consequences for network loading, inertia and reliability, and a diffuse demand reduction of equivalent size. Climateworks' 2025 ISP Methodology submission named the gap: place-based modelling is needed to give industrial actors local forecasting data and infrastructure pathways.[2] Without it, interventions are inevitable; a planning system that cannot see a crisis until it arrives will always respond rather than prevent.

Figure 4.2: Disconnect between Local & National Systems Planning[3]



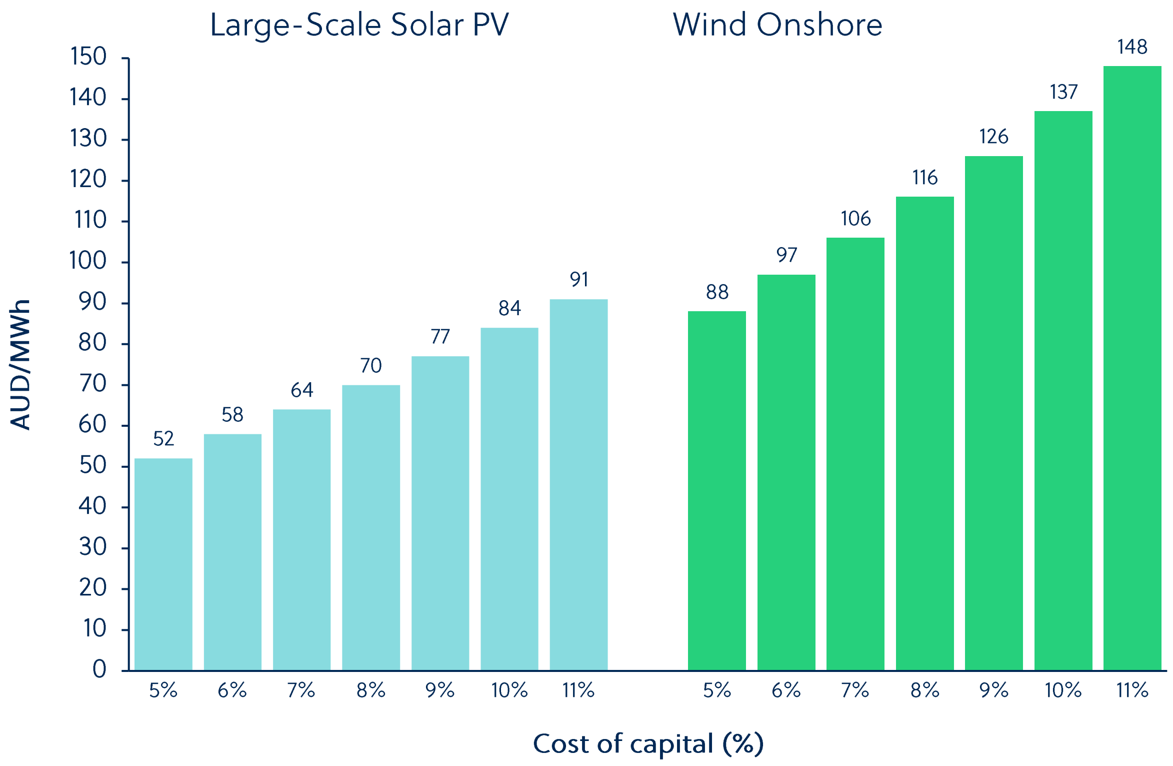
Source: 1. AEMC, National Electricity Amendment (Integrating price-responsive resources into the NEM) Rule 2024 (2024); 2. Climateworks Centre, Submission on the 2025 Draft ISP Methodology to the Australian Energy Market Operator (2025) 3. Climateworks Centre, Seizing Gladstone's Low-carbon Opportunity (2025)

Failure 3: Legacy assets face a financing gap for new PPAs, stranded between private capital risk appetite and community value

Private capital markets perceive aluminium smelters as high-risk, driven by energy cost uncertainty and the narrative of decarbonisation-driven industrial restructuring. This risk perception manifests directly in the cost of capital applied to new PPA financing. When a smelter seeks to negotiate a new long-term agreement, the commercial terms offered by generators and financiers embed a risk premium that translates into an electricity price materially above the threshold at which profitable operation can be sustained. The facility may be technically capable and economically valuable to the community, but the financing structure of the proposed energy agreement renders it commercially unviable. This is the paradox at the heart of smelter PPA negotiations: a functioning smelter facing closure not because of operational failure but because of the risks posed by the electricity market and decarbonisation obligations.

This financing gap cannot be resolved by the market alone, driving the piecemeal government risk-sharing or co-investment being seen in the market. Government co-investment reduces the risk premium embedded in private financing by providing a creditworthy counterparty or an effective price floor. As such, these subsidies are correcting a market pricing failure that would otherwise impose a far larger economic cost on regional communities through industrial closure than the co-investment itself represents.

Figure 4.3: The impact of the cost of capital on levelised cost of electricity from generators[1]



Source: 1. IEEFA analysis based on CSIRO, GenCost 2024–25 (2024)

Failure 4: Grid access is becoming increasingly challenging and could worsen with new inelastic demand sources

Transmission investment is oriented toward connecting new generation and enabling interstate trade, not toward enabling large industrial loads to access electricity supply. The network access terms, augmentation cost allocation rules, and connection frameworks available to industrial consumers were designed for passive, price-taking load and not for gigawatt-scale electrification customers seeking firm access to electricity supply. Industrial decarbonisation requires network infrastructure decisions that current transmission frameworks have no mechanism to prioritise or fund.

Aluminium smelters are exposed to network charges that are both volatile and growing, undermining the long-term cost certainty that energy-intensive smelting operations depend on. Transmission cost uncertainty is particularly acute for smelters because electricity represents the single largest input cost, meaning that unexpected network charge increases flow directly and materially to the bottom line. Unlike smaller demand sources that may absorb transmission cost variability as a marginal concern, smelters must plan capital-intensive operations over decade-long horizons, making unpredictable and rising transmission costs a structural competitiveness risk rather than simply an operational irritant.

The arrival of large data centre demand is an excellent opportunity for Australia but is compounding this failure and shifting network augmentation costs onto existing users. Unlike industrial loads, data centres run near-continuously, add inelastic baseload demand that drives peak network investment, and, until recently, faced no obligation to fund the network augmentation their growth requires. The Australian Government's March 2026 Expectations of Data Centres and AI Infrastructure Developers named this challenge directly,[1] requiring operators to cover their share of transmission and distribution costs so those costs are not passed to consumers or businesses. That these expectations remain non-binding signals that the regulatory framework has not yet caught up with the infrastructure problem it is trying to solve.

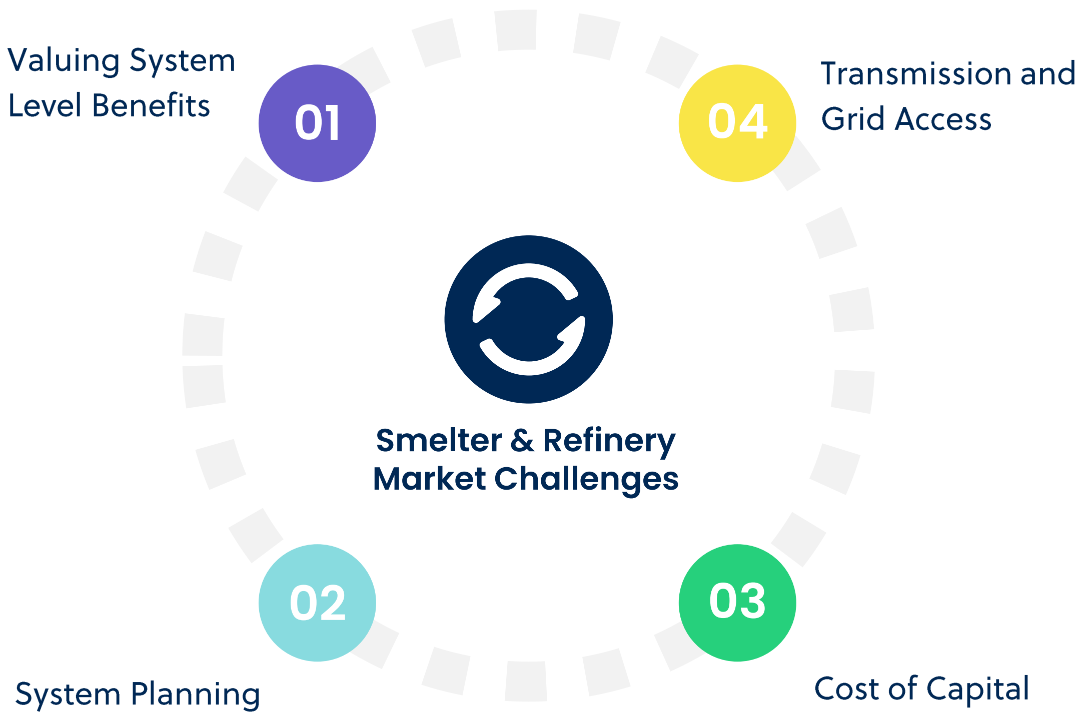
Source: 1. DISR, Expectations of Data Centres and AI Infrastructure Developers (2026)

Taken together, all four failures compound to prevent investment, stifle returns, and slow decarbonisation

Together these market failures create a mutually reinforcing cycle that makes it structurally challenging for smelters to secure competitive, long-term electricity supply through the market alone. Under rewarded system services worsen smelters' financial position, reducing their creditworthiness as PPA counterparties. Inadequate demand-side planning visibility reduces investor confidence in long-term industrial demand, increasing the risk premium embedded in new energy contracts. The resulting elevated electricity costs, combined with private capital's risk premium, produce PPA prices that are commercially unacceptable. Transmission access barriers and higher network costs, create further uncertainty for smelters and refineries. No single failure creates this outcome; all four necessary contributors.

Effective reform requires a coordinated package that resolves all four market failures simultaneously. Facility-level interventions, such as the Boyne package and the proposed Tomago arrangement, are necessary but insufficient. They address the financing failure for a specific asset in a specific moment but leave the underlying planning, market design, and transmission failures intact. Without systematic reform, the next facility-level crisis arrives on the same schedule as the next PPA expiry and reactive intervention becomes a permanent feature of Australian industrial policy rather than a temporary emergency response.

Figure 4.4: Together, four market failures are amplified to create challenges for smelters and refineries



Recommendations for Reform

In navigating the window to energy abundance, policy makers need a new way of thinking about capturing value for demand response, system planning, financial support and grid access.

Four reforms emerge across valuing demand response, system planning, cost of capital and grid access

The four market failures identified in this analysis have four corresponding reform responses; each targeting a specific failure mode, collectively constituting a coherent policy package.

- **Reform 1** addresses the failure to value system level benefits by reforming market mechanisms to recognise and remunerate full system value.
- **Reform 2** addresses the system planning failure by embedding demand visibility, socio-economic value, and place-based delivery into grid access and energy allocation decisions to better inform transmission and supporting infrastructure planning decisions.
- **Reform 3** addresses the cost of capital failure by establishing a concessional debt facility to support electricity project developers supplying to strategically significant industry.
- **Reform 4** addresses the transmission and grid access failure by requiring new large price-insensitive loads to invest in supply and implementing tariff structures for strategic, price sensitive loads.

These reforms are designed to be implemented as a package: each addresses a distinct failure, and together they close the feedback loops that have made facility-level crises inevitable. These are not industry-specific subsidies but are instead corrections to market design failures affecting all large industrial electricity users. Left unaddressed, these failures will continue to produce outcomes that are suboptimal from a national economic perspective. Aluminium is the immediate and most urgent application; the policy architecture is applicable across the full range of energy-intensive industries Australia needs to retain and grow.

Table 5.1: Key market failures and the associated policy reforms

Market Failure	Reform
Valuing System Level Benefits	Reform market mechanisms to recognise and remunerate the full system value of industrial system level benefits
System Planning	Shift the systems planning paradigm better value the demand-side and incorporate socio-economic value and place-based delivery into transmission planning
Cost of Capital	Establish a concessional debt facility to bridge strategically significant industry through the energy transition by supporting generators supplying to strategically significant regional industry
Transmission & Grid Access	Require new large price-insensitive loads to invest in supply and implement tariff structures for strategic, price sensitive loads

Reform 1: Reform market mechanisms to recognise and remunerate the full system value of industrial system benefits

The NEM's ancillary services markets were designed around generation-side response characteristics. Industrial load flexibility is still under-recognised and under-remunerated even when it delivers equivalent system value. The issue is not whether the value exists, but whether current products, baselines, and settlement rules can adequately reward the value provided.

The fix requires product redefinition, not new infrastructure. Other markets, such as the UK's Flexibility Innovation Programme,[1] have long provided structured, market-based payments to retail and industrial consumers for load flexibility, demonstrating the approach is technically sound and commercially durable at scale.

The NEM wholesale market settings review is the live vehicle for this reform in Australia. It should explicitly mandate expanded industrial demand response remuneration, with implementation timelines which consider smelter PPA expiry cycles, where the viability case is most acute. This reform requires no government expenditure. It redistributes existing market value more accurately to the assets that create it.

Source: 1. UK Government, Flexibility Innovation Programme (2023)

Table 5.2: Example areas for policy reform to support valuation of system level benefits

	Example reforms
1	Redefine FCAS and related flexibility products so industrial load can be valued on the same technical basis as generation where it delivers equivalent service
2	Expand participation pathways for industrial sites and aggregators, including simpler registration and aggregation rules
3	Improve baselines and measurement so performance is verifiable and settlement reflects actual contribution
4	Allow industrial flexibility to participate across wholesale, ancillary, and balancing-style products where technically appropriate
5	Use the NEM wholesale market settings review as the rule-change pathway, but make the implementation explicit and time-bound

Reform 2: Shift the systems planning paradigm by embedding demand value, socio-economic value, and place-based delivery

The ISP can be reformed from a supply-side optimisation tool into a demand activation instrument. In doing so, it could see industrial loads before they commit capital, value their regional economic function, and better plan infrastructure around the places where that value is concentrated. The AEMC's December 2024 rule change requires AEMO to publish a demand-side factors statement for the first time,[1] but the ISP's Large Industrial Load methodology still requires a load commitment before a load enters the central scenario.[2] However, infrastructure certainty is precisely what demand needs before it can commit. Greater government risk sharing could resolve this market dynamic.[3] Resolving it requires embedding socio-economic, strategic value and emission reduction weighting criteria directly into optimisation frameworks, applied consistently across all competing large electricity user categories. The current structure means government is placed in the position of picking winners which has high political risk. This method could reduce that risk.

Place-based industrial energy precincts are the delivery mechanism. Designating existing smelter and refinery sites as formal energy precincts enables co-ordinated investment in shared connection assets, grid-forming inverters, and storage at a scale that reduces per-facility costs and makes large-scale generation investment bankable. State and federal governments should co-ordinate precinct designation (including existing renewable energy zones where applicable) with AEMO and network operators to deliver the long-term regulatory certainty that makes industrial investment decisions viable.

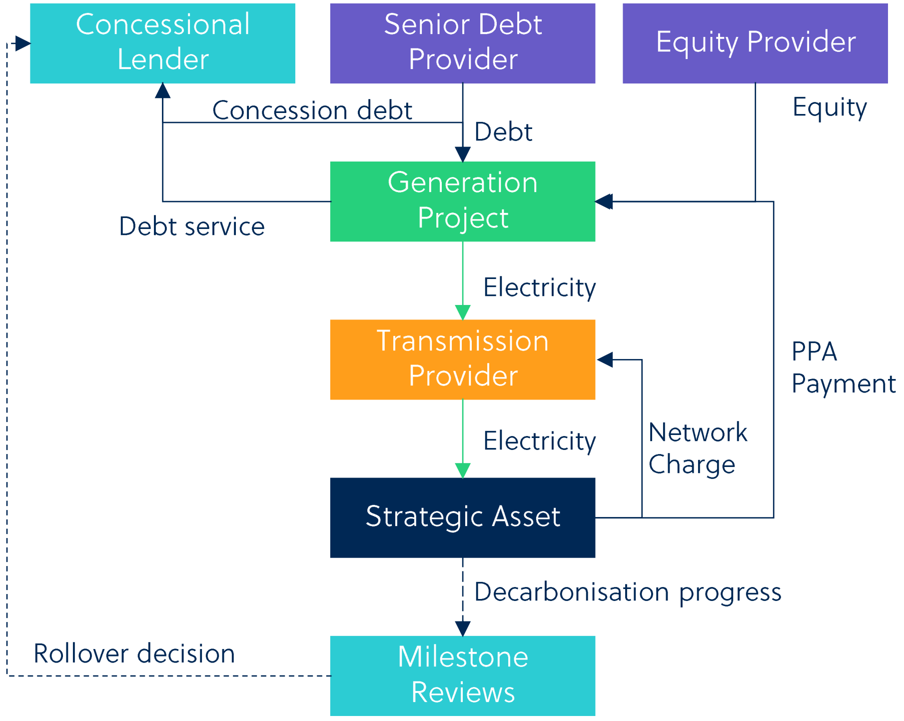
Sources: 1. AEMC, National Electricity Amendment (Integrating price-responsive resources into the NEM) Rule 2024 (2024); 2. AEMO, Forecasting Approach – Electricity Demand Forecasting Methodology (2025) 3. See Appendix: the valuation methodology on page 51 illustrates why demand response value cannot be captured when the load does not yet formally exist in the planning system — making the chicken-and-egg self-reinforcing.

Reform 3: Establish a concessional debt facility to bridge strategically significant industry through decarbonisation

The announcement of support for Boyne and ongoing negotiations with Tomago establish a precedent but not a framework for intervention. The agreement and negotiations respectively are bilateral. The result is an industry policy conducted through ad hoc rescue packages, where the decision to support or not support a facility is driven by the proximity of closure rather than by clear and consistent assessment of strategic value. This creates challenges for generation project developers who face commercial uncertainty, with investment decisions dependent on knowing whether the anchor demand will survive long enough to make a long-term PPA financeable.

A standing concessional debt facility, extending the Clean Energy Finance Corporation's or Net Zero Funds existing mandates explicitly to industrial transition risk, could replace reactive interventions with a structured, criteria-based instrument. Eligibility for generators would require supply to industrial facilities with demonstrated strategic regional economic significance, binding energy price sensitivity, and decarbonisation milestones as drawdown conditions. The instrument is explicitly transitional: debt terms timed to PPA renewal cycles of ten to fifteen years, with mandatory milestone reviews. This structure de-risks the investment decision for both the industrial operator and the project developer simultaneously, providing the demand-side certainty that makes large-scale PPAs financeable without requiring government to own the generation asset or underwrite the price indefinitely. The goal is to make concessional debt an effective bridge that is time-limited, transparent, and tied to a credible exit.

Figure 5.3: Example of the special investment vehicle deal structure which could underpin smelter support



Source: 1. Rio Tinto, Rio Tinto Signs Australia's Largest Industrial Renewable Power Agreements (2023)

Reform 4: Require new large inelastic loads to co-invest in supply, and implement tariff structures for strategic, price sensitive loads

New large inelastic electricity users benefit from generation adequacy and system security maintained by existing users without contributing proportionately to the investment required to sustain it. The free-rider problem is structural. Data centres requiring near-100% availability impose non-trivial firming and system security costs on all other users; their inelastic baseload demand drives peak network investment; and until the Australian Government's March 2026 Expectations, no obligation existed to fund the network augmentation their growth requires. Those Expectations, requiring operators to cover their share of transmission and distribution costs and secure new competitive energy to offset demand, are the right signal but are non-binding. This reform proposes to make co-investment in new generation and firming capacity a binding condition of connection approval, calibrated by sector. This way, Australia can realise the data centre opportunity while maintaining our existing industrial base.

Greater certainty and reductions on network charges are a necessary condition for smelters to maintain international competitiveness. The existing system, whereby charges are redetermined regularly, and a large burden is placed upon aluminium smelters is not sustainable and creating significant challenges for smelters. Governments can establish clear network charge agreements with smelters over longer durations which provide competitive fees.

Transmission infrastructure decision frameworks, particularly in WA, must better consider demand-side augmentation benefits, giving industrial electrification the same planning visibility that generation currently receives. Current frameworks have no mechanism to fund network investment ahead of committed industrial load. The result is that transmission follows industry decisions rather than enabling them. WA's SWIS Transmission Plan was reactive: its first 1,500 MW for industrial precincts in Phase One followed industry surveys rather than anticipated electrification demand.[1] The SWIS Demand Assessment 2023 to 2042 shows the need for anticipatory industrial demand scenarios to drive transmission investment planning from the outset.[2]

Figure 5.4: Expectations of data centres and AI infrastructure developers

Source: 1. Government of Western Australia, The South West Interconnected System Transmission Plan: A Future-Ready Transmission Network for WA's Main Electricity System (2026) 2. Government of Western Australia, SWIS Demand Assessment 2023 to 2042 (2023)

Together, four reforms addressing these market failures can serve as a time-limited bridge to energy abundance

These reforms address a market failure that is structural but time-limited: the transition window during which cost-competitive electricity is scarce without coordinated management. This distinction is essential to the political economy of the reforms. These are not permanent industrial subsidies; they are time-bounded policy interventions calibrated to the specific conditions of the energy transition. Each reform should include a built-in review trigger linked to observable market conditions: renewable energy penetration reaching a specified threshold, or wholesale spot prices sustained below a target level for a defined period. When those conditions are met, the intervention scales back automatically; providing certainty to industry during the transition while establishing a clear exit pathway that prevents permanent regulatory entrenchment.

The long-term objective is a competitive energy market in which low-cost electricity is abundant enough that all consumers can access affordable power without special frameworks. Getting there requires bridging the transition window without sacrificing the industrial base that makes the destination economically worthwhile.

Figure 5.5: The key periods of the energy transition to unlock a Future Made in Australia

Critical Window

2025 – 2035

Market failure is acute

- Coal retirements accelerate; grid capacity scarce
- Data centre demand surges
- Industrial loads at risk of displacement or delayed electrification
- Demand response value rises as reliability gap widens

Intervene: access frameworks, system level benefit reform, co-investment rules, precinct planning

Managed Transition

2035+

Constraints ease as investment lands

- ISP transmission build-out matures
- Renewable generation exceeds coal replacement
- Renewable replacements grow
- Firming capacity (batteries, pumped hydro) scales
- Industrial electrification pathways become viable

Wind down: review access frameworks, relax load-class distinctions as supply grows

Energy Abundance

2040+

Efficiency-based market mechanisms restored

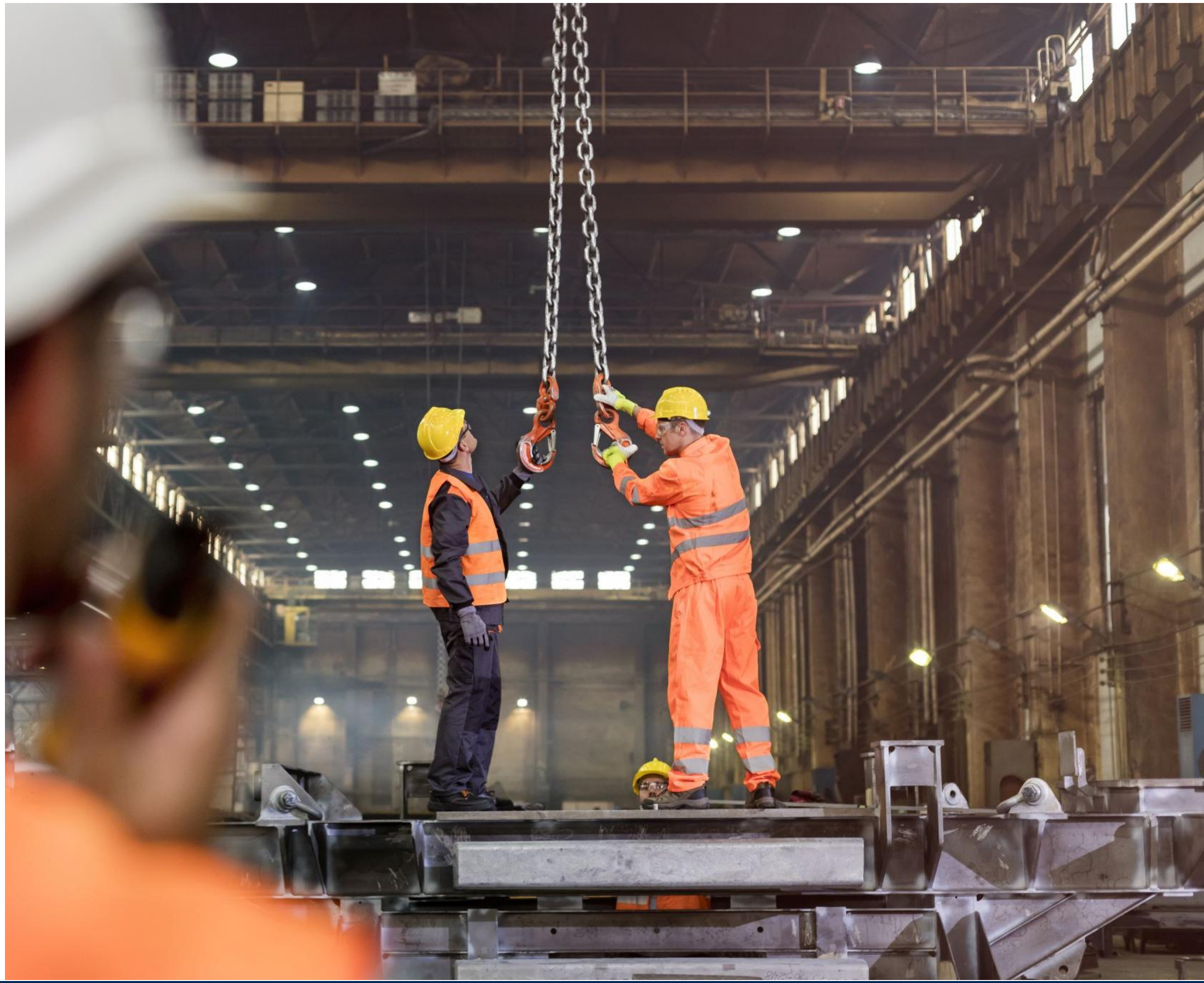
- Energy is abundant and low-cost
- Grid capacity sufficient for all load types
- Industrial competitiveness secured through competitively-priced and reliable electricity

Sunset: interventions no longer needed — market competition allocates efficiently

These reforms can anchor a broader, coherent Government approach to industrial policy for a competitive, sovereign economy

The four reforms sit within a larger policy opportunity: Australia lacks a coherent industrial policy framework that aligns energy market design, trade strategy, decarbonisation pathways, and regional economic development. Getting the policy settings right for aluminium creates an immediately replicable architecture for the full range of energy-intensive industries Australia needs to retain and grow. These sectors face near-identical market design failures, require similar infrastructure solutions, and share the same fundamental dependence on competitively priced, long-term electricity supply. A policy framework designed with aluminium as the primary use case has multiplier value well beyond the sector itself: it is the foundational layer of an Australian industrial policy for a competitive, sovereign economy.

Access to competitively priced energy must be treated as a strategic national resource, not merely a commodity allocated by price signals, as Australia navigates the transition. The energy transition is the most significant structural transformation of Australia's industrial economy in a generation. The decisions made in the next five years about which industries access affordable electricity will determine the shape of Australia's economy for the following fifty. This report's four reforms are the entry point; a practical, implementable first step toward an industrial policy that is coherent, evidence-based, and fit for the competitive, sovereign economy Australia is building.



Appendix

The comparator assessment applies a four-step method to quantify the socio-economic contribution of large electricity users

A structured four-stage methodology was applied consistently across all comparator sectors

1 Define Comparator Universe

- Five categories: electrochemical projects, critical minerals, data centres, aluminium smelters and alumina refineries
- Identified project developed from industry databases, government registries, and investment announcements
- Focus: facilities operating, under construction, or with committed investment as at early 2026

2 Estimate Electricity Demand and Economic Scale

- Demand from: nameplate capacity (MW), production volumes, or floor area (data centres)
- Economic output from ABS input-output tables and production price benchmarks

3 Apply I-O Analysis for Indirect Economic Impacts

- ABS Supply and Use Tables (2023-24) used as foundation
- Synthetic I-O columns constructed for sectors without standard ANZSIC codes
- Employment and GVA multipliers at Types 1A, 1B, 2A, 2B derived for each comparator

4 Estimate Demand Response and System Services Value

- DR capability assessed from reported load-shedding capacity at each smelter
- System services estimated using AEMO avoided network cost and frequency regulation methodologies

Electrochemical projects: 32 hydrogen production, DRI, and derivative facilities were assessed across Australia

32 facilities across 4 sub-categories: hydrogen production, DRI, derivatives, and blending

14 facilities

H2 Production — Operating

- ATCO Hydrogen Blending Project (WA)
- Clean Energy Innovation Hub (WA)
- Denham Hydrogen Demonstration Plant (WA)
- Geelong New Energies Service Station (VIC)
- Hydrogen Park Gladstone / HyP SA (SA)
- H2 Production & Research Facility (TAS)
- Hydrogen Refueller Station Project (WA)
- Christmas Creek Renewable H2 Mobility (WA)
- Green H2 & BESS System (SA)
- Hazer Commercial Demonstration Plant (WA)
- Hyundai Integrated H2 Production (NSW)
- Port Kembla H2 Refuelling Facility (NSW)
- Renewable H2 Production & Refuelling (QLD)

7 facilities

H2 Production — Construction / Planned

- ENEOS MCH Hydrogen Demo Plant (QLD)
- Energys Renewable H2 Facility (VIC)
- Good Earth Green H2 & Ammonia (NSW)
- Goondiwindi Hydrogen (QLD)
- Hydrogen Murray Valley / HyP Murray Valley (VIC)
- Hydrogen Refueller @ H2Perth (WA)
- Kogan Creek Renewable H2 Demo Plant (QLD)

3 facility

Green Iron / Direct Reduced Iron (DRI)

- Christmas Creek Green Iron Trial (WA)
- Mid-West Green Iron Project (WA)
- Whyalla Green Steel (SA)

8 facilities

H2 Derivatives — Ammonia, MCH & Blending

- Good Earth Green H2 & Ammonia Project (NSW)
- ENEOS MCH Demonstration (QLD)
- HyP Murray Valley blending (VIC)
- Goondiwindi Hydrogen Stage 2 (QLD)
- ATCO Hydrogen Blending Project (WA)
- HyP SA blending into Adelaide gas network
- Murchinson Hydrogen Renewables Pty Ltd (WA)
- Hunter Valley Hydrogen Hub (NSW)

Beyond 2030, new grid connected production is assumed to align with the 2026 AEMO ISP Step Change scenario.

Critical minerals: 28 refining and processing facilities were assessed spanning lithium, nickel, rare earths, graphite, and titanium

28 facilities across 5 mineral categories — lithium, nickel/cobalt, rare earths, graphite, and titanium

Lithium hydroxide (3 facilities)

- Tianqi Lithium — Kwinana Lithium Hydroxide Refinery Train 1 (WA)
- Albemarle — Kemerton Lithium Hydroxide Plant (WA)
- Covalent Lithium — Kwinana Lithium Hydroxide Refinery (WA)

Nickel / cobalt (7 facilities)

- BHP Nickel West — Kwinana Nickel Refinery & Nickel Sulphate Plant (WA)
- Glencore — Murrin Murrin Nickel Cobalt Operation (WA)
- First Quantum — Ravensthorpe Nickel Operation (WA)
- Broken Hill Cobalt Project (NSW)
- Kalgoorlie Nickel Project (WA)
- NiWest Nickel Cobalt Project (WA)
- Sunrise Battery Materials Complex (NSW)

Graphite (4 facilities)

- International Graphite — Collie Micronising & R&D Facility (WA)
- International Graphite — Collie Commercial Stage 1 (WA)
- Siviour Battery Anode Materials Project (SA) Sunlands Eyre Peninsula Graphite Hub (SA)

Rare earth elements (5 facilities)

- Lynas — Mt Weld Concentration Plant (WA)
- Lynas — Kalgoorlie Rare Earths Processing Facility (WA)
- Iluka Resources — Eneabba Rare Earths Refinery (WA)
- Donald Rare Earth and Minerals Project (VIC)
- Gonneville Critical Minerals Project (WA)

Titanium dioxide / PGEs and other minerals (10 facilities)

- Tronox — Kwinana Pigment Plant (WA)
- Tronox — Chandala Processing Site (WA)
- Iluka — Narngulu Mineral Separation Plant & Capel SR Kilns (WA)
- Donald Rare Earth and Minerals Project (VIC)
- Fingerboards Project (VIC)
- Goschen Rare Earth Mineral Sands Project (VIC)
- Luni Niobium (WA)
- Speewah Fluorospar/Vanadium (WA)
- Northern Silica (QLD)
- Wingellina Ni/Co (WA)

The short-list has been developed based upon existing facilities and facilities with major project status.

Data centres: 110+ facilities from 12 operators assessed, covering hyperscale, co-location, and smaller facilities

110+ facilities across 12 operators — classified by scale from hyperscale to smaller regional facilities

>100 MW	**Hyperscale** Large-scale cloud and AI infrastructure. e.g. AirTrunk, AWS, Google Cloud, Microsoft Azure, CDC, Digital Realty
26–100 MW	**Co-location** Multi-tenant enterprise and carrier-neutral data centres. e.g. NEXTDC, Equinix, Digital Realty
0–25 MW	**Smaller / Regional** Enterprise edge and regional facilities. e.g. Fujitsu, Telstra InfraCo, Vocus, DXC Technology

Revenue & scope

- Revenue treated as 100% domestic
- Colocation & interconnection revenues included; cloud hyperscaler activity modelled via revenue share
- 10% rest-of-market allowance applied by state for smaller unlisted operators

Assessed operators	
NEXTDC	27 facilities
AirTrunk	5 facilities
CDC Data Centres	8 facilities
Digital Realty	8 facilities
Microsoft Azure	7 facilities
Amazon Web Services	9 facilities
Google Cloud	7 facilities
Equinix	17 facilities
Telstra InfraCo	7 facilities
Vocus	6 facilities
Fujitsu	4 facilities
DXC Technology	1 facility

Input-output analysis was used to estimate direct, indirect, and induced economic impacts across all comparator sectors

Input-output analysis quantifies indirect and induced economic effects using ABS Supply and Use Tables 2023-24

Analytical framework

- I-O analysis uses the ABS Supply and Use Tables to trace how an industry's expenditures ripple through the broader economy, generating indirect employment and output in upstream supplier industries.
- The method is industry-standard for economic impact assessment and is used by federal and state governments in Australia for infrastructure and industry policy analysis.
- Four multiplier types are derived, representing progressively broader measures of economy-wide effects. Types 1A/1B use the open I-O model; Types 2A/2B close the household sector to capture consumption-induced effects.
- A consistent approach has been applied across all comparator sectors to enable effective comparison.

Type 1A	**Direct + Indirect** Direct workforce plus indirect supply-chain employment from the facility's purchases.
Type 1B	**Direct + Indirect + Production-induced** Extends 1A to add production-induced effects — employment in supplier industries responding to the facility's demand chain.
Type 2A	**1A + Consumption-induced** Closes the household sector to capture employment generated by workers spending their wages.
Type 2B	**1B + Consumption-induced** Broadest measure: combines all supply-chain effects (1B) with consumption-induced employment. Highest absolute multiplier; used for total economic impact statements.

Synthetic I-O columns were constructed for sectors not directly represented in the ABS national accounts

Synthetic I-O columns constructed for three emerging sectors without standard ABS industry classifications

Why synthetic I-O columns are required

- Electrochemical, data centre, and critical minerals sectors have no dedicated ABS I-O columns. Instead, adapted forms of the nearest ANZSIC code have been built from facility-level cost data, published financials, and feasibility studies to produce sector-specific technical coefficients that reflect where these industries source their inputs.

Electrochemical projects

Hydrogen, DRI, derivatives

Built from facility-level cost studies and published H_2 LCA benchmarks

- Electricity: 55-80% of operating cost
- Capital equipment: predominantly imported electrolysers and DRI plant
- Civil construction, O&M services: domestic content
- Low labour intensity per MW relative to traditional industries

Data centres

Co-location, hyperscale, smaller/regional

Built from financials and operator benchmarks

- Electricity: 35-50% of operating cost (PUE ~1.4)
- ICT hardware: predominantly imported servers, networking, cooling
- Domestic content: construction, security, facilities management
- Very high output-per-direct-worker drives high multipliers

Critical minerals refining

Lithium, Ni/Co, REE, graphite, TiO2

Built from feasibility studies and EIS documents

- Electricity: 10-45% of opex by mineral and processing route
- Reagents and consumables: mix of domestic and imported
- Significant direct workforce relative to electrochemicals/data centres
- Strong regional supply chain linkages to existing mining industries

Employment multipliers measure how total jobs supported across the economy compare to direct employment at a facility

1 How employment multipliers are interpreted

- A multiplier of 3.0x means every direct job at the facility supports two additional jobs elsewhere in the economy, through supply chain purchases and worker spending. A 1.0x multiplier means no ripple effects beyond direct employment.
- Type 1A/1B multipliers use the open I-O model and measure supply-chain (indirect) effects only. Type 2A/2B close the household sector to add consumption-induced effects. These are more appropriate for economy-wide assessment but less suitable for project-specific CBA.

2 Why data centres carry the highest multipliers

- Data centres are capital and electricity-intensive relative to their direct workforce — expenditure is concentrated in ICT equipment, construction, security, and facilities management, all of which support diverse indirect employment across the economy.
- High output-per-worker ratios mean a small direct workforce generates large indirect employment when multiplied through the supply chain. This differs from labour-intensive sectors where direct jobs already represent a larger share of total activity.

3 Why aluminium and critical minerals multipliers are comparable

- Both sectors share a similar cost structure: high electricity and raw material inputs, significant direct employment, and strong regional supply chain linkages. Their 1A multipliers (~1.9-2.0x) reflect mature, embedded supply chains with high direct employment relative to output.
- Electrochemicals carry lower 1A multipliers (~1.25x) reflecting early-stage, small-scale facilities with immature domestic supply chains and imported capital equipment. These are expected to rise as the industry scales.

Sector	Type 1A	Type 1B	Type 2A	Type 2B
Electrochemical projects	1.25x	1.67x	2.03x	1.03x
Data centres	3.32x	6.12x	9.47x	8.47x
Critical minerals & Alumina Refineries	1.91x	3.53x	4.93x	3.93x
Aluminium Smelters	1.97x	3.87x	5.41x	4.41x

GVA multipliers measure how total value-add is transferred through the economy

1 Why alumina and aluminium lead on GVA

- Type 2A multipliers of 14.11x are the highest in the comparator set — every $1 of direct output generates $14.11 of total economy-wide value
- This reflects deep, integrated supply chains: bauxite mining → refining → smelting each add substantial domestic value before product leaves the gate
- Alumina and aluminium share identical multipliers in the model as they sit in the same ANZSIC 2-digit industry classification

2 Electrochemicals and critical minerals are comparable

- Type 1A multipliers are nearly identical: 1.85x (electrochemicals) vs 1.82x (critical minerals) — both sit in similar ANZSIC manufacturing classifications with comparable upstream supply chain depth
- Critical minerals carry a slightly higher Type 2A (4.45x vs 4.24x), reflecting broader domestic re-spending from a regionally distributed workforce
- Data centres (1.74x Type 1A) sit lowest on GVA — large revenues flow to imported hardware and overseas intellectual property, reducing the domestic value-added share

3 Revenue adjustment factor

- The revenue adjustment converts gross revenue to the GVA component that enters the I-O model, accounting for intermediate inputs purchased from other sectors
- A lower revenue adjustment paired with a high multiplier (aluminium) still produces large economy-wide GVA because the multiplier acts on the value-added base, not gross revenue

Sector	Type 1A	Type 1B	Type 2A	Type 2B
Electrochemicals	1.85x	3.17x	4.24x	3.24x
Data centres	1.74x	2.59x	3.69x	2.69x
Critical minerals	1.82x	3.15x	4.45x	3.45x
Alumina	4.04x	9.18x	14.11x	13.11x
Aluminium	4.04x	9.18x	14.11x	13.11x

We have used the stakeholder engagements to workshop how to value demand response

Valuing demand response: using a counterfactual framework where facility curtailment doesn't occur during a reliability event.

1 Establish Base Year Value

Value demand response using two pricing scenarios:

Price Scenario
MW × duration x frequency × NEM spot price
VCR Scenario
MW × duration x frequency × AER Value of Customer Reliability

Curtailable MW sourced from operator engagement based on current levels of demand response provision.
~3.5 curtailment hrs/year based on Gridcog empirical data.

2 Subtract Opportunity Cost

Calculate the smelter's forgone revenue during curtailment:

Production lost per MWh × Market price for product

Net DR value = Gross value – Forgone revenue

3 Scale Forward to 2050

Scale base year value forward using AEMO reliability gap trajectory:

Annual DR value = Base year × (Gap in year / Gap in base year)

As coal exits & reliability gap widens, curtailment events become more frequent

Sources: AEMO 2024 ESOO (10-yr) & ISP Step Change (to 2050)

4 Compare Across Sectors

Apply equivalent methodology to comparator sectors:

- Alumina refineries
- Data centres[1]
- Electrochemicals
- Critical minerals

Benchmark aluminium smelter DR value against peers

Source1. Increased future values for demand response arise from increasing value for the service rather than assumed increases in the provision of demand response services.

We have used the stakeholder engagements to workshop how to value system services

Valuing system services: pooled metric from facility data to protect confidentiality while enabling extrapolation

1 Establish Base Year Value

Pool dollar values from smelters and refineries into a single normalised metric:

Pooled $/MWh across all system services

Protects confidential facility-level data.

Creates a portable number for cross-sector extrapolation.

2 Project Price Growth

Index forward using LCoFCAS framework (Gilmore, Nolan & Simshauser 2024):

Regulation: ~$30/MW/hr
Reserves: ~$8–10/MW/hr

Costs decline as battery costs fall but never reach zero (opportunity cost of reserving capacity).

3 Project Quantity Growth

Use same reliability gap scaling factor as demand response workstream:

AEMO ESOO (10-yr horizon)
ISP Step Change (to 2050)

As coal exits and supply tightens, demand for system services increases proportionally.

4 Quantify Non-Captured Value

If smelter exit, system must replace its services via batteries or synchronous condensers:

- ElectraNet SA: ~$375K/MVA
- AEMO: ~$8B by 2039–40 for system strength remediation

Provides upper bound; may reduce if grid-forming inverters become viable

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