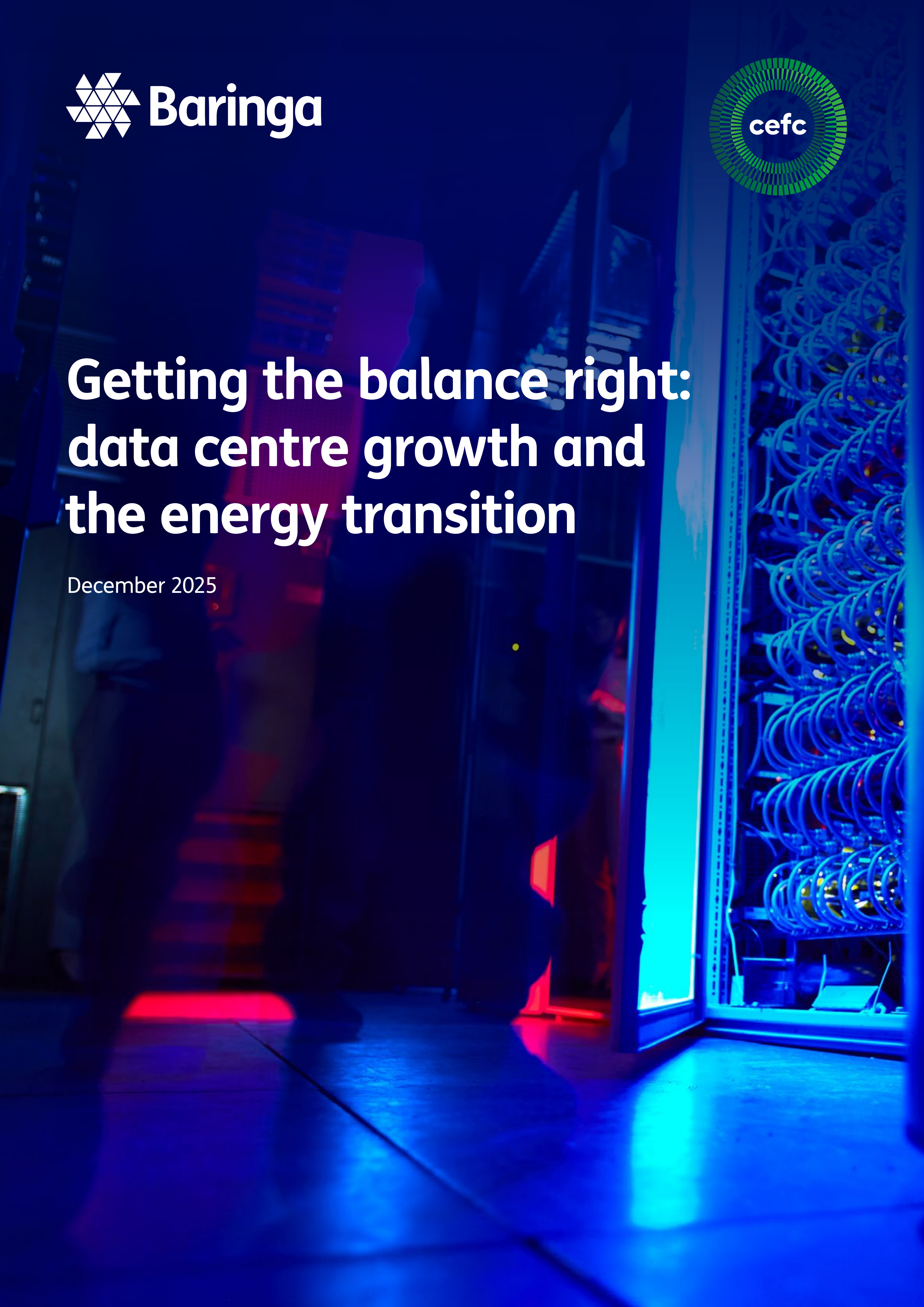
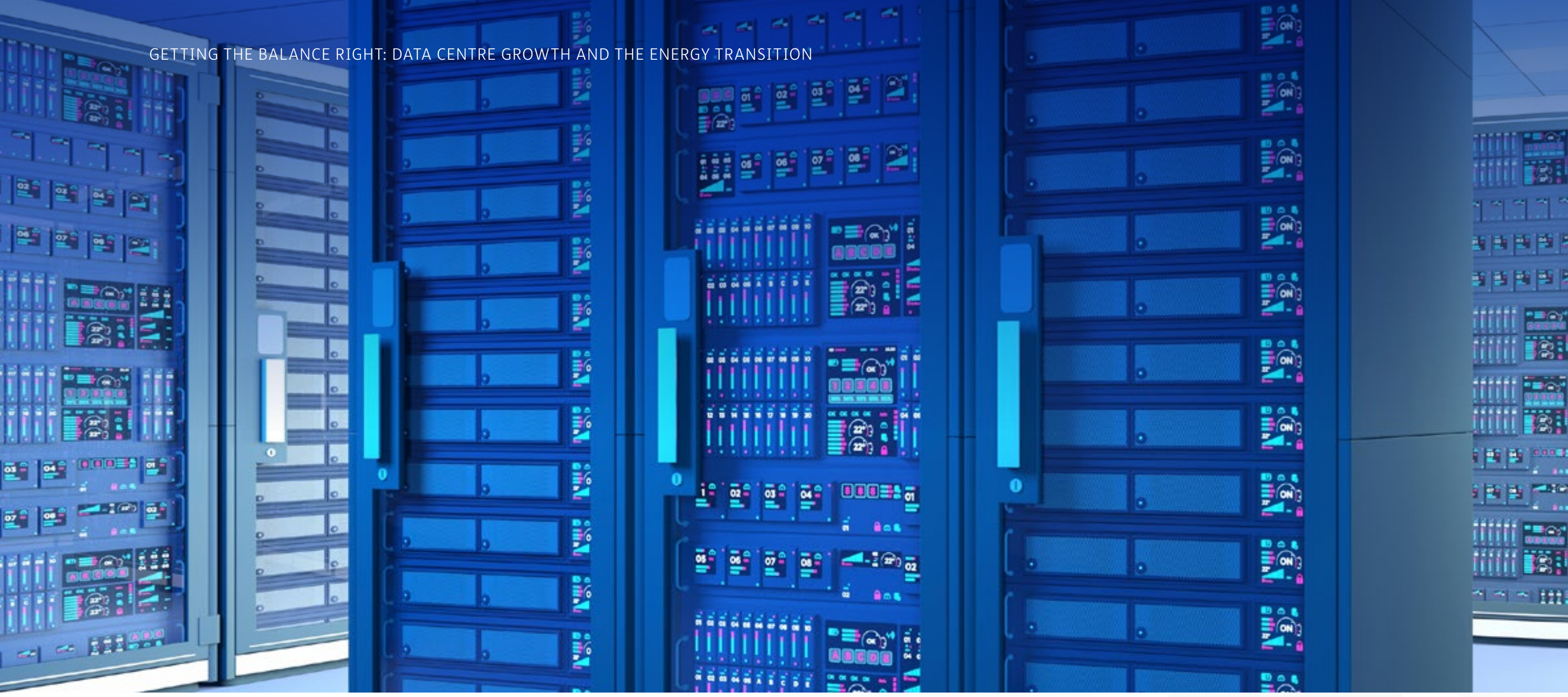


Baringa

cefc

# Getting the balance right: data centre growth and the energy transition

December 2025



# Foreword

## A message from the CEFC

### Digitalisation, AI, data centres and the energy implications

A bystander may be forgiven for feeling as if artificial intelligence—AI—simply burst into the zeitgeist as if by chance. Previously hot topics around digital transformation, cyber security and handheld devices have been eclipsed as our collective attention is captured by bold new concepts, from large language models to robotics, and machine learning.

In truth, AI has been a growing part of our digital life for some time, and it is hard to imagine a day not enabled by even the simplest digital solution.

In this increasingly digital world, data centres are emerging as a critical infrastructure asset class, essential to our use of email, virtual desktops, data storage, streaming services, e-commerce and financial markets. They are the quiet foundation that powers the AI revolution.

Australia is already a world leader when it comes to investing in data centres, second only to the US in the level of investment in 2024. As this investment increases, the approach to sustainability will move front and centre. To aid this thinking, we asked Baringa to develop this report: 'Getting the balance right: data centre growth and the energy transition.'

### A question of energy

Reflecting our role as a specialist investor in Australia's net zero future, we see increasing urgency in considering the energy implications of AI and digitalisation.

While we cannot be certain about where AI will take us, we can be certain that the energy required to power the data centres behind AI is substantial. And for an economy such as Australia's, which is already undertaking an unprecedented transformation of its energy system, it is clear we need to get granular on the energy implications of AI.

### What the future holds

This report provides a comprehensive bottom-up view of the energy demands of Australia's data centre pipeline.

- Australia's data centre operational capacity is expected to be between 2.2 GW and 3.2 GW by 2035, up from around 0.3 GW in 2024–25. This represents 8–11 per cent of Australia's projected electricity consumption in 2035, up from around one per cent today, and up to $135 billion in data centre investment.
- Most of these facilities are expected to be developed in Sydney and Melbourne, driven by the growing demand for AI, cloud computing, data storage, and digital services. Data centres are large, consistent energy consumers, with a

relatively flat load throughout the day. This 'baseload' demand profile during the day could see consumption of renewable generation that would have otherwise been curtailed.

- The International Energy Agency sees AI achieving energy savings of up to eight per cent in light industries by 2035. Emissions reductions from the broad application of existing AI-led solutions could be about five per cent of energy-related emissions in 2035.
- Data use is expected to continue to grow exponentially. In 2025, the world is expected to create or consume some 180 zettabytes of data, compared to 41 zettabytes in 2019.

## Moving fast to capture benefits

Australian Government analysis suggests AI and automation alone could generate up to $600 billion for Australia's GDP by 2030. To realise this potential, we must foster a sustainable investment climate to accelerate investment in supporting renewable energy and storage while also actively mitigating environmental and electricity system risks. This will help ensure that data centre growth does not 'crowd out' grid access for other sectors of the economy undergoing rapid electrification, such as transport.

Realising these benefits requires a coordinated approach. Policymakers have a critical role in creating the right conditions for sustainable growth. This includes guiding development into locations with sufficient network capacity or strategic importance, incentivising clean energy and storage investment, and improving transparency of expected loads to support planning and manage network costs.

Investors also have a critical role to incentivise data centres to minimise impacts and adopt green operations. Capital should be directed towards projects and companies that prioritise ESG factors. Investors in infrastructure funds, fixed income markets and institutional lenders to the sector all have a potentially important role to play in encouraging greater ambition around sustainability and energy performance.

Data centre operators must act decisively to maintain their social licence to operate, committing to clean energy procurement, investing in energy storage, and adopting innovative technologies. And they should work closely with customers to align on ESG requirements and reporting standards, while developing new business models that deliver resilience and efficiency.

We trust you find this detailed report an important guide to decision making as we capitalise on the exciting and fast-moving opportunities presented by digitalisation, AI and the enabling infrastructure of data centres.

Yours sincerely,

**Ian Learmonth**
CEO, CEFC

**Julia Hinwood**
Head of Infrastructure, CEFC

# Executive summary

Data centres are critical infrastructure underpinning Australia's digital economy, enabling everything from cloud computing and data storage to artificial intelligence (AI), government services, and financial transactions. Every time we unlock our phones, stream a video, or use GPS for directions, we access vast amounts of stored and processed data. Businesses use data to track inventory, analyse customer preferences, and optimise supply chains, while hospitals rely on patient records and AI diagnostics to improve healthcare outcomes. Even simple actions like tapping a credit card for payment or checking the weather app involve complex data processing behind the scenes. These everyday use cases drive us to use more data than ever—a trend expected to grow for the foreseeable future, placing data centres at the forefront of national productivity, innovation, and connectivity.

As a result, the Australian data centre market is experiencing a period of strong growth, with rated capacity (total nameplate installed capacity) expected to grow significantly. Australia was the second-largest investment destination globally in 2024 with US$6.7 billion in capital investment, trailing only the United States.[1] As the third-largest market in APAC after China and Japan, representing approximately 10% of the region's data centre capacity, Australia is well-positioned to capture continued data centre growth, given its significant renewable energy resources, land availability, strong geopolitical position and robust data sovereignty.

While data centre investment is a major focus of the infrastructure sector, there is not enough information on the implications for the energy transition—particularly in terms of electricity demand and emissions.

With this in mind, the Clean Energy Finance Corporation (CEFC) commissioned Baringa to develop this report: 'Getting the balance right: data centre growth and the energy transition' to gain insight into the opportunities and challenges for the electricity market.

### The rise of hyperscale data centres in urban Australia

Data centre development has been led by industry, with significant capital investment available. Development has been concentrated in populated urban areas such as Sydney and Melbourne and the rise of hyperscale data centres—large-scale, efficient facilities built for cloud and digital services—has seen their size and energy consumption significantly increase in recent years. Many data centre developers have made sustainability commitments, but these are voluntary, often global, and differ by provider, meaning that local action can be mixed. The CEFC sought to understand the impacts of these trends if left unmitigated through to 2035, as well as the roles innovation and policy could play in mitigating risks and capitalising on opportunities.

1 Knight Frank (2025) 'Global data centre market is projected to reach US $4 trillion by 2030'.

A bottom-up view of the development pipeline was used to create a data centre growth forecast. Based on this, data centre rated capacity is currently expected to grow by 4.7 GW under the central case and 7.4 GW under the high case by 2035, with between 2.2 GW and 3.2 GW expected to be operational by 2035. Australian data centres are expected to consume between 24 and 35 TWh in 2035. This would represent between 8% and 11% (up from 1% as referenced in the 2024 ESOO) of Australia's projected electricity consumption across the National Electricity Market (NEM) and Wholesale Electricity Market (WEM) in 2035.[2] The central case would represent up to $85 billion in data centre investment and the high case up to $135 billion.[3]

If current trends continue, most new data centres will continue to be concentrated within specific areas of Sydney and Melbourne, with around half of pipeline projects located in Sydney alone—adding 2.6 GW of demand to the local network. Hyperscale and colocation facilities will dominate these hubs, supporting rising demand for AI, cloud computing, data storage, and digital services required for day-to-day household and business operations.

## Modelling impacts of data centres on the electricity market

To understand the potential impacts of new data centre load growth on electricity prices and emissions, four scenarios were modelled to illustrate a range of possible outcomes. This included scenarios where data centre growth was not matched with any additional renewable generation, over and above the baseline scenario, as well as scenarios where data centre demand was matched with additional renewable generation and storage.

Our analysis highlights the importance of further accelerating investment in renewable energy and storage to support data centre growth. Without additional renewable energy and storage, data centre growth could significantly impact the electricity market, potentially increasing wholesale electricity prices by 26% in NSW and 23% in Victoria by 2035 in the central case, compared to the baseline scenario, primarily driven by a need for more expensive gas peaking generation. This reliance not only drives up prices, but could also lead to a 14% increase in grid emissions across the NEM. This is not specific to data centre load, but an inherent result of load growth tightening electricity supply in the short term.

To mitigate most of this impact, an additional 3.2 GW of renewable capacity will be required—over and above the solar and wind capacity expected to be built in the Baringa Reference Case during this period to meet other demand. While challenging, if the right incentives were in place to enable this additional renewable generation to be built in those timeframes, price rises would be limited to 7% for NSW and 6% for Victoria, with emissions increases eliminated. Price rises could be further reduced by introducing additional flexibility through the deployment of a further 1.9 GW of large-scale battery energy storage systems (BESS).

2 2024 ESOO figures utilised throughout, AEMO 2024-electricity-statement-of-opportunities.pdf

3 Baringa calculation informed by Cushman & Wakefield (2025) 'Asia Pacific Data Construction Cost Guide 2025'.

Figure 1: **Grid emissions by region in 2035**

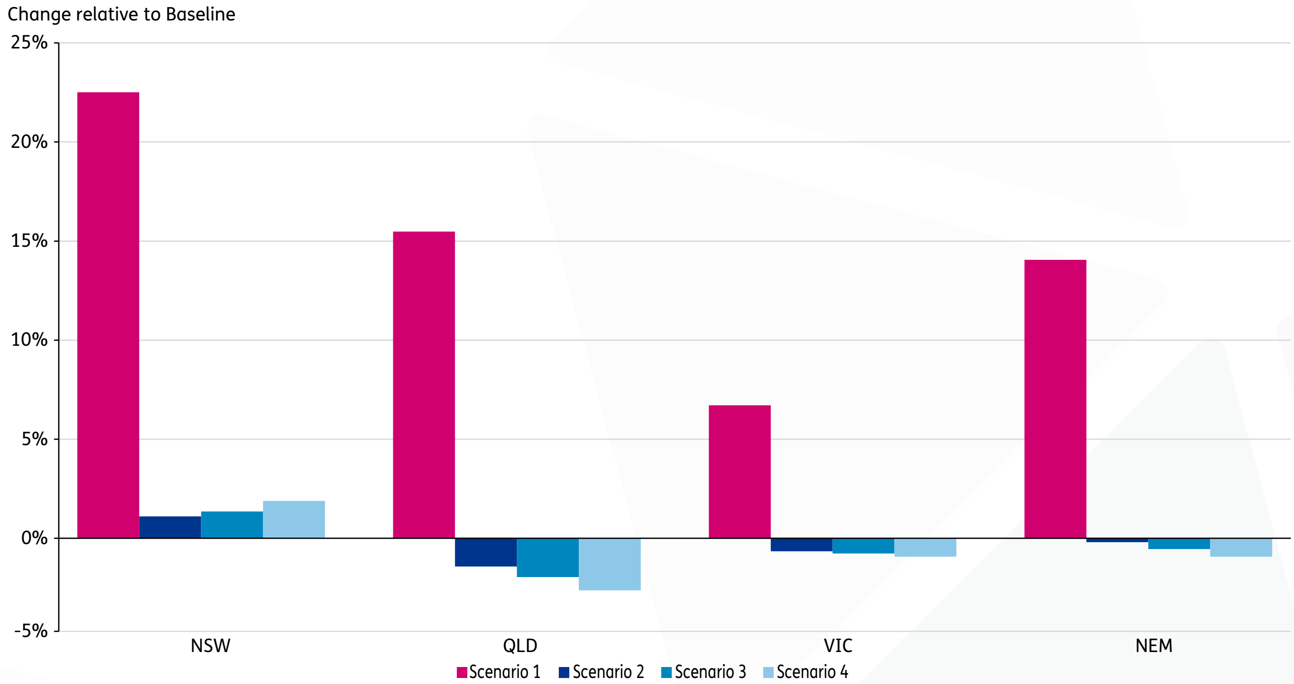



Table 1: **Modelling assumptions by scenario**

| | Baseline | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 |
|---|---|---|---|---|---|
| **Data centre demand: 2024 ESOO data centre sensitivity** | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Additional data centre demand: Baringa central case** | | ✓ | ✓ | ✓ | ✓ |
| **Additional renewable generation by 2035** | | | 3.2 GW | 3.2 GW | 3.2 GW |
| **Additional 4-hour storage by 2035** | | | | 0.95 GW | 1.9 GW |

The broader impacts on the grid vary depending on the location of the data centre. Data centres can potentially unlock some benefits, including reduced curtailment of renewables and increased minimum demand during the day, which can improve grid security. In other instances, the additional load could impact reliability and may make future decarbonisation and electrification of other industries harder and more costly by utilising network headroom.

To illustrate this further, a deep dive has been done on four locations, representing urban, regional and remote areas to illustrate the difference in impacts of different locations for data centre hubs. Urban centres like Western Sydney can capitalise upon existing workforce and infrastructure but face network constraints. Renewable energy zones like the Hunter Central-Coast have the advantage of unlocking additional renewable generation and reducing curtailment, but face challenges around proximity to end users, infrastructure and workforce.

## Sustainable growth through innovation, coordination and policy settings

Data centres by their very nature are at the cutting edge of innovation, and AI itself will contribute to efficiencies across the economy. Whilst this report does not try to quantify those broader benefits, it does highlight the importance of using innovation to reduce the impact of data centre growth. Ensuring data centres are being developed in a sustainable way by maximising energy efficiency using novel cooling technologies (for example, using AI to increase flexibility) and harnessing the growth of large-scale energy storage systems should be key considerations for data centre developers and investors. The rise of large, efficient hyperscale facilities has improved the efficiency of the sector and should continue to be incentivised and enabled.

Policymakers have a role to play in facilitating sustainable data centre growth and ensuring the policy environment protects consumers from adverse impacts while still attracting investment in the industry. This is illustrated by the recent policy requiring a five-star NABERS energy rating for data centres providing government services. Policymakers and the energy industry are already working to address these challenges by collaborating with market bodies to minimise system impacts, maximise potential benefits, and evaluate whether regulatory frameworks remain fit for purpose. As explored in the policy section of this report, government can play a role in delivering locational coordination and ensuring data centre investment is driven into locations with the network capacity to accommodate them, or regions that are otherwise strategic. Government could:

- Consider how best to enable clean energy procurement by data centres
- Consider what mechanisms could improve transparency of the expected electricity load from data centres, better managing network capacity and network costs
- Ensure the right system settings are in place to understand and manage any system security impacts of connecting large loads
- Encourage innovations to improve energy efficiency, demand flexibility and the use of cleaner backup energy solutions to mitigate risks.

While many major data centre developers are voluntarily procuring some clean energy, this often does not fully offset the impact of their increased energy demand in Australia. As the sector continues to grow, addressing its environmental footprint requires broader action and coordination between government and industry.

## The role of investors in driving sustainable data centre best practice

Investors also have a role to play in influencing the sustainability of the sector. Investors can reward those who seek better environmental outcomes, potentially aligning with the data processing, hosting and related activities requirements and definitions in the European Green Taxonomy or utilising Australia's new Sustainable Finance Taxonomy, launched in June 2025.

The EU Green Taxonomy aims to provide a clear, standardised framework for data centres to demonstrate their environmental sustainability, thereby attracting green finance. It pushes data centre operators towards higher energy efficiency, responsible resource management, and transparent reporting. Effective water use should also be a consideration.

Similarly, the Australian Sustainable Finance Taxonomy has been released for voluntary use in the market, suggesting "green" data centres to have no fossil fuel combustion on-site, use 100% renewable energy and achieve a reduction in energy intensity. This would not only reduce the environmental impacts of the data centre operations but also incentivise and accelerate investment in renewable energy and storage by increasing demand.

Building on these frameworks, clear, objective definitions should be utilised to set standards to build market confidence in "green" differentiation between data centre projects. This will ensure green bonds and loans to the sector are genuinely green, with preferential terms offered to projects that meet the highest standards. ESG funds or sustainability-linked loans can also play a role in incentivising sustainable operations.

The Australian Sustainable Finance taxonomy will become an important tool for data centre customers to clearly distinguish best practice and ensure transparent reporting of operational impacts to direct green finance and the associated benefits.

In summary, Australia's accelerating demand for digital services is driving significant growth in data centre capacity, creating both opportunities and challenges. To capture these benefits while mitigating risks, action will be required across policy, investment, and innovation—ensuring sustainable operations and supporting the energy transition for the future.

# Contents



## Editors note:

The modelling contained within this report was conducted in March 2025, using the latest figures available at the time. Notably this includes AEMO's 2024 ESOO. However, since then, AEMO has published more up-to-date figures in the 2025 ESOO (published in August 2025), including updates to the following values.

| Quantity | AEMO ESOO 2024 | AEMO ESOO 2025 |
|---|---|---|
| Current operational capacity of data centres 2024-25 (GW) | 0.30 | 0.45 |
| Current data centre consumption (TWh), and proportion of NEM and WEM demand (%) 2024-25 | 3, 1% | 4, 2% |

Baringa has also released updated market capacity and price views in the Baringa Q3 Reference Case, which incorporates the latest ESOO and updated market dynamics. While this would impact the specific figures in the report, we believe the relative impacts discussed remain relevant*.

* AEMO ESOO 2025.

## Section 1

# Growth of data centres

## Chapter overview:

Australia's data centre transformation is accelerating at an unprecedented pace. **Between 2.2 GW and 3.2 GW of data centre capacity is expected to be operational by 2035**, up from around 0.3 GW in 2024–25. This represents up to $135 billion in investment and between 8% and 11% of Australia's projected electricity consumption across the NEM and WEM in 2035, up from 1% today.

Australia is a **strong contender within the APAC region to continue hosting data centre growth**. The nation offers potential for significant renewable energy generation, land availability, a favourable geopolitical position, and robust data sovereignty frameworks. However, key constraints that may prevent rapid expansion include slow approval processes, high development costs, land competition and limited grid connections as capacity continues to expand.

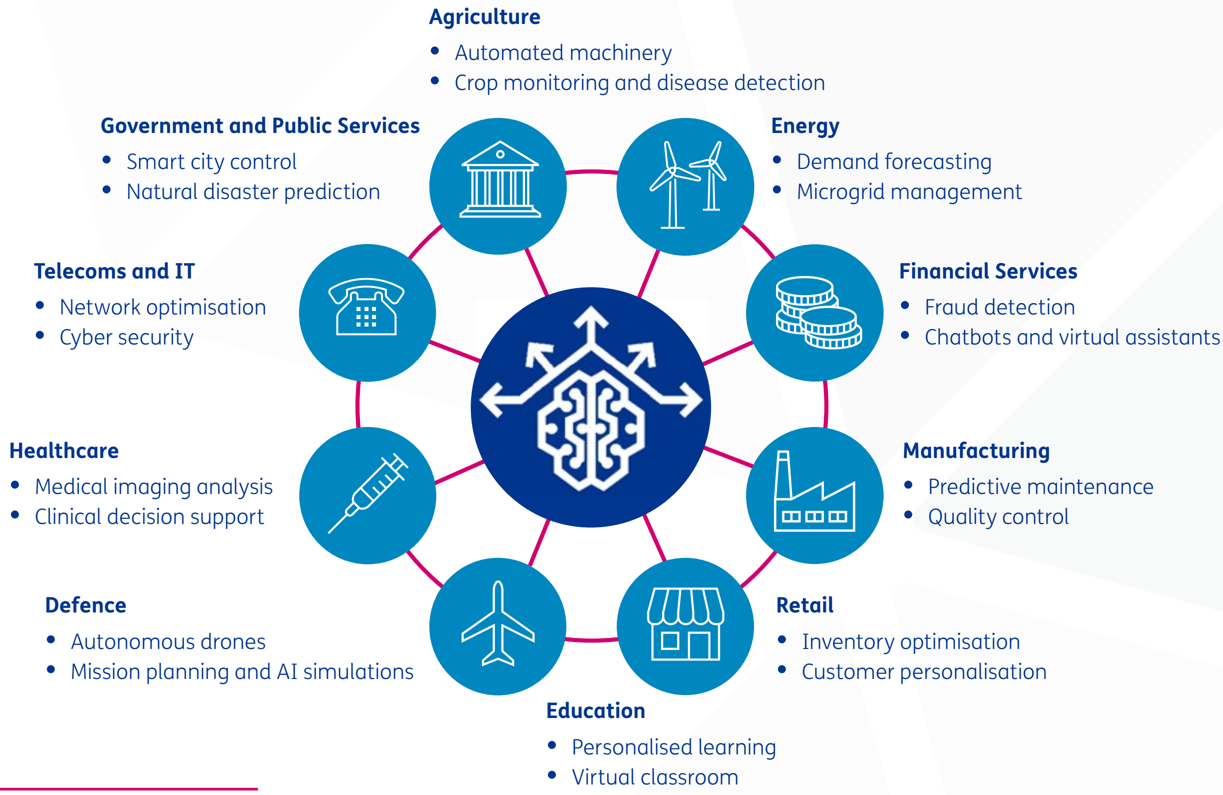
**Around three quarters of Australian data centres are expected to be developed in Sydney and Melbourne.** Sydney's growth is primarily driven within the Western Sydney growth corridor, while Melbourne's growth is spread throughout Melbourne's north and west.

**Hyperscale and colocation data centres will dominate development** in these hubs, servicing growing demand for AI, cloud computing, data storage, and the digital services required for day-to-day household and business operations.

# Data centre market

Data use is expected to continue to grow exponentially over the coming years, as it has been doing since 2010. In 2023, the world created or consumed approximately 120 zettabytes of data, compared to 41 zettabytes in 2019.[4] During 2025, this is expected to reach over 180 zettabytes.[5] The use of data and AI across the economy are driving this remarkable growth, as illustrated by Figure 2.

Figure 2: **Illustrative use of AI throughout the economy**




4 One trillion gigabyte equates to one zettabyte
5 CBRE Research (2024) 'Australia Data Centres'.

## Use cases and energy requirements of data centres

Data centres underpin the digital services we use daily and can be divided into five main types, outlined in Figure 3. Two operating models are transforming the market: hyperscale and colocation data centres. These facilities can handle the growing demands of AI computing and cloud services.

Examples of key hyperscale players in Australia include Google, Microsoft and Amazon Web Services (AWS). Colocation developers include Equinix, Digital Realty, NextDC and AirTrunk. As facilities grow larger, traditional colocation providers are also developing hyperscale facilities. The rapid uptake of these models is dictating the growth and energy consumption of data centres in Australia, given their technical requirements.

Figure 3: **Description of data centre types**

| DC type | Size (MW) | PUE[13] | Description | Use cases |
|---|---|---|---|---|
| Edge | <0.1 – 0.15 | ~1.91 | Smaller facilities located closer to end users, reducing latency and delivering faster services.[6]<br>Located at the network edge, these data centres are still connected to larger, centralised facilities for data processing while providing regional businesses with improved streaming and data storage capabilities.<br>Due to their size, these facilities have a far higher PUE than other types of data centres (~1.91).[7] | Smart city control, industrial automation, healthcare and retail. |
| Colocation | ~100 | ~1.68 | Shared facilities, typically smaller than hyperscale facilities, where providers lease server space to multiple companies.[8] This allows businesses to house their IT infrastructure without building their own data centres.<br>Colocation data centres serve diverse needs, such as streaming and smaller data storage requirements, enabling companies to distribute their IT infrastructure across different locations.<br>These facilities generally have a higher PUE (~1.68) than hyperscale data centres.[9] | Government hosting, financial services and SaaS hosting. |
| Hyperscale | >100 | 1.14-1.22 | Large-scale facilities designed for large workloads including AI inference and training, cloud computing, and big data storage.[10]<br>Hyperscale data centres offer high efficiency (PUE 1.14–1.22) and can scale operations up or down based on demand.[11]<br>Major providers like AWS and Microsoft Azure own and operate hyperscale cloud facilities, while others are dedicated to housing AI technology. | AI training and inference, enterprise cloud computing and streaming platforms. |

**Enterprise (on premises) & Crypto mining facilities fall across all three types of data centres[12]**

6 Phillip Powell and Ian Smalley (2024) 'What is a hyperscale data center?'
7 Shehabi et al (2024) '2024 United States Data Center Energy Usage Report'.
8 Phillip Powell and Ian Smalley (2024) 'What is a hyperscale data center?'
9 Shehabi et al (2024) '2024 United States Data Center Energy Usage Report'.
10 Phillip Powell and Ian Smalley (2024) 'What is a hyperscale data center?'
11 Shehabi et al (2024) '2024 United States Data Center Energy Usage Report'.
12 Enterprise data centres are on-premises facilities of varying sizes (1–100 MW) operated by individual organisations for their exclusive use. As these facilities lack the scalability and efficiency of hyperscale data centres (with a PUE of ~1.68), many businesses are shifting away from this model. Crypto mining facilities are Specialised facilities designed solely to process cryptocurrency transactions. As AI demand outpaces crypto growth, these data centres are increasingly converting their facilities to service hyperscale cloud needs.
13 Power Usage Effectiveness (PUE), the ratio of total infrastructure load to IT load

Data centre capacity falls into three broad categories: edge, colocation, and hyperscale, as shown in Figure 3. Enterprise and crypto mining data centres can fit within any category depending on their individual capacity and use.

## Australian data centre growth: a transformation underway

Australia's data centre transformation is accelerating. Current rated capacity is estimated to be 1.35 GW[14], representing approximately 10% of the APAC region's capacity.[15] In 2024–25, AEMO estimates that the 0.3 GW of currently operational capacity equates to around 3 TWh of annual electricity consumption—1% of Australia's total electricity consumption.[16]

Technology adoption in homes and businesses, along with the rise of AI, is driving unprecedented growth. This surge attracted significant investment last year, with Blackstone closing its $24 billion acquisition of AirTrunk, marking the completion of the largest data centre transaction to date globally and Australia's largest transaction in 2024. The pipeline is impressive with projects totalling over 4 GW of rated capacity by 2035.

However, developers respond to changing dynamics and constraints across Australia and the wider APAC region. The actual capacity brought online could match or even exceed the current pipeline, even if many specific projects fall away.

## Two growth cases for Australia's data centre future

We have created two growth cases to consider the grid impacts in this study.

**The central case** takes a pragmatic view of the pipeline being realised and a conservative growth beyond 2030. It assumes that projects without approval will not come online by 2035. This accounts for development delays, as well as vacancy and ramp rates across existing data centres leading to excess capacity in the early 2030s. Annual growth beyond 2030 is set at 50% of the growth seen through to 2030. This accounts for capacity banking, where data centre developers oversize grid connections to reserve power and infrastructure capacity beyond current needs, ensuring availability for future expansion. Other factors considered include changing APAC hubs, limited power and land supply, developers responding to rising electricity prices, evolving AI demand and slow Australian planning approvals.

**The high case** represents a bullish view of the pipeline with few deterrents. It assumes all projects in the pipeline come online with growth maintaining the same trajectory post-2030.

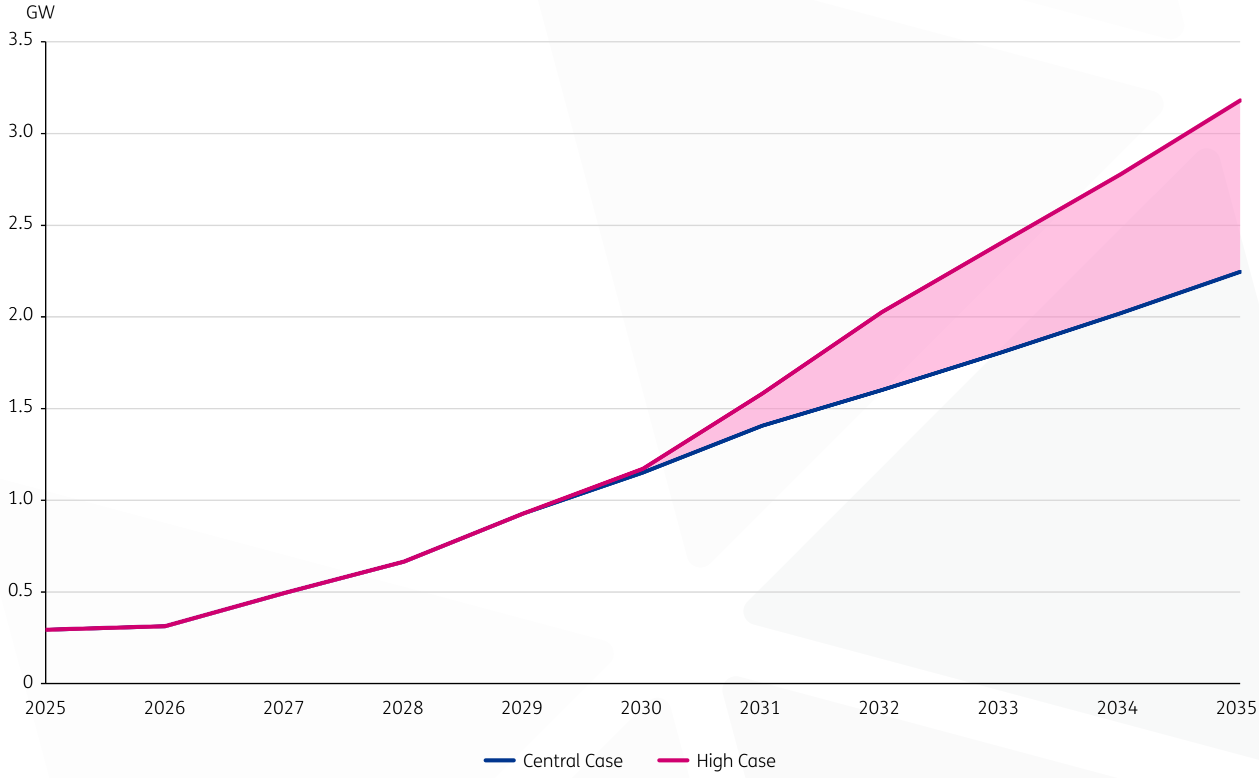
Both scenarios use rated capacity assumptions (total nameplate installed capacity), converted to operational capacity (peak electricity consumption) through assumed ramping profiles.

14 Mandala (2024) 'Empowering Australia's Digital Future'.
15 Cushman & Wakefield (2024) 'Asia Pacific Data Centre: H2 2024 Update'.
16 AEMO (2024). '2024 Electricity Statement of Opportunities'

## Investment and capacity projections

Data centre rated capacity is expected to grow by between 4.7 GW (central case) and 7.4 GW (high case) by 2034–35. This represents $85 billion to $135 billion in construction investment.[17] This development is expected to create between 2.2 and 3.2 GW of operational capacity by 2034–35, shown in Figure 4.

Figure 4: **Projected growth in operational capacity of Australian data centres by growth case**




Rated capacity reflects the maximum theoretical capacity a data centre can support. Operational capacity accounts for actual utilisation, taking account of factors such as ramp rates and vacancy rates. Including the existing 3 TWh consumption, this pipeline could see Australian data centres consume up to 24 TWh annually by 2034–35 under the central case (see Figure 5). This would equate to approximately 8% of projected electricity consumption across the NEM and WEM.[18]

The compound annual growth rate of operational capacity is expected to sit between 23% and 27%.[19] In terms of rated capacity, the central case aligns with key industry benchmarks for 2030. The projected 4 GW of rated capacity sits between the Mandala report (3.1 GW) and the Australian Energy Market Operator's draft data centre demand forecast (around 4.5 GW).[20]

Australia's total data centre capacity is expected to be at least four times larger than current levels by 2035, even under the central case.

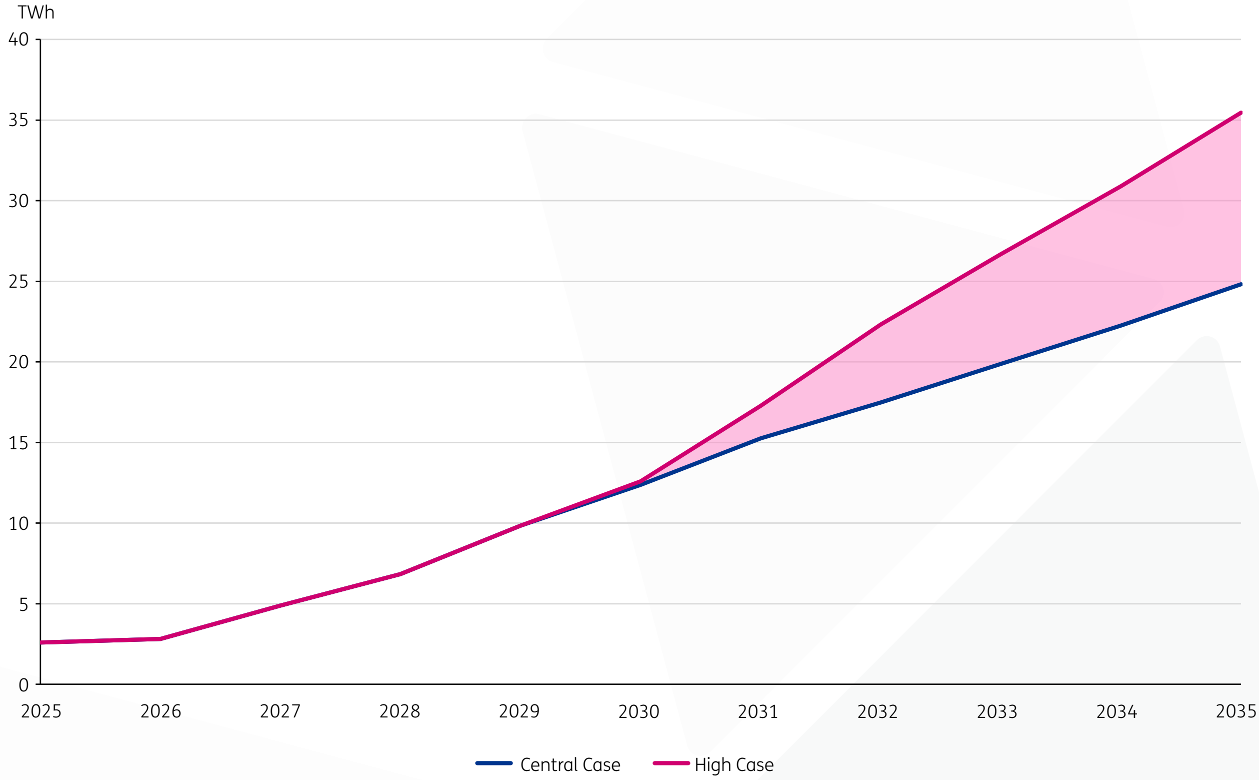
**17** This assumes construction costs equivalent to US$11,660,284 per MW of deployable capacity and an exchange rate of 1.54 AUD/USD. Estimates of construction costs sourced from Cushman & Wakefield (2025) 'Asia Pacific — Data Centre Construction Cost Guide 2025'.

**18** Across the NEM and WEM only, Australia's projected electricity consumption is 312 TWh. This is informed by Baringa Q1 2025 NEM Reference Case view of annual demand on a sent-out basis and 2025 WEM ESOO demand, with additional data centre growth from the central case. Data centre consumption solely in the NEM is expected to be approximately 9% under the central case, and is expected to remain low in the WEM at around 1% of total consumption.

**19** This growth rate is calculated on the Baringa Q1 2025 reference case assumption that in 2024–25, there is 294 MW of operational data centre capacity across the NEM. This assumption aligns with the assumption in AEMO's ESOO 2024 data centre sensitivity. The demand is converted from TWh/year to MW capacity to inform the estimate on the quantity of existing operational capacity.

**20** Mandala (2024) 'Empowering Australia's Digital Future'; AEMO engaged Oxford Economics to prepare forecasts of data centre load in the NEM for the 2025 ESOO. These forecasts were first presented in May 2025 to AEMO's Forecasting Reference Group (FRG), which facilitates AEMO's engagement with the market around ESOO forecasting. The FRG meeting pack can be found here and the final report can be found here.

Figure 5: **Projected growth in electricity consumption of Australian data centres by case**




Our market research estimates that 65% of the pipeline's MW capacity will be hyperscale facilities, with 35% developed as colocations. Of those facilities, an estimated 84% could host AI.[21]

## Geographic concentration and future expansion

Australia's data centre capacity is concentrated on the East Coast, with over three quarters in either Sydney or Melbourne as shown in Figure 6. This results from factors essential for data centre operation: nearby household and business activity concentration, necessary infrastructure and workforce availability, location within cloud availability zones (see Appendix 2: Location factors), development speed and proximity to subsea cable landing points. This proximity allows lower latency and better customer interconnectivity.

Both Sydney and Melbourne rank in the top 10 APAC data centre markets, currently 3rd and 8th, respectively.[22] Appendix 2 further explores location drivers and limiting factors.

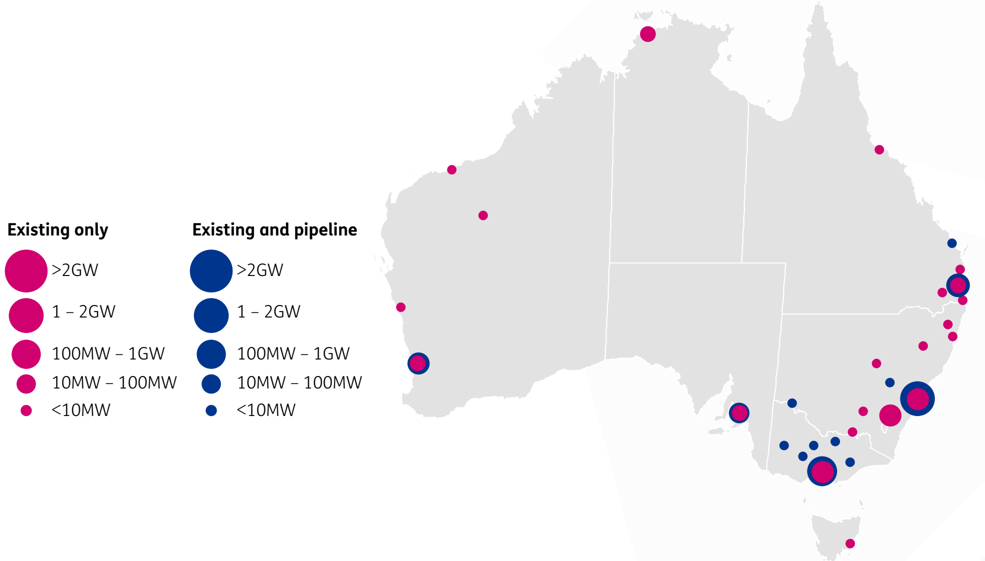
Upcoming projects will also concentrate in Sydney and Melbourne, particularly Western Sydney and Melbourne's north and west. Sydney is expected to continue its position as Australia's data centre hub due to a larger and more mature project pipeline. Around half of the pipeline projects plan to operate within Sydney, adding 2.6 GW of load to the grid. Of these, many projects are likely to connect to the transmission network, given they exceed 50 MW and data centres increasingly seek opportunities for future scale.

As a relatively less established data centre location, Melbourne's growth is expected to come from prospective projects rather than existing developments ramping up. As land availability becomes constrained in both cities, investment may spread to other capital cities such as Perth and Brisbane to meet low-latency data centre requirements. The Brisbane Supernode exemplifies this, with an initial 260 MW buildout and potential expansion to 800 MW of data centre capacity. The next chapter of this report explores regional data centre growth potential further.

21 Market research was used to ascertain the size and capabilities of each data centre, determining the type of data centre beyond just considering their capacity. Several colocation facilities can accommodate hyperscale clients and are therefore considered hyperscale facilities. Similarly, those advertised as being able to support AI and AI clients are considered to be equipped to host this service.

22 Australian Trade and Investment Commission (2024) 'Australia: APAC's rising regional hub for green data centres'.

Figure 6: **Distribution of existing and pipeline data centre nameplate capacity**




## What's driving Australia's data centre boom

Several factors are positioning Australia, particularly Sydney, as an emerging data centre hub. These factors are outlined in Figure 7.

Figure 7: **Description of factors driving Australian data centre growth**

### Technology use

Australian households are embracing internet-connected devices and are expected to double their ownership by 2030.[23] Internet users worldwide are increasing steadily, along with reliance on e-commerce. Growing household and business technology use will drive demand for cloud services and applications housed within data centres. This growth will pressure existing facilities and encourage new development to improve the reach and speed of digital services.

### AI demand

Data centres play three key roles in AI technology: housing high-powered servers, storing massive data required by AI models, and cooling server racks to prevent overheating. Without these facilities, AI cannot operate at current depths or speeds. Global AI adoption across households and businesses is accelerating. AI and automation could generate up to $600 billion for Australia's GDP by 2030.[24] This expansion requires growth in data centre capacity to support continued development.

### Political stability

Australia offers political stability. This means data centre providers can invest in long-term developments with confidence. Within the APAC region, Australia stands out as a remarkably politically stable country with a strategic geopolitical position.

### Data security

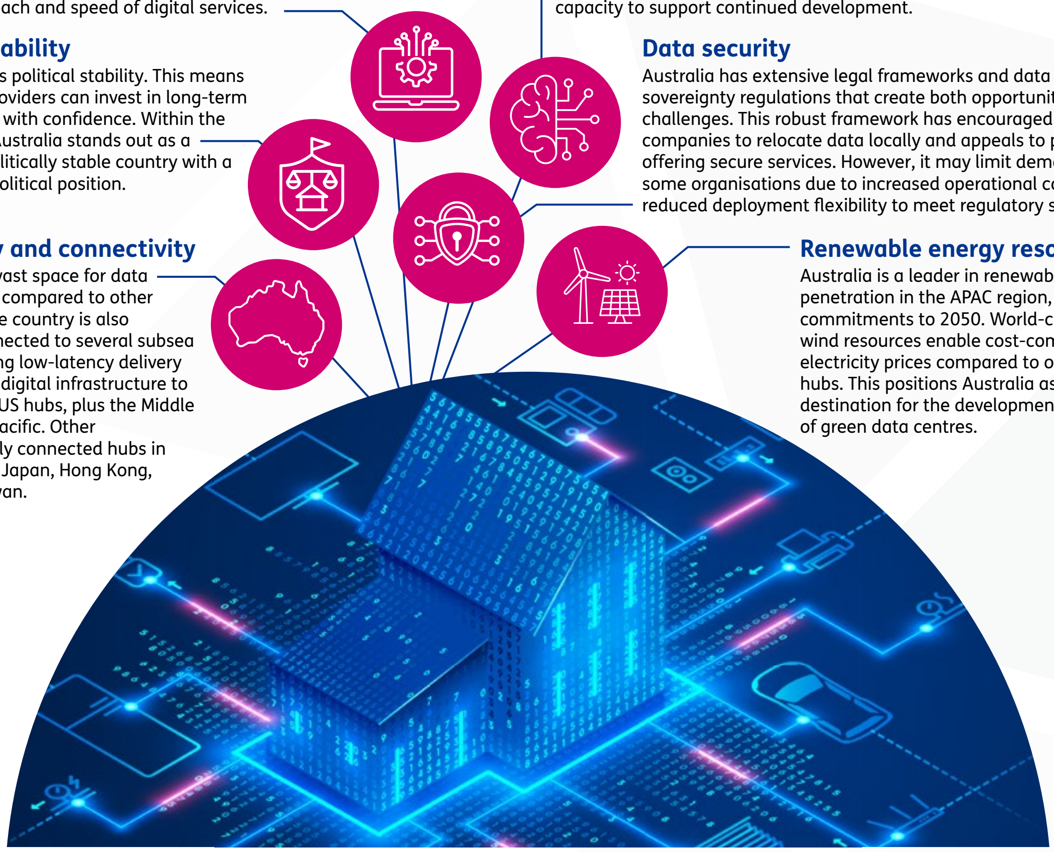
Australia has extensive legal frameworks and data sovereignty regulations that create both opportunities and challenges. This robust framework has encouraged Australian companies to relocate data locally and appeals to providers offering secure services. However, it may limit demand from some organisations due to increased operational costs and reduced deployment flexibility to meet regulatory standards.

### Geography and connectivity

Australia has vast space for data centre growth compared to other APAC hubs. The country is also optimally connected to several subsea cables providing low-latency delivery and linking its digital infrastructure to key APAC and US hubs, plus the Middle East and the Pacific. Other advantageously connected hubs in the region are Japan, Hong Kong, India and Taiwan.

### Renewable energy resources

Australia is a leader in renewable energy penetration in the APAC region, with net zero commitments to 2050. World-class solar and wind resources enable cost-competitive electricity prices compared to other regional hubs. This positions Australia as an attractive destination for the development and operation of green data centres.



23 Mandala (2024) 'Empowering Australia's Digital Future'.
24 Department of Industry, Science and Resources (2024) Developing a National AI Capability Plan.

## Strong demand signals across the region

Australian data centre demand aligns with strong global growth, but its position within the APAC region drives particularly strong pipeline development. Low vacancy rates reflect this demand—as low as 9% in major hubs such as Sydney compared to the average APAC vacancy rate of 16%.[25] This shows limited space in existing data centres for additional servers, signalling high demand and the need for new capacity to satisfy the growing requirements of households and businesses.

Technology and AI demand will continue driving underlying growth in Australian data centre capacity. However, the growth rate will depend on the interaction of demand and supply as vacancy rates and Australia's regional position evolve.

The APAC region is experiencing significant data centre expansion, with notable countries including Japan, Malaysia, and South Korea. Baringa identifies these as having high market attractiveness for investment alongside Australia.[26] However, Australia maintains a distinct competitive advantage through superior capability to source clean energy, as illustrated in Figure 8.

Figure 8: **APAC market scan**

| | Demand | Development | Clean Energy | Policy | Power | Macro | Overall |
|---|---|---|---|---|---|---|---|
| Australia | Very attractive | High | High | High | High | Very attractive | Very attractive |
| Singapore | Very attractive | High | Low | Very attractive | Low | Very attractive | High |
| Japan | Very attractive | High | Medium | Very attractive | High | Very attractive | High |
| Malaysia | Very attractive | Medium | Low | Very attractive | Very attractive | Very attractive | Medium |
| Taiwan | Very attractive | High | Low | High | Medium | High | Medium |
| South Korea | Very attractive | Very attractive | Low | Very attractive | High | Very attractive | High |
| Vietnam | Medium | Medium | Medium | Very attractive | High | Medium | Medium |
| Philippines | Medium | High | Medium | High | High | Medium | Medium |

**Key** Very attractive High Medium Low

| Demand | Development | Clean (renewable) energy availability | Policy | Power attractiveness | Macroeconomic risk |
|---|---|---|---|---|---|
| The size of the opportunity for data centre growth, total demand as well as data centre power demand. | Development constraints across building and planning, water scarcity, skilled labour availability and land availability. | Percentage of generation which is from renewable sources 2024-2030, looking at the projected power mix from Baringa's power market projections, and the natural climate attractiveness for renewable energy. | How supportive and well-established the current data and data centre policy environment is, both from a credibility and durability perspective. | An assessment of barriers to development (e.g. permitting and other timelines, grid connection queues), as well as power cost. | Macroeconomic and political risk through World Bank indicators (regulatory quality, government effectiveness, political stability, corruption, rule of law) and credit ratings, inflation and growth projections. |

**25** Cushman & Wakefield (2024) 'Asia Pacific Data Centre: H2 2024 Update'.; CBRE (2024) Global Data Center Trends 2024.
**26** Baringa (2025) Data centre market scanning report.

Following a recent moratorium, Singapore expects moderate, but strategic growth of data centres focused on sustainability, innovation and emissions mitigation. Across these four countries alone (Singapore, Japan, Malaysia, and South Korea), over 3.7 GW of capacity is in the pipeline.[27] This excludes the subsequent announcement of a 3 GW data centre which Fir Hills Inc. plans to begin construction in South Korea.[28] More regional capacity will likely come online simultaneously with some of Australia's early pipeline capacity.

Given the region's interconnectivity, an accelerated build out in these markets, coupled with large amounts of capacity coming online each year across Australia could see supply outstrip domestic demand. This impacts vacancy rates and further growth development. This outcome is reflected in our central case, which assumes some projects without approval will not come online, and those that do will reach 65% operational capacity by the end of their ramp period.

This dynamic could intensify if Australia's importance as a regional hub is reduced as other countries strengthen their data transmission capabilities and lower latency. An example is Singapore looking to Malaysia's Johor region to service data centre demand, given limited land and power supply.[29] As data centres spill into Malaysia, the two regions have recently established a Special Economic Zone focused on digital ecosystem development.[30] Although this could reduce Australian data centre growth, challenges with renewable energy procurement in Johor and similar locations may ensure Australia remains an attractive regional hub.


**27** Cushman & Wakefield (2024) 'Asia Pacific Data Centre: H2 2024 Update'.; Amber Jackson (2025) 'A 3GW Pledge: Plans for the Largest AI Data Centre Explained', Digital Magazine.
**28** The 3GW Promise South Korea's Mega AI Data Centre Explained | Data Centre Magazine
**29** Christopher Ong and Lee Ong (2024), 'The Rise of Johor as a Data Centre Hub', Lexology.
**30** HSBC (2025) 'The Johor-Singapore Special Economic Zone (JS-SEZ)'.

Section 2

# Power market and grid impacts of data centre growth

## Chapter overview:

**Australia stands at a pivotal moment in managing the unprecedented growth in data centre demand.** The scale, pace and geographic concentration of this buildout—combined with data centres' unique flat load profile—creates both significant opportunities and challenges for our power system and the energy transition. Many data centre operators are planning to invest in renewable energy assets to support their growth.

**Data centres could significantly impact electricity markets if no additional offsetting renewable generation is built.** Modelling based on the central case would result in wholesale prices rising by 26% in NSW and 23% in Victoria by 2035, while increasing emissions by 14% across the NEM, compared to the baseline scenario.

**Data centre growth presents an opportunity to further accelerate investment in renewable energy and storage.** If an additional 3.2 GW of renewable capacity is built—over and above what is expected between now and 2035—price impacts would be limited to rises of 7% in NSW and 6% in Victoria. Adding grid-scale storage equivalent to the data centre capacity could reduce price impacts further to only 3% and 2%, respectively. Emissions would also fall in line with Baringa's best estimate for the future of electricity markets.

**Location is critical for maximising benefits while minimising risks, as grid impacts vary by location.** Additional data centre load could increase pressure on the grid in some areas, but also unlock locally curtailed renewables, and help mitigate minimum system load risks. Urban centres like Western Sydney offer workforce and infrastructure advantages but face network constraints. Renewable energy zones like the Hunter Central-Coast could unlock additional renewable generation and reduce curtailment but proximity to end users, infrastructure availability and workforce considerations may outweigh these benefits.

**Policymakers and the energy industry are already working to address these challenges.** Governments are collaborating with market bodies to minimise system impacts, maximise potential benefits, and evaluate whether regulatory frameworks remain fit for purpose. Combined with ongoing innovation by data centre developers to improve energy efficiency, Australia can harness this growth to capture the economic opportunity of data centres and AI while delivering on decarbonisation commitments.

We are at a pivotal point in managing global data centre demand load. While the world has seen periods of significant demand growth—such as post-war electrification or China's industrial boom—several factors make data centre demand unique:

- The pace at which the buildout is happening
- Geographic concentration of sites
- Flat load profile of data centres
- The scale and speed of renewable energy deployment.

These characteristics present both opportunities and challenges for Australia's energy system, which will be explored further in this chapter.

Data centre developers operate at the cutting edge of innovation, and AI itself will contribute to efficiencies across the energy sector. For example, the International Energy Agency (IEA) recently found that AI could achieve energy savings of up to 8% in light industries, such as electronics and machinery manufacturing, by 2035.[31] The same report found that emissions reductions from the broad application of existing AI-led solutions could be equivalent to around 5% of energy-related emissions in 2035.

31 International Energy Agency (2025) 'Energy and AI'.

This chapter explores the potential impact of new data centre load growth on electricity prices and emissions. The base case of this methodology is the Baringa Q1 2025 Reference Case. Baringa produces independent, industry-leading projections that are updated and published quarterly. Baringa projections cover a range of scenarios, including our Reference Case, a benchmark for the industry. The Reference Case is Baringa's independent, industry-leading projections of Australia's NEM, incorporating our assumptions of gas, coal and carbon prices, electricity demand, power generation capacity and interconnection assumptions to produce our "best view" on outputs such as baseload power prices, generation mix, and emissions, at the point of its release. The central case growth scenarios have been used as the basis for future data centre demand. The assumptions associated with the modelling are summarised at a high level below, with further detail in Appendix 1 and Table 2.

The results of these scenarios are not specific to data centre load, but an inherent result of load growth tightening electricity supply in the short term. Importantly, this analysis does not quantitatively consider the downward pressure on prices and emissions arising from the wider efficiency benefits that AI and other data centre services may provide across the economy. These benefits were excluded due to modelling uncertainty but would be expected to reduce 'net new load' and impacts on the system.

Appendix 1 also details changes to Baringa reference case assumptions.

Table 2: **Modelling assumptions by scenario**

| | Baseline | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 |
|---|---|---|---|---|---|
| **Data centre demand: 2024 ESOO data centre sensitivity**[32] | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Additional data centre demand: Baringa central case** | | ✓ | ✓ | ✓ | ✓ |
| **Additional renewable generation by 2035** | | | 3.2 GW | 3.2 GW | 3.2 GW |
| **Additional 4-hour storage by 2035** | | | | 0.95 GW | 1.9 GW |

# Electricity market impacts

## Intraday impacts of data centres

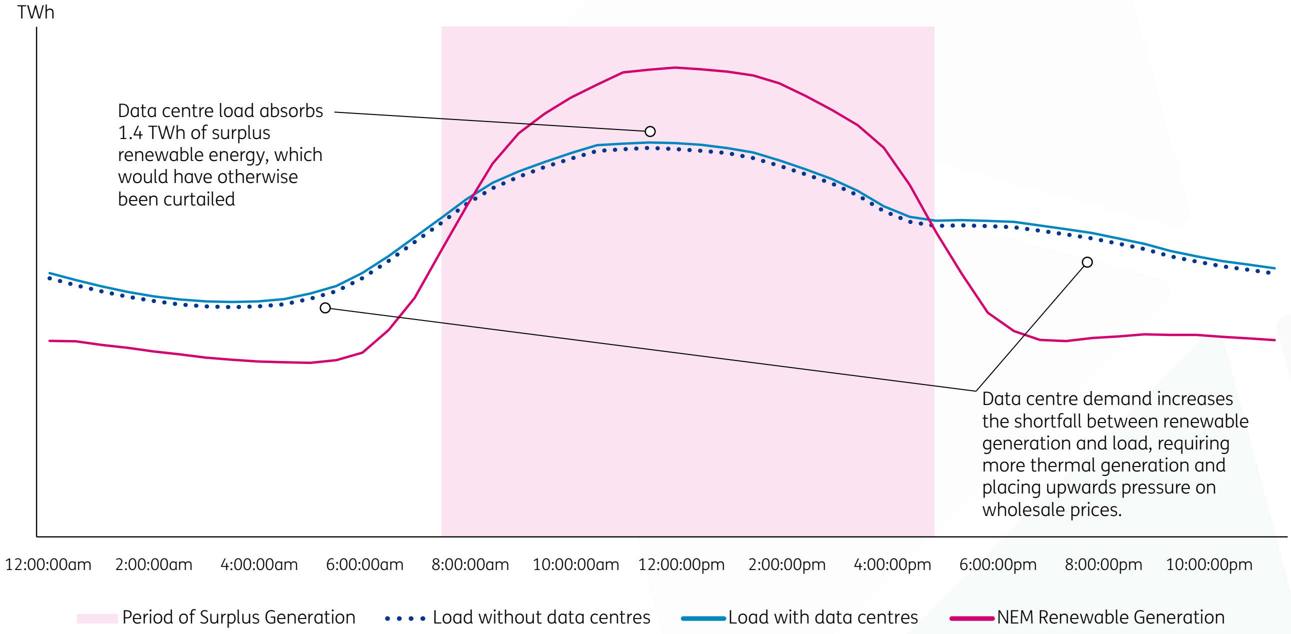
Data centres are large, consistent energy consumers, with a relatively flat load throughout the day. This 'baseload' demand has both a positive and negative impact on the market and network, as illustrated in Figure 9.

All else being equal, additional data centre load during the middle of the day leads to the consumption of renewable generation that would have otherwise been curtailed. In Scenario 1, we see 1.4 TWh of renewable generation that would have otherwise been subject to market curtailment in NSW in 2030—enough energy to power approximately 3.6 million homes for an entire month—which could be used by new load. This is a significant benefit for the grid, as it increases the quantity of renewable energy consumed and improves stability without relying on non-renewable sources throughout the day.

However, during the morning and evening peaks, data centre demand increases the shortfall between renewable generation and load. As a result, thermal generation such as coal and gas are required to meet demand, placing upward pressure on the wholesale prices set within the electricity market.

32 AEMO (2024) '2024 Electricity Statement of Opportunities'.

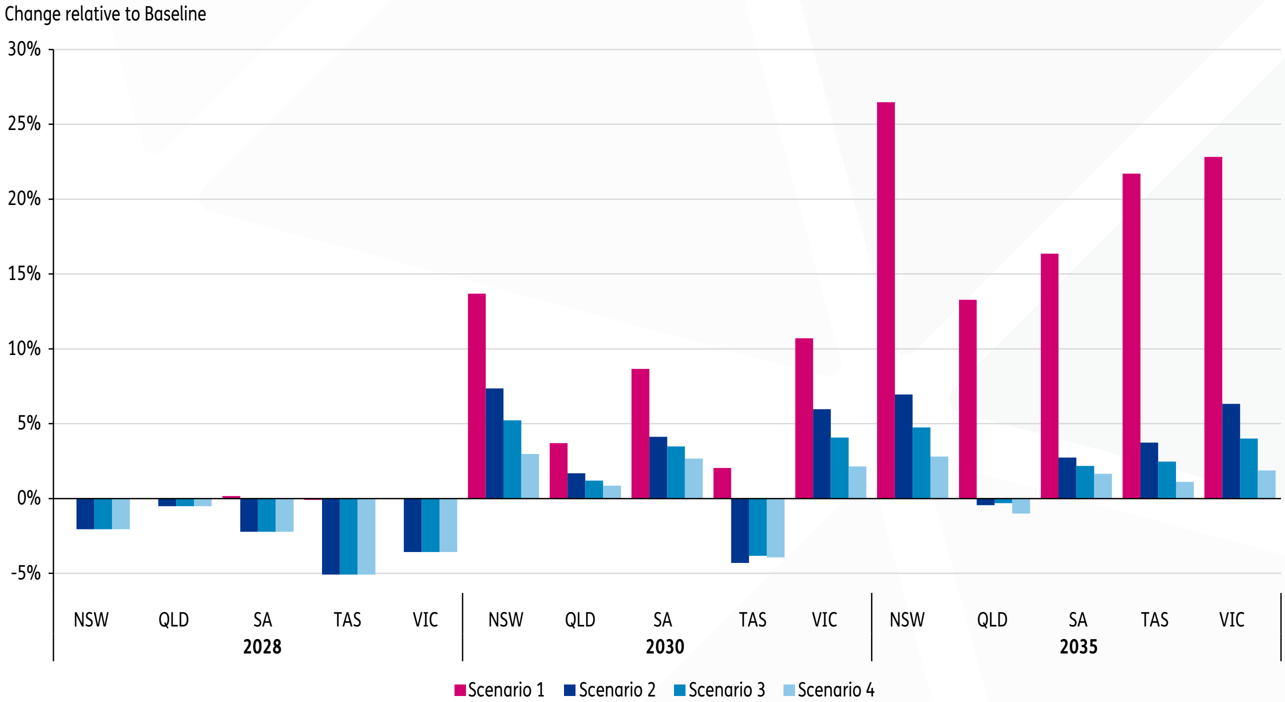
Figure 9: **Illustrative example of the intraday impacts of additional load from data centres**




## Central case impacts

Our central case projection outlined in the previous chapter represents a 1.2 GW increase in expected operational load compared to the Baseline in 2034–35. If this new data centre capacity is added without accompanying generation, the load-weighted prices across the NEM gradually rise beyond the Baseline. This is felt most strongly in New South Wales and Victoria, where we expect most data centres will be hosted. As illustrated by Figure 10, by 2035, prices in these states will increase by 26% and 23% respectively, if no mitigating action is taken. This price increase is largely driven by increased gas generation (coal closures remain consistent with the Baringa Reference Case) relative to the Baseline. Under Scenario 1, the impact on load-weighted prices in 2028 is minimal, as the renewable capacity buildout expected under the baseline scenario completely mitigates the limited operational data centre capacity projected.

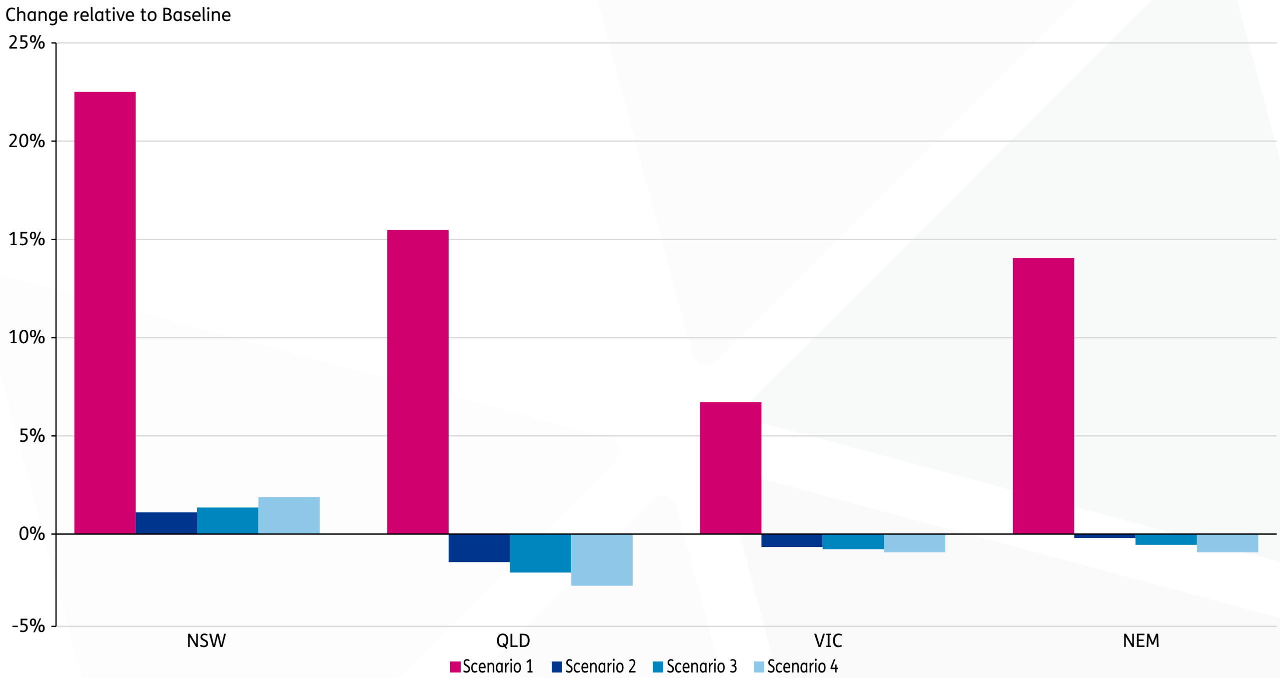
Figure 10: **Average load-weighted prices**



The different quantities of data centre load and generation profiles in each state cause impacts to vary across the NEM, with stronger impacts felt across New South Wales and Victoria given they are expected to host most of the new load. However, despite limited load added in South Australia and Tasmania, some price impacts are still expected as their generation is exported to other states to meet demand.

In addition to the impact on prices, the impact of additional thermal generation on grid emissions should also be considered—particularly at a time when the market is targeting a shift to renewable generation. Data centre growth in line with our central case without accompanying generation would see a 14% increase in grid emissions in 2035, equivalent to an additional 5.86 million tonnes of carbon dioxide equivalent (Mt $CO_2$-e) a year across the NEM, although, as illustrated by Figure 11, the impacts vary by state.

Figure 11: **Grid emissions by state in 2035**




Similar to the variance in price impacts across the states, the impacts on emissions vary between states given the differing generation profiles in each state. For example, Queensland and Victoria's heavier reliance on black and brown coal generation, respectively, contributes to higher emissions than New South Wales. As shown by scenarios 2–4, additional renewables can mostly mitigate any increase in emissions, but this increases the volume of new build renewables required to meet targets.

## Mitigations

Scenarios 2, 3 and 4 explore a range of options which could be employed to mitigate the impact of data centre growth. The levers required to enable this are explored further in the chapters focused on innovation and policy.

Scenario 2 aligns with global commitments made by some data centre developers such as AWS, Equinix, Next DC and AirTrunk, who have already committed to procuring 100% renewable energy for operations globally by 2030.[33] A commitment also mirrored by data centre users such as NBN, Telstra and the Commonwealth Bank of Australia.[34] The scenario modelled assumes that all of this is additional new build.

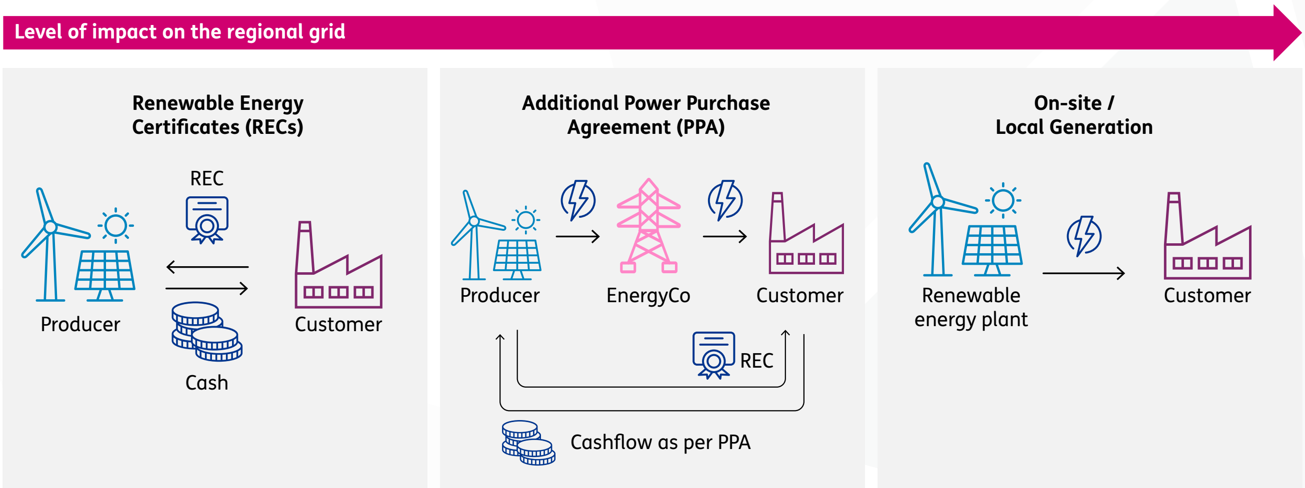
33 Amazon (2025) 'AWS Cloud'; Christopher Wellise and Ali Ruckteschler (2025) 'Powering a Sustainable Future: Energy Innovation for the Digital Era', Equinix; NEXTDC (2022) 'FY22 Environmental, Social and Governance Report'; AirTrunk (2025) 'Clean Energy'.

34 NBN Co (2021), 'NBN Co announces 100% renewable electricity target and towards zero carbon ambition'; Telstra (2020), 'Carbon neutral from this year, enabling 100% renewable energy by 2025, and reducing absolute emissions 50% by 2030—we're acting on climate change'; Telstra (2020), 'Carbon neutral from this year, enabling 100% renewable energy by 2025, and reducing absolute emissions 50% by 2030—we're acting on climate change'.

In reality, this usually means a company purchases enough renewable energy or renewable energy certificates over a year to cover its electricity use, but this is not necessarily matched with consumption over specific periods or within specific geographies.

To achieve these commitments, data centre providers are becoming the leading corporate buyers of Power Purchase Agreements (PPAs) globally, enabling them to secure renewable electricity at a certain price through either a third party or directly with a generator.[35] This agreement essentially underwrites the renewable project and provides it with financial certainty, reducing developer risk and ensuring the project reaches development stage. Procuring clean energy can take many forms, as explained in Figure 12.

Figure 12: **Approaches to the procurement of green energy**




Customers can procure a REC or Renewable Electricity Guarantee of Origin (REGO) directly from the producer or from the market. These certify that the bearer owns one MWh of electricity generated from renewable sources.

A physical PPA is a multi-year contract between producer and customer whereby the PPA underwrites new generation by delivering an agreed volume of electricity at a pre-agreed price (avoiding market price volatility). The PPA can either be direct with a generator, or sleeved via a retailer.

On-site/near-site renewable energy installation owned by the customer. The option is feasible when there is availability of space and conditions supporting renewable energy generation near customer.

Over the past 5 years, data centre developers, along with telcos and other data centre users, have signed over 5 TWh of PPAs in Australia, with this capacity becoming fully operational over time.[36] In 2030, Australian data centre power consumption is forecast to reach approximately 10 TWh. Therefore, significant new renewable energy generation and storage capacity will need to be contracted and delivered to keep pace with the data centre buildout. A failure to overcome persistent barriers to the financing, delivery and connection of new renewable generation projects in the NEM would create a risk of a temporal mismatch between data centre demand and firmed renewable generation.

As explored in 'Section 3: Potential for innovation', the introduction of Renewable Energy Guarantee of Origin Certificates (REGOs) in late 2025 as part of the Future Made in Australia (Guarantee of Origin) Act 2024, will introduce new dynamics to the market, allowing for 24/7 time matching of renewable supply.

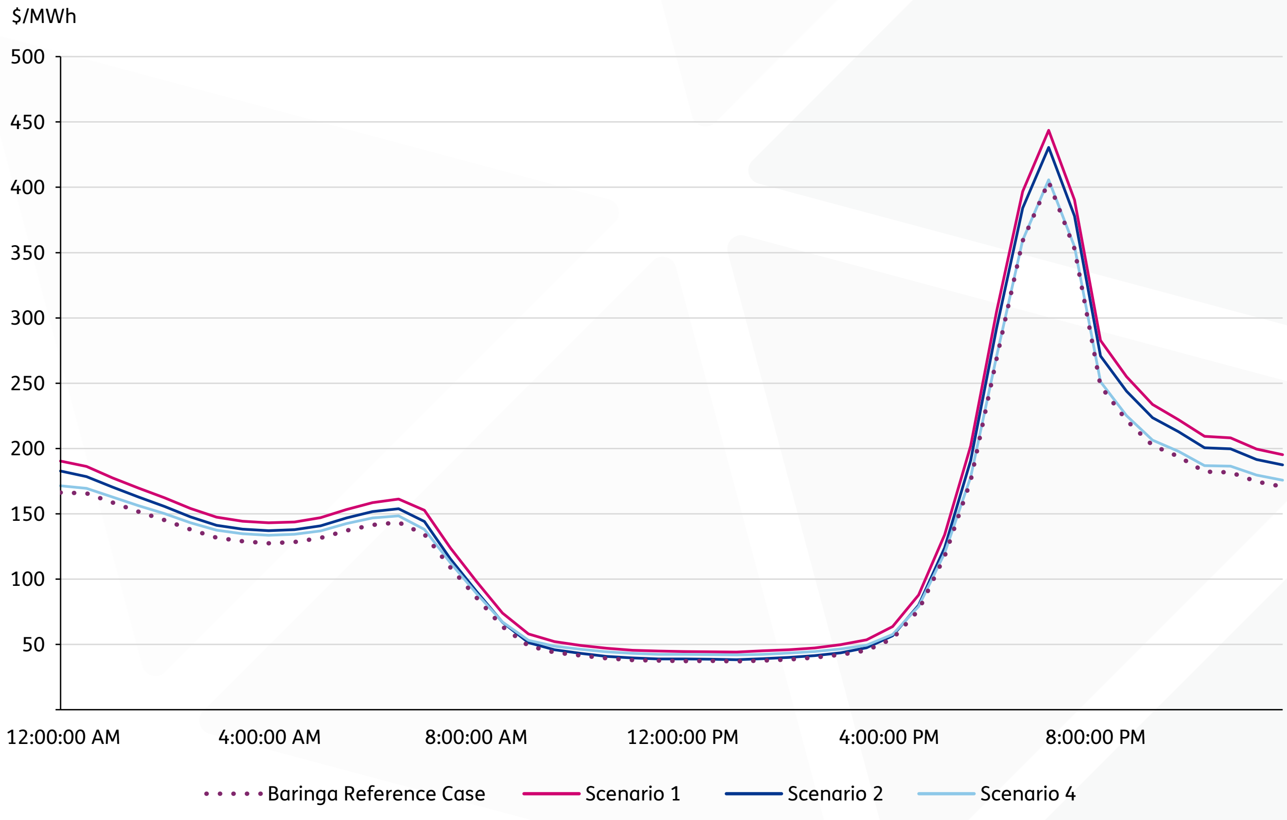
In the Baseline scenario, 36 GW of wind and 19 GW of solar capacity are built by 2035 to meet demand. To meet the additional data centre demand in the central case above and beyond the Reference Case with renewable generation, an additional 1.5 GW of solar and 1.7 GW of wind capacity would be required.

**35** International Energy Agency (2025) Data Centres and Data Transmission Networks.
**36** Calculation completed using publicly available data

Matching data centre demand with additional renewables would significantly reduce price impacts in 2035, limiting price increases to 7% and 6% for NSW and VIC respectively, a significant reduction compared to when data centres are built without any additional renewables.

As illustrated by Figure 13, it is possible to further mitigate the impacts by matching data centre load with grid-scale storage solutions as well as renewable generation. This additional storage would draw excess renewable generation during the middle of the day, and discharge during the peak, lowering the peak electricity price. This results in a strategy where there is a greater 'match' between load and generation, similar to the 24/7 matching initiatives announced by Google and Microsoft which they expect to implement in Australia by 2030, thereby reducing the need for more expensive peaking generators as illustrated in Figure 9.[37]
In fact, by 2030, during the 7 pm peak, our modelled scenario of renewable generation and additional storage (scenario 4) leads to a negligible price increase, as opposed to a 10% increase in a scenario without any additional generation or storage. This reduces load-weighted price impacts to 3% in NSW and 2% in VIC by 2035, equivalent to $1.59 and $2.58/MWh increase per GW of additional data centre capacity relative to the Baseline. However, prices do remain higher than the baseline due to higher overnight prices, particularly in the early morning, where renewable output tends to be low.

Figure 13: **Intraday price shape impacts in NSW in 2030***




* Figure 13 is primarily designed to illustrate the negligible impact of scenario 4 on peak prices which is why not all scenarios have been included.

37 Google (2025) 'Operating Sustainably'; Noelle Walsh (2021) 'Supporting our customers on the path to net zero: The Microsoft cloud and decarbonization'.

The storage scenarios were modelled to illustrate the impact of flexibility on prices and grid emissions. In this scenario, it was assumed the storage was grid connected, but similar outcomes would be seen with behind-the-meter solutions.

In addition to flexing data centre load via the use of grid-scale batteries, data centres may be able to flex an additional portion of their load through initiatives such as workload shifting—delaying non-urgent tasks to off-peak periods, or by location shifting, moving workload to leverage grids with lower carbon intensity. Demand response can also be facilitated by participation in Virtual Power Plants (VPPs). Data centres can potentially utilise their backup generators, Uninterruptible Power Supply batteries (UPS), turn down HVAC systems or flex some IT load to provide grid services during peak demand or through specific price or frequency events, as explored further in 'Section 3: Potential for innovation'. Baringa estimates that shifting a further 10% of load away from peak periods would reduce costs by an additional 1% across both New South Wales and Victoria by 2035. A description of this modelling can be found in Appendix 1.

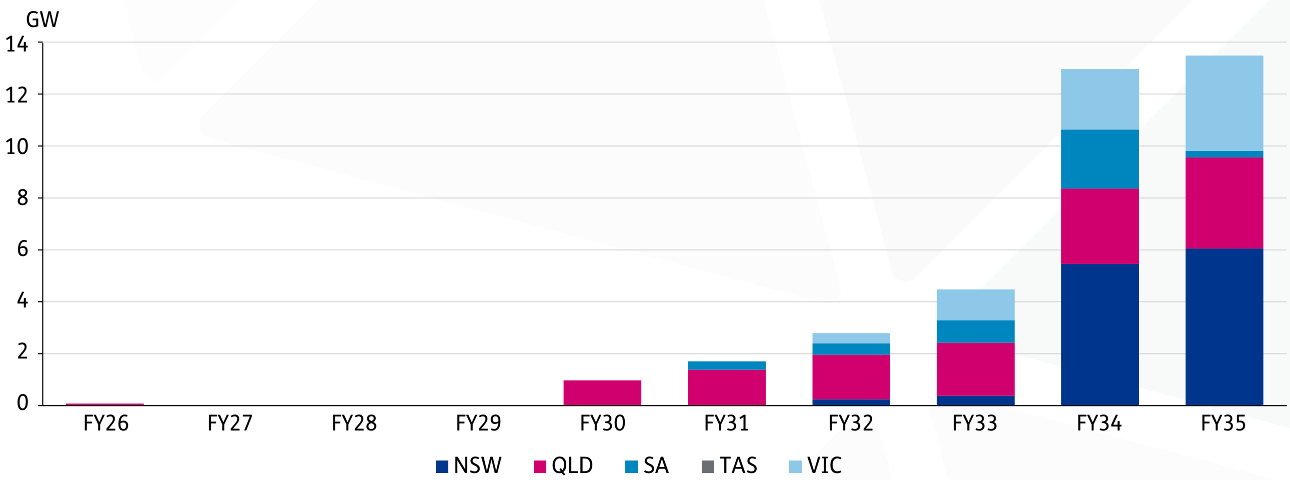
## Reliability

In addition to core market impacts, it is worth considering an assessment of grid reliability through the likelihood that the available supply can meet demand.

AEMO annually publish a report considering the likelihood of periods where the full electricity demand will not be met by generation—unserved energy, or 'USE'—via the Electricity Statement of Opportunities (ESOO) for the NEM.[38] This is a probabilistic analysis, which projects a certain 'shortfall' of capacity when the existing, committed and anticipated new plants do not meet demand in all periods and result in a USE above the reliability standards set.

In the most recent 2025 ESOO,[39] AEMO have included material new growth in data centre demand, which is broadly similar to the projections included in this report. With this new demand, AEMO found that reliability standards will be met to 2034-35 if federal and state government programs are delivered on time, and in full, alongside planned transmission and coordination of consumer energy resources. However, reliability gaps are forecast if only considering committed and anticipated projects. These gaps are to be expected, given it is uncommon for new generation projects to be committed more than 4 years ahead of commissioning. However, this does highlight the requirement for significant additional capacity build out into the future to maintain system reliability. Figure 14 below summarises AEMO's Committed and Anticipated Investments outlook results.

Figure 14: **Additional firm capacity required to meet the reliability standards in the 2025 ESOO, October update**[40]




38 AEMO (2025) "October 2025 Update to the 2025 Electricity Statement of Opportunities"

39 AEMO published the 2025 ESOO in August 2025, but updated it in October due to changes in thermal plant retirement

40 Up until 2027–28, the reliability gaps are measured against the IRM. Beyond this, reliability gaps are measured against the reliability standard.

Without adequate additional generation capacity, significant new data centre load could act to increase any forecast shortfall in reliability. Therefore, it is imperative that the significant investment in additional dispatchable and flexible capacity which is required is incentivised and enabled in the NEM to meet underlying demand growth and new data centre demand. Additionally, there is a risk that if inadequate new capacity is built, the retirement of thermal generation will be delayed and emissions from the NEM may increase.

## Regional and network impacts

This chapter so far has considered regional wholesale market impacts. Another important energy market impact is that of new load on the network.

As data centre connections increase, concerns have been raised that the transmission and distribution networks supporting urban hubs such as the Western Sydney corridor may become increasingly constrained. Other potential impacts may extend to reliability and impacts on availability of network capacity to other industries and consumers trying to undergo electrification due to increased data centre connections, which could increase decarbonisation costs.

On the other hand, data centres are beneficial and can be used to soak up locally curtailed renewable generation by adding load or acting as an 'anchor' facility for other beneficial infrastructure such as electric vehicle (EV) charging. Furthermore, the constant load of data centres supports grid security at times of minimum system load. By raising base grid demand, large-scale generators that provide critical system security services, such as inertia and system strength, can remain online to maintain a safe and resilient power system.

We look to illustrate the broader impacts of location with four case studies. Data centre locations are determined based on a wide range of factors in addition to the energy considerations explored in the previous chapter, 'Growth of data centres'. These include a nearby concentration of household and business activity, the availability of necessary infrastructure and workforce, their location within cloud availability zones, and the proximity to subsea cable landing points which allows them lower latency and better interconnectivity to most of their customers. We consider three types of location in our study—urban centres, regional and remote locations.

Traditionally, the key location for data centre capacity has been in urban centres, given it is close to customer needs and has benefits in terms of high reliability grid, skilled workforce and is within cloud availability zones. In particular, hyperscale and large colocation facilities are typically exclusively found in urban locations.

Increasingly, however, a combination of grid congestion and insufficient network capacity in urban locations has led data centre developers to start considering regional or remote locations. These locations are potentially attractive to some data centre operators with less stringent latency requirements, such as large, hyperscale data centres used for AI training. Regional and remote networks can often have lower reliability metrics (i.e. interruptions in minutes or occasions) than urban areas. Therefore, we assume that all regional and remote data centres are located in areas of strong network reliability, such as Renewable Energy Zones (REZ), under the assumption that network upgrades reach a suitable level of reliability in these locations. Notably, the additional data centre load could assist in alleviating network congestion in REZs by utilising some of the surplus renewable generation and reducing renewable curtailment in times of peak generation. Ultimately, however, the location of data centres alongside REZs is unlikely to be attractive to most data centre operators that do not have AI training workloads. Regional and remote data centres are unlikely to meet the stringent requirements of most hyperscale data centre operators and are unlikely to enable co-located data centre operators to meet the varying needs of their customers.

For each location, we comment on general suitability for data centres, the current available headroom and potential headroom constraints, and the efficient utilisation of renewable energy resources. Further details on the specific substations sampled and the headroom availability can be found in Appendix 3. Table 3 outlines the evaluation of the 4 locations this report examines across New South Wales and Queensland.

## Illustration of grid impacts in different locations

### Western Sydney

Western Sydney was chosen to represent an urban location, and currently hosts a significant portion of Australia's data centre capacity. It is a tier one location for all types of data centres and accompanying use cases. Notably, around half of the pipeline projects are planned to operate within Sydney, adding 2.6 GW of rated capacity to the grid in this area. This projected growth has caused some concern around the availability of resources such as land, energy and water in some areas. In response, the NSW Government recently imposed a ban on new data centre development in Macquarie Park, a Sydney suburb, to free up land for housing, although an extension of this policy has not been proposed.[41]

Strong advantages for Western Sydney stem from its proximity to workforce, fibre connectivity, subsea cables and infrastructure, meaning that this location is attractive for data centre development. In terms of general location suitability, Sydney has great access to fibre and cloud availability zones.

Available hosting capacity means it is suitable for all types of data centre, from smaller edge facilities to large hyperscale ones. However, the grid connection and land that data centres require could create issues surrounding competition for other industries either looking to electrify or be located within this industrial area.

Significant transmission connection headroom is currently available at Kemps Creek (>1100 MVA), although this would likely require the construction of step-down transformers from the high voltage 500/330 kV line. In addition, some distribution-level headroom across Homebush, Penrith and Mount Druitt makes this an attractive location compared with other urban areas. However, there are concerns that if the pipeline continues to be concentrated in this area, it could cause significant reliability issues and constraints. Data centre growth in these regions is driving network expansion. For example, Transgrid (TNSP) and Endeavour Energy (DNSP) have identified that the data centre growth planned for the region will require the upgrade of the constrained Sydney West bulk supply point.[42]

In locations like Western Sydney, efficient use of headroom is particularly valuable. Consideration of how future developments can lessen their grid impacts through flexibility is explored in the 'Potential for innovation' chapter. Data centres can also contribute to community benefit by covering a material part of upgrade costs and supplying shared infrastructure such as EV charging, as discussed later in this report.

Highly urban locations are unlikely to have large volumes of colocated renewable generation, and utilisation of otherwise curtailed generation is relatively low. However, there may be an opportunity to utilise distribution-connected smaller scale renewables. For example, Endeavour Energy is trialling the concept of a distribution-level REZ at Eastern Creek, in Western Sydney.[43]

### Hunter-Central Coast REZ

Hunter-Central Coast REZ is located in a regional area, characterised by proximity to cities and towns, but outside of state capitals. This area would be broadly comparable to the Illawarra (NSW), Central Highlands (VIC) or Gippsland (VIC) REZs, for example.

The Hunter-Central Coast REZ may offer future opportunities for data centre development, given its proximity to Sydney and expanding fibre interconnectivity. This area may be suited to large hyperscalers undertaking AI training activities, which can tolerate greater latency. Colocators may find it more challenging to locate here due to the varying needs of their customers, some of whom are likely to require low latency. For the same reasons, an area like this would be unsuitable for hyperscale facilities running services which require high degrees of human interaction (see Appendix 2), unless populations and economic activity shifts to these regions over time.

41 The NSW Government has announced a ban on new data centres in Macquarie Park, a suburb of Sydney, however a wider-reaching ban has not been proposed.
42 Transgrid (2024) 'Maintaining reliable supply to Western Sydney: RIT-T Project Assessment Conclusions Report'.
43 Endeavour Energy (2024) 'Powering Western Sydney'.

Areas like the Hunter-Central Coast offer good infrastructure along with limited land competition. Similarly, future data centres located in this area, or other new data centre hubs with associated infrastructure could help to create jobs and stimulate the wider economy.

There is suitable headroom at some substations across the transmission network to accommodate large data centre load, and this is expected to increase materially by 2030 with the closure of Eraring Power Station. In addition, the distribution network upgrade planned as part of the REZ, and the number of new generation projects in the region, mean a low likelihood of network constraints.

In fact, locating large data centre load on a main distribution line between the Upper Hunter renewables projects and Newcastle and the transmission backbone may unlock additional renewable capacity. Indicatively, Baringa estimates that an additional 200 MW data centre load may unlock an additional 90 MW of solar and 170 MW of wind.[44] This is due to an increase in generation capacity required to service the increase in baseload demand. Locating load and generation within the right areas of the network can also help to balance supply and demand locally, reducing the need for long-distance transmission and reducing the stress on high-voltage lines. It also helps to reduce transmission losses, making the grid more efficient.

## South-West REZ

The South-West REZ is chosen to illustrate a remote area with significant planned renewable energy capacity and minimal land constraints. A similar area would be the New England REZ, for example.

Current headroom in the South-West REZ is minimal, given the zone is dependent on two new transmission lines, Project EnergyConnect (2027) and the Victoria to NSW Interconnector West (2029), with HumeLink (2029) also playing a role in supporting NSW network strength. The main focus of transmission buildout in this area is to enable renewable capacity to connect, increase transfer capacity between states and reduce congestion on line flows north from southern NSW. The network in the region is currently constrained, with limitations on the flow from southern NSW to major demand centres around Sydney causing instances of counter-price flows between NSW and Victoria (where NSW exports to Victoria in periods when the power price in NSW is greater than in Victoria) which result in negative inter-regional settlements residue which are recovered from consumers.

In April 2025, four projects were awarded the right to connect to power lines within this REZ, totalling over 3.65 GW with a mix of wind, solar, and battery technology. Large new loads such as data centres have not been considered as part of the access rights process, but could help to unlock additional capacity in the REZ.

Additional demand in the region could in addition reduce network congestion, reducing the curtailment risk of renewables in southern NSW, and reducing the frequency and depth of negative inter-regional settlements residue.

Despite this, there are significant obstacles to locating data centres in the South-West REZ. The remote nature of this location means it would only be suitable for certain data centre activity, such as AI learning and small edge data centres which are not subject to the same latency and proximity issues as other use cases. It would also require the development of a cloud availability zone, a critical part of data centre infrastructure. Currently, cloud availability zones are only located in existing data centre hubs in Sydney, Canberra and Melbourne, with a private fibre connection established by AWS between the Sydney cloud availability zone and Perth to facilitate lower latency.[45] These cloud availability zones require good fibre connections, as well as a critical mass of data centres to be viable. Significant investment in a hub would be required and even then, may be challenging to achieve due to latency issues. The distance to subsea cable landing points and workforce constraints would also need to be considered further. Between 40–60% of the data centre workforce are highly skilled jobs, for which there is a national shortage, meaning it is likely to be difficult to attract workers to more remote areas.

**44** Example addition includes a flat data centre load of 200 MW, met with a portfolio consisting of 40% solar generation and 60% wind generation. The portfolio is limited in its generation by the 4% curtailment limit set by EnergyCo's access rights.
**45** TeleGeography (2025) 'Cloud Infrastructure Map'; AWS (2025) 'AWS Local Zones features'.

## Brisbane North

Brisbane North is likely to host additional data centre capacity in the future, primarily through the Supernode development. With suitable headroom available in both its transmission and distribution networks, Brisbane North may provide significant opportunity for future development given its proximity to population and infrastructure, meaning it could be a suitable location for all types of data centres, albeit on a smaller scale than the tier one hubs in Melbourne and Sydney.

Unlike the REZ locations, Brisbane North would not have a material impact on curtailed renewables, with generation predominantly coming from North Queensland down to Brisbane.

Moving forward, this location could help to alleviate constraints on networks across Sydney and Melbourne. As a result, this could help to alleviate network congestion and decarbonisation costs in Australia's current hubs. However, consideration should be given to electrification of other industries within the network, allowing others to electrify simultaneously to data centres coming online in this area.

Table 3: **Summary network impacts of placing data centres in location types across Australia**

| | Location suitability | | | | | | Headroom utilisation | Renewable utilisation |
|---|---|---|---|---|---|---|---|---|
| | Fibre connectivity | Proximity to infrastructure | Proximity to skilled workforce | Proximity to population | Proximity to cloud availability zones | Local availability | | |
| **Western Sydney (urban)** | Attractive | Attractive | Attractive | Attractive | Attractive | Medium | Medium | Medium |
| **Hunter Central-Coast REZ (regional)** | Attractive | Medium | Medium | Medium | Medium | Attractive | Attractive | Attractive |
| **South-West REZ (remote)** | Very low attractiveness | Very low attractiveness | Very low attractiveness | Very low attractiveness | Very low attractiveness | Attractive | Medium | Attractive |
| **Brisbane North (urban non-established)** | Attractive | Attractive | Attractive | Attractive | Medium | Attractive | Medium | Medium |

**Key**

Attractive Medium Very low attractiveness

## Network upgrade costs

Finally, in addition to the location-specific impacts of data centres, it is important to note the role data centres can play in improving local network infrastructure through part-funding network upgrades. When large loads like data centres connect to the grid, there may be a requirement for new augmentation to enable their connection. The costs of assets used exclusively by the data centre itself are fully or largely recovered from the data centre directly.[46] To the extent that augmentations are required in the shared network, the data centre may partly fund these upgrades with the funding arrangements differing between distribution and transmission connections.

**46** The exact amount of cost recovery varies across networks, but Baringa expect this to be in the range of 80-90% based on discussions with networks and data centre developers

## Section 3

# Potential for innovation

## Chapter overview:

This chapter explores the role data centres can play in becoming dynamic, flexible energy assets of the future through the incentivisation and use of innovation.

**Additional clean energy generation and procurement could significantly reduce the impacts of additional data centre demand.** Investors, data centre operators and customers all have a role to play in ensuring data centres are making and fulfilling requirements to procure 100% clean energy.

**The rapid deployment of battery energy storage systems in Australia presents an opportunity to increase the flexibility of data centre demand.** On-site battery storage or storage strategically located on the network can reduce price and emission impacts, alleviate network impacts, enable flexible grid connections and provide a viable alternative to fossil fuel backup generation. The acceleration and participation of data centres in VPPs is an additional way to optimise benefits for all.

**Significant advancements have been made in energy efficiency and cooling techniques, leading to a reduction in Power Usage Effectiveness (PUE), the ratio of total infrastructure load to IT load, in recent years.** In the future, liquid and immersive cooling, AI-driven efficiencies and advanced chip technology are all expected to create efficiencies. These efficiencies will be crucial in mitigating the impact of rapid data centre demand growth on the grid. The implementation of minimum PUE requirements by investors and policymakers can help to ensure market-leading technology is implemented in new developments.

**Beyond immediate impacts on operations, data centres can also potentially provide broader community benefits.** Consideration should be given to the effective use of waste heat for either residential or industrial heat processes as well as exploring ways in which local communities can benefit from shared grid infrastructure, either by utilising headroom or providing services such as EV charging for example.

**Investors, data centre operators, customers and policymakers all have an important role to play in encouraging innovation** to enable data centres to alleviate impacts and become flexible energy assets of the future.

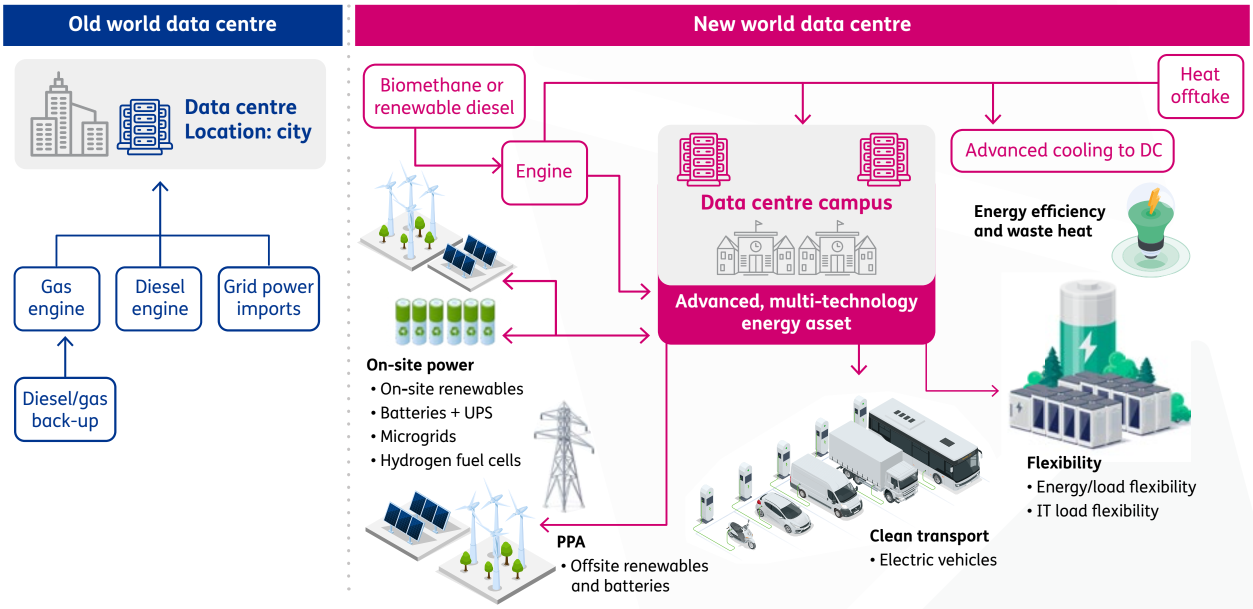
Data centres are critical infrastructure that will underpin the digital economy of the future. With demand set to soar, innovation in data centre design, operation and integration with broader energy systems will be critical. This chapter explores the key areas of potential innovation, including energy efficiency, renewable integration, and demand flexibility. It will also explore the opportunities for data centres to provide wider community benefits for other energy users. The goal of this innovation is to minimise environmental impacts whilst maintaining the high performance and reliability needed for modern data centre operations.

As noted elsewhere in this report, AI has the potential to enable great innovations across the energy sector, leading to more efficient operations at generation plants and integration of renewables into the grid, for example. Whilst it is important to understand this potential and how that may offset other risks associated with data centre growth, this report is focused on the potential for innovation to minimise the market and network risks highlighted in the previous chapter 'Power market and grid impacts of data centre growth'.

Data centres are pivotal in the growth of the digital economy. To support rapid escalation in demand while supporting an efficient electricity grid, they must evolve into dynamically flexible energy consumers.

As noted in the previous chapter 'Power market and grid impacts of data centre growth', increasing generation and storage alongside increased data centre demand can significantly reduce the impacts noted, and is wholly achievable now with the right incentives.

Figure 15: **Potential data centre innovations**




## On-site generation and load flexibility

On-site renewable energy solutions such as solar panels and wind turbines, can help data centres mitigate grid dependence and impacts along with emissions, but space constraints often make this solution difficult to implement in existing hubs. The inclusion of battery storage systems further complements renewables, enabling data centres to utilise power generated on-site even during periods of limited energy production.

When colocated on-site and connected behind-the-meter, BESS can provide several additional benefits. They reduce load at the connection point, provide grid services if also grid-connected and alleviate network constraints, and potentially act as backup power, as well as reducing net system load. This makes them more valuable to mitigate system impacts, but space required to colocate a BESS can be challenging, particularly for urban locations. The Quinbrook Supernode project is an example of hyperscale campus (up to 800 MW) with colocated BESS (760 MW/3096 MWh), illustrating the potential for sustainable data centre development, when space is not constrained.

Rising electricity prices, falling solar and battery costs and the ability to revenue stack and access additional value streams such as wholesale arbitrage, demand response and grid services like frequency control are key economic drivers and help to ensure options are not only technically feasible but also make economic sense. Emissions reduction incentives like avoided carbon costs or the ability to attract low-cost finance through sustainable development are also key incentives.

On-site generation technology may be owned by the data centre owner, or could be owned and operated by a third party. The operations in the energy market, and maintenance of the asset may also be done by the owner directly, or via a third party with deep technical expertise. For example, the data centre may own the storage asset but contract with a third party to optimise dispatch and bid the flexibility into the energy market to monetise benefits or reduce impact on the grid.

Data centres are ideal for VPP participation. In addition to potential installation of on-site BESS, they also have backup generators, UPS batteries, HVAC systems, and some IT load flexibility. Their continuous operation and built-in infrastructure allow them to provide grid services during peak demand (when they can reduce their load) or through specific price or frequency events (when they can dispatch their on-site generation and storage into the energy and FCAS markets). Data centre VPP models typically use an Energy Management System (EMS) to aggregate and schedule battery discharge, generators, and flexible loads into day-ahead and real-time demand response and energy markets.

Digital Realty has two data centres in Australia offering grid services via their UPS generators and batteries as part of a VPP and Enel X has 70 MW of data centre load under contract with data centres being a key focus of VPP programs in Australia.[47]

As detailed in the 'Power market and grid impacts of data centre growth' chapter of this report, the inclusion of four-hour BESS alongside additional renewables decreases the price impact of data centres by storing excess renewables and discharging energy at periods of peak prices, reducing net load on the system.

To achieve these wholesale market benefits, storage can also be located offsite, with data centre owners underwriting new storage development. The deployment of batteries has been growing steadily. They currently contribute about 1.3% of the supply mix.[48] However, Baringa forecasts that storage capacity (battery, virtual power plants and pumped hydro) across the NEM will need to increase significantly to 35 GW by 2034–35. Due to their lower land constraints and more flexible output, BESS often have shorter lead times for development than large-scale renewables and it may be easier to accelerate the deployment of these than new renewables.

Offsite BESS would typically be owned and operated by a third party, with the data centre signing a financial contract to provide the owner with a degree of revenue certainty. These may be virtual 'tolls', capacity swaps, or revenue-sharing agreements, with revenue certainty providing the owner with a means to lower the cost of capital for the project, similar to the model employed for renewable generation.

### Demand flexibility through on-site generation or storage

On-site generation or storage can be used to fully offset data centre capacity without disruption. For example, Verrus in the United States have recently demonstrated it is possible to curtail data centre load by up to 100% within one minute of receiving a signal from the utility. The data centres do so by transitioning to using power from on-site utility-scale batteries, automatically and without interruptions.[49]

Demand flexibility supported by on-site generation or storage could be an essential grid management tool if enabled by innovative flexible grid connection agreements that alleviate pressure at times of maximum grid constraint, reducing the need for expensive network augmentation. Under a flexible grid connection agreement, a data centre developer agrees to either ramp up capacity over a period or commit to a defined portion of the load that can be operated flexibly for a limited period. Data centres could enable this flexibility using behind-the-meter or strategically located nearby BESS, on-site diesel generators or their UPS. This is likely to be an effective way of enabling and accelerating grid connections, with some networks already actively exploring this option.

## Backup power systems in data centres

Data centres are critical infrastructures that house servers and other IT equipment, enabling the functioning of countless digital services. Because of their critical role, data centres require robust backup power systems to ensure continuity in the event of power outages. A power interruption lasting even a few seconds can result in significant downtime, data loss, and loss of service reliability. To mitigate such risks, backup power systems are deployed to seamlessly take over when the main electricity supply is disrupted.

### Types of backup power systems

The most commonly used backup power systems in data centres include UPS and diesel or gas-powered generators. UPS provide an immediate power supply when the primary source fails, preventing disruptions by bridging the gap until generators or secondary sources can take over. These systems commonly use batteries, though newer supercapacitors or flywheel-based systems are emerging as alternative solutions due to their longer lifespan and reliability.

47 Luke Upton (2021) 'Ask the expert – how VPP platforms offer a world of opportunities'.
48 AEMO (2025) 'Quarterly Energy Dynamics Q1 2025
49 Bianca Giacobone (2025) 'Verrus successfully demos its flexible data center technology'.

Diesel generators are widely deployed in contemporary data centres because of their reliability and ability to generate substantial amounts of electricity on demand. Diesel can be substituted for renewable diesel to cut emissions. Gas-powered generators are an alternative, utilising natural gas or alternative biofuels (such as biomethane). Advances in hydrogen fuel cells are also being explored as a substitute for traditional backup systems, providing not only reliability but also a cleaner energy source. Many data centres adopt a layered approach, combining these elements to ensure a cascade of redundancy and significantly mitigating the risk of outages.

## Decarbonising backup generation

While backup power systems ensure operational reliability, they also pose environmental challenges. To align with global decarbonisation strategies and achieve sustainability targets, data centres are beginning to explore innovative approaches to reduce their carbon footprint.

To make backup systems more sustainable, further incentives should be explored in Australia to incentivise alternative options such as biofuels like renewable diesel (also known as Hydrotreated vegetable oil, HVO) or hydrogen fuel cells, which significantly reduce emissions compared to traditional fossil fuels. Both HVO and hydrogen fuel cells are being trialled in certain facilities as a sustainable backup power option, though the adoption of hydrogen fuel cells in particular is still in early stages due to cost and infrastructure requirements.[50] Microgrids also offer a low-carbon alternative to enhance resilience. These systems often combine local renewable energy production with battery storage and traditional backup generators to provide a redundant and sustainable power supply.

By combining technological advancements and strategic renewable energy integration, the data centre industry can maintain reliability while contributing towards a low-carbon future.

## Renewable energy procurement

As shown in the previous chapter 'Power market and grid impacts of data centre growth', a key aspect of ensuring large new load does not impact electricity prices and emissions is the acceleration of new renewable energy and storage projects to meet this load. Data centre owners and customers globally have been driving this through their procurement practices, sustainability strategies and targets, or government-mandated requirements. The most common method in Australia to date has been signing direct PPAs with generation. This provides a level of revenue certainty for the project, and can support competitive financing. Further innovation can come through enhanced standards, or through de-risking development.

50 Rolls-Royce (2024) Sustainable data protection: EcoDataCenter in Sweden relies on mtu backup generators from Rolls-Royce that run on HVO fuel | Rolls-Royce; S&P Global (2024), Meta pilots renewable diesel use for power generation in Ireland | S&P Global; Microsoft (2024) Microsoft announces pioneering green hydrogen pilot project with ESB.

Table 4: **Selected data centre players' clean energy and decarbonisation commitments**

| Company | Estimated global data centre capacity (MW)[51] | Target year for net zero emissions | Target year for 100% renewable energy[52] | Target year for 24/7 carbon-free energy |
|---|---|---|---|---|
| **Meta**[53] | 9,780 | 2030 | 2020 | – |
| **Google**[54] | 8,960 | 2030 | 2017 | 2030 |
| **Amazon**[55] | 7,660 | 2040 | 2023 | – |
| **Microsoft**[56] | 6,970 | 2030 | 2025 | 2030 |
| **CDC**[57] | 2,296 | 2030 | – | – |
| **Equinix**[58] | 1,850 | 2040 | 2030 | – |
| **AirTrunk**[59] | 1,440 | 2030 | 2030 | – |
| **Apple**[60] | 1,240 | 2020 | 2018 | – |

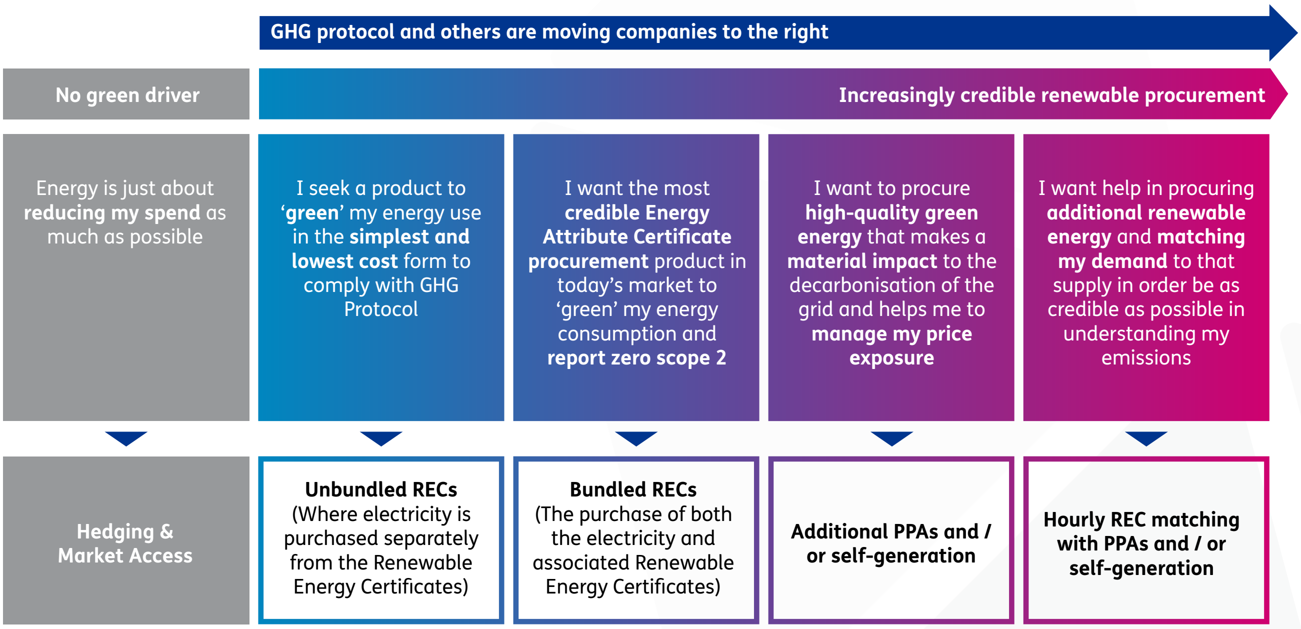
## Innovation in green standards

Green standards can reduce the impact on prices and emissions by going beyond annual matching of green certificates. More innovative and rigorous green standards can encourage clean energy generation to be built and dispatched. Standards such as Google's 24/7 Carbon Free Energy, or the consideration of abatement of carbon emissions at the time of demand will encourage flexible low-carbon generation. However, strictly adhering to these standards can greatly increase the cost of serving load.

Colocation providers can face complexity in defining the green standards they will commit to and deliver on. As shown by Figure 16, data centre end customers can have differing requirements in terms of sustainability and green energy procurement. With some customers contracting for only 1–2 years, there is likely to be a mix of different green requirements from customers using a colocation facility at any given point, and therefore limited visibility of green needs for the full duration of a long-term PPA (typically over 10 years) required to underwrite additional generation. This tenor risk and definition mismatch can lead to hesitation from data centre providers to fully offset their demand with renewable energy PPAs.

51 International Energy Agency (2025) 'Energy and AI'.
52 If a company has already achieved its target of 100% renewable electricity, the year in which it achieved this target is shown in this column. Companies that offer customers the option of using 100% renewable electricity are not deemed to have met this threshold unless all customers have exercised this option.
53 Meta (2023) 'Our Path to Net Zero'.
54 Google (2025) 'Environmental Report 2025'.
55 Amazon (2025) 'Amazon Sustainability Report 2024'.
56 Microsoft (2025) '2025 Environmental Sustainability Report'.
57 CDC (2024) 'Sustainability Report 2024'.
58 Equinix (2025) 'Equinix 2024 Sustainability Data Summary'.
59 AirTrunk (2024) 'Catalysing Change, Sustainability Report 2024'
60 Apple (2025) 'Environmental Progress Report 2025'.

Figure 16: **Renewable energy procurement approaches**




Commercial model development in this space could come from retailers or other intermediaries that have access to a larger portfolio of green generation and are therefore better equipped to manage flex in demand for green power. This would see the intermediary signing long-term additional PPAs with green generation and managing the risk of selling shorter-term contracts to data centres to match their load.

The introduction of REGOs in late 2025 as part of the Future Made in Australia (Guarantee of Origin) Act 2025 (GO Act), introduces new dynamics to the market, allowing for 24/7 time matching of renewable supply. REGOs will work alongside LGCs from their introduction before replacing them at the sunset of the Renewable Energy Target (RET) after 2030. REGOs are intended to provide greater flexibility and transparency to the market and meet the needs of a growing secondary market (i.e. the voluntary surrender market) that was not foreseen at the time the RET scheme was introduced. This includes time-stamping of certificates intended to enable price differentiation for REGOs (and eligible storage) that operate in low renewable production periods. This is especially important to data centre players, a number of which have public 24/7 time matching targets (see Table 4 above).

### De-risking or accelerating development

Partnerships between data centre developers and renewable energy developers could be considered to reduce development risk. This may include a degree of coordination or visibility between the development of load and generation in similar parts of the network, thus improving network outcomes and possibly reducing development timelines.

## IT load flexibility

In addition to energy flexibility, IT load shifting and dynamic workload shifting can also play an important role in providing flexibility and minimising the peak load impact on the grid and prices.

IT load shifting involves moving non-critical computing tasks to times of high renewable output or low grid stress, whereas dynamic workload distribution enables the geographical redistribution of computing tasks based on energy availability, carbon intensity and pricing.

Google's Carbon Aware Computing, introduced in 2021, initially focused on shifting non-essential IT tasks such as software builds and testing, YouTube video processing, data backup and redundancy and large-scale model training to different times of the day within the same data centre.[61] However, recent innovations have led data centre operators to test the feasibility of shifting loads around the world to maximise the availability of renewable energy.

US-based Cirrus Nexus successfully shifted its computing load[62] from the Netherlands to the US West Coast and back again to maximise the availability of solar power. It found it could reduce computing emissions for certain workloads by 34%, as opposed to relying on servers in either location alone.

Whilst this technology is exciting and will no doubt play a role in flexing data centre demand, there are limits on its applicability. The ability to shift IT load varies across different types of data centres. While data centres that serve customers from a range of different locations may have the ability to shift load, it is much harder for colocation data centres for many reasons:

1. **Customer ownership of IT infrastructure:** In colocation data centres, tenants (not the operator) own and control the IT hardware and software, meaning data centre operators cannot independently shift workloads.
2. **Lack of centralised control:** Unlike hyperscalers (e.g. AWS, Microsoft, Google), colocation providers do not control or manage the applications or scheduling of workloads. Customers run different systems, with different priorities and regulations, making coordinated load shifting more complex.
3. **Diverse requirements across customers:** Colocation data centres host a mix of customers and industries, including finance, healthcare, and content delivery, each with unique latency, security, and compliance needs.
4. **No shared orchestration layer:** There is typically no unified software layer that can move workloads dynamically across customer servers, unlike in cloud platforms.

Whilst it is more challenging, solutions such as 'green' colocation services where providers offer incentives for flexible load, partnerships between colocation providers and large customers or aggregators could create opt-in flexibility programs to help remove barriers.

There are also general limitations around the amount of AI load that can be shifted. Industry data suggests that a low percentage (~20%) of AI data centre usage will be attributed to AI training in future. Therefore, the majority (~80%) will be AI inference, will need to be close to population and can't be as easily shifted.[63] Complexity around data sovereignty laws will also limit the type and amount of data that can be moved across regions.

While the data centre owner may be able to flex cooling energy usage for example, this ties very closely with usage pattern and processing requirements of the customers of that data centre. It is expected that any IT load flexing is predominantly driven by the customer of the data centre (particularly where they also own the facility as in the case of some hyperscale facilities). Further coordination between data centre operators and customers to determine the flexible potential of data centre loads as well as the development of innovative business models such as tiered pricing to incentivise flexibility may be one way to overcome these barriers.

61 Ana Radovanovic (2020) 'Our data centres now work harder when the sun shines and wind blows'.
62 Datacenterknowledge (2024) 'How 'Load Shifting' May Help Improve Data Center Sustainability'
63 Alavarez & Marsal (2025) 'Rethinking AI demand | Part 1: AI data centers are experiencing a surge of training demand – what happens when the surge is over?'.

## Energy efficiency

In addition to clean energy generation, energy efficiency should also be a key focus for data centre developers. Technology is available now to reduce energy use and the most sustainable energy is the energy not used. Cooling load can represent around 40% of the total energy consumption of a data centre and therefore has been a significant focus for innovation aimed at improving energy efficiency.[64]

### Impact of data centre design on power usage effectiveness

Data centre energy consumption and efficiency are closely tied to capacity. Larger facilities, such as hyperscale data centres, are designed for high-density data processing and house more high-density racks, resulting in a significantly larger IT power load than colocation data centres. Conversely, edge data centres operate at a much smaller scale, with lower IT power demands.

Power Usage Effectiveness (PUE), the ratio of total infrastructure load to IT load, is a key measure in data centres. It quantifies how efficiently a data centre uses energy—specifically, how much of the total energy is used by the IT equipment (servers, storage, networking) versus how much is consumed by overhead systems like cooling, lighting, and power distribution. A PUE of 1.0 means 100% of energy goes directly to computing—this is ideal but practically unattainable. A PUE of 1.5 means that for every 1 kW used by IT, 0.5 kW is used for cooling, lighting and other overhead systems.

Lower-capacity data centres require less IT power but are less efficient in terms of PUE. This disparity is largely due to economies of scale, as larger data centres benefit from more advanced cooling technologies and infrastructure efficiencies. Hyperscale data centres typically achieve a PUE of approximately 1.19, whereas smaller edge data centres may reach 1.91.[65] In 2023, Australia's average PUE was 1.44, slightly above the global average of 1.43.[66] A PUE of 1.3 was used for modelling purposes in this report to reflect the expectation of further efficiency gains in future.

Whilst developments have been made to lower the PUE, this has previously led to trade-offs with higher water use. Traditional evaporative cooling systems can reduce fan power and compressor use, improving PUE but consume significantly more water than alternative methods such as air cooling. Explored further below, innovative solutions like closed-loop liquid cooling and immersion cooling offer a path forward—achieving low PUE without compromising water sustainability.

It can also be assumed that the migration of energy-intensive on-site data processing to more efficient cloud services could lead to a reduction in energy use. However, this reduction is more than offset by the increased demand and use cases for data.

IT chips and data centre hardware have become significantly more powerful over time, enabling greater computational output per unit of energy consumed. Modern processors, such as Graphics Processing Units and AI accelerators, offer higher performance-per-watt ratios than older hardware, allowing data centres to process more workloads without a proportional increase in energy use. However, while this improves IT efficiency, it does not necessarily reduce PUE. That's because PUE measures the proportion of total facility energy that reaches IT equipment—not how efficiently that IT equipment performs. In fact, as IT hardware becomes denser and hotter, it can increase cooling demands. Therefore, while hardware innovation boosts computing efficiency and can lower emissions per workload, PUE remains largely a measure of how effectively the supporting infrastructure delivers power to the IT load, not how efficiently that load operates. Efficiencies in hardware are also offset by data processing requirements such as AI becoming more intense.

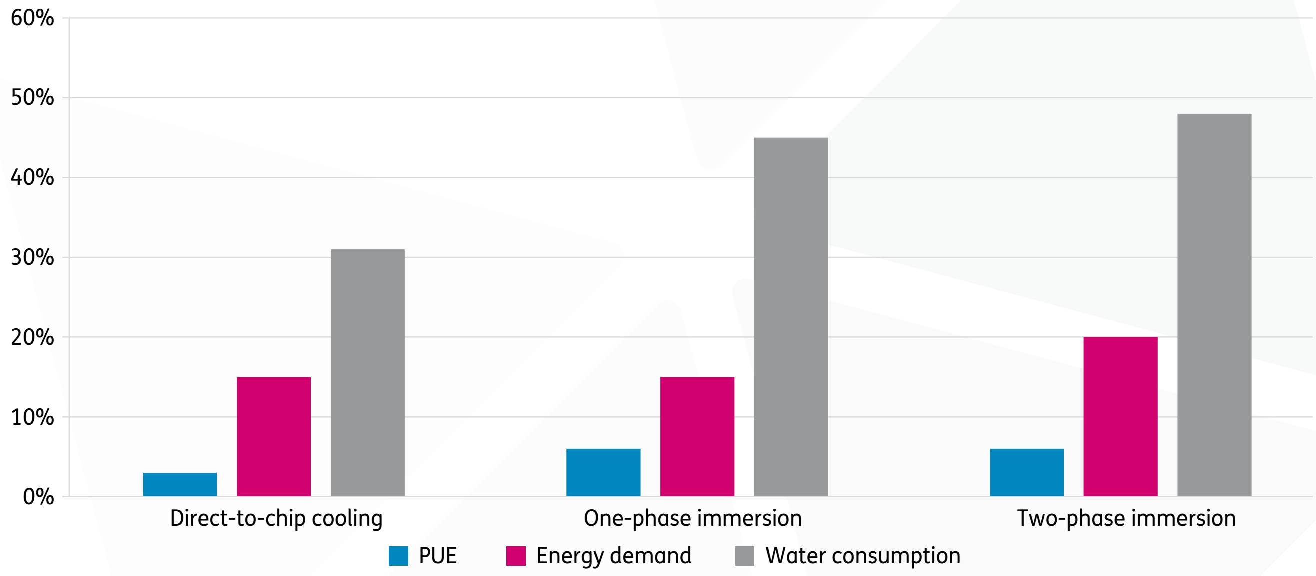
64 Australian Energy Council (2023) 'Data centres: A 24hr power source?'
65 Shehabi et al (2024) '2024 United States Data Center Energy Usage Report'.
66 International Energy Agency (2025) 'Energy and AI.

## Advancements in data centre cooling and energy efficiency

Innovation in data centre cooling has led to measurable reductions in energy consumption, enhancing PUE and reducing overall carbon emissions, albeit some solutions have been at the expense of additional water use. Advanced cooling technologies, including liquid and immersion cooling, offer efficient alternatives to traditional air-based methods, significantly lowering the energy required to maintain optimal server temperatures, whilst also having the potential to lower water use, compared to evaporative cooling methods.

Leading technology companies, including Microsoft and Google, are investing heavily in cooling innovation.[67] A recent study by Microsoft provided a comprehensive assessment of energy use and greenhouse gas emissions across four distinct data centre cooling techniques.[68] The research found that transitioning from air cooling to cold plate cooling, which directly cools data centre chips, could reduce emissions and energy demand by approximately 15% compared to traditional air-based cooling methods. This approach builds upon Microsoft's earlier project Natick, which explored the potential benefits of underwater data centres, demonstrating improvements in both energy efficiency and server reliability.[69]

Figure 17: **Impact on PUE, energy demand, water usage from new technologies**




Liquid cooling and immersion cooling are fast-growing innovations in data centre thermal management, driven by the rise of high-density computing (especially for AI and High-Performance Computing workloads). These technologies offer superior cooling efficiency compared to traditional air cooling, reducing energy use, water use and enabling greater compute density within the same footprint.

Liquid cooling uses chilled liquid—typically water or a dielectric coolant—to absorb heat directly from IT components like Central Processing Units and Graphics Processing Units. Liquid cooling techniques can include Direct-to-Chip (D2C) whereby cold plates are mounted directly on processors; coolant circulates through tubes to remove heat and rear-door heat exchangers which are mounted on the back of racks allowing hot air from servers to pass through a liquid-cooled coil.

67 Rich Miller (2023) 'Google developing new 'climate conscious' cooling tech to save water'.
68 Catherine Bolgar (2025) 'Microsoft quantifies environmental impacts of data center cooling from 'cradle to grave' in new Nature study'.
69 Rich Miller (2023) 'Google developing new 'climate conscious' cooling tech to save water'.

Immersion cooling submerges entire servers or components in a thermally conductive, non-conductive fluid (typically oil- or synthetic-based). Heat is transferred from components to the fluid, which is cooled via heat exchangers. Immersion cooling techniques can include single-phase whereby fluid stays liquid; heat is carried away via pumps and external heat exchangers and two-phase where fluid boils at low temperatures and heat is removed as the vapour condenses (more efficient, more complex).

Google has also leveraged AI-driven cooling management through its collaboration with DeepMind.[70] By integrating cloud-based AI, Google's data centres analyse sensor data every five minutes, optimising cooling system performance. This AI-powered approach has yielded an average 30% reduction in energy consumption, with further efficiency gains anticipated over time.

Large-scale savings of this magnitude may become less frequent in the future, but incremental efficiency improvements remain achievable across cooling and broader data centre operations.

Beyond cooling innovations, data centres are enhancing efficiency through next-generation servers, AI-enabled chips, and advanced software that facilitates server virtualisation, significantly improving utilisation rates and reducing energy demand. We expect this trend to continue, driven by the relatively low capital cost and rapid payback of these initiatives, as well as external requirements to ensure energy efficiency. For example, since July 2025, new data centre developments must achieve and maintain a 5-star National Australian Built Environment Rating System (NABERS) Energy for Data Centres rating or an equivalent environmental standard, such as a PUE of 1.4 or lower, to qualify for inclusion in the Australian Government Digital Transformation Agency Panel.[71] Facilities that fail to meet these criteria are not eligible for participation.

Data centre owners mostly own and operate these forms of energy efficiency technology because they are integrated into core data centre functions.

## Next-generation chips and compute architectures

AI-optimised chips will continue to evolve rapidly, focusing on improving energy efficiency and enabling real-world deployment of more complex AI models. Innovations like quantum computing may further revolutionise the field, potentially enabling unprecedented performance levels for AI in the coming decades. With growing demand for AI solutions and constant advancements in chip technology, AI-optimised chips are set to play a critical role in shaping the future of technology and innovation.

## Community benefits

Beyond reducing grid impacts, data centres can deliver wider community benefits by providing shared infrastructure. This could include repurposing waste heat from cooling systems or leveraging spare network capacity to provide community EV charge points.

### Use of waste heat

Heat produced from data centres is typically between 30–35 °C, making it suitable for use in heat networks and other industrial processes. This concept is being utilised already, with some countries setting targets for heat reuse.[72] Facebook's data centre in Odense was located and designed to recover and donate up to 100 GWh of waste energy each year, sending hot water directly into the city's heat network.[73] Equinix undertook a similar innovation at their PA10 data centre in Paris, providing 10 GWh of heat per year, free of charge for 15 years, which is being used to heat homes and leisure facilities, including the Olympic swimming pool in the Plaine Saulnier urban development zone.[74] Industrial uses have also been proven, in Lhasa, Tibet, a cooling system to utilise the waste heat from a data centre has been implemented, sending waste heat directly to aquaculture and agricultural facilities.[75] District heating networks are not as common in Australia as in other parts of the

70 Chris Gamble and Jim Gao (2018) 'Safety-first AI for autonomous data centre cooling and industrial control'.
71 Digital Transformation Agency (2023) 'New Data Centre Panel'.
72 Mitsubishi Electric (2024) 'Data Centres: Heat reuse for a low carbon future'.
73 International Renewable Energy Agency (2025) 'Overview of the status and impact of the innovation'.
74 Sean Michael Kerner and James Walker (2024) 'Paris 2024: Excess data center heat used to warm Olympic swimming pools'.
75 International Renewable Energy Agency (2025) 'Overview of the status and impact of the innovation'.

world, however, they could offer an opportunity in specific commercial or industrial hubs. For example, the Aerotropolis development in Sydney may provide an opportunity to consider the efficient use of waste heat, with the development of significant new urban facilities, including relevant industries such as manufacturing and light agriculture. Areas within Melbourne also provide an interesting use case for these services due to a colder climate and increased need for residential heating.

The inclusion of or retrofitting of waste heat recovery systems can be expensive and so incentives may be needed, particularly in retrofit scenarios. This would work alongside a number of established business models, whereby data centres can sell heat to existing heat networks, data centres can partner with energy service companies who provide and manage the infrastructure investment while data centres receive revenue from heat sales, or public private partnerships, whereby the government plays a role in incentivising data centres to integrate with urban heat networks, as demonstrated in London.[76]

### Use of additional network connection infrastructure

As previously mentioned, data centres often require additional network connection infrastructure. Due to the gradual increase in demand for services over the initial five or more years, this connection capacity may not be fully utilised. This may present an opportunity to accelerate the deployment of other electrification technologies, such as community EV charging points. This could be accomplished either by utilising EV chargers on the broader electricity network that benefit from the additional capacity provided by data centres, or by data centres themselves offering behind-the-meter charge points.

Examples of this are currently limited, with coordination required across network companies, energy retailers and the data centre owners to ensure success. Innovative business models for consideration could involve leasing of land or network hosting capacity, or an intermediary role for a utility to align community demand with available infrastructure.

## A vision for the future

The potential for data centres to become key assets in supporting grid flexibility and decarbonisation as their ability to shift both energy consumption and IT processing loads is becoming clearer. With the right incentives, digital infrastructure and operational practices, future data centres will integrate advanced technologies such as AI-driven energy optimisation, liquid and immersive cooling, real-time grid interaction, and on-site renewable generation and storage. These facilities may evolve beyond isolated IT hubs into dynamic energy and digital nodes that support grid stability, enable 24/7 clean energy usage, and provide critical resilience for communities. Data centres of tomorrow have the potential to be intelligent, low-carbon ecosystems that sit at the intersection of digital infrastructure and clean energy transformation.

As explored further in 'The role of policy in driving sustainable data centre growth' chapter—and highlighted by the Singapore case study below—a combination of policy incentives, financial benefits, advancing technology, and external pressures from customers, investors, and the market can push data centres to adopt sustainable operations. Sustainability should become a key differentiator in the data centre market, with ESG requirements incentivising customers and clients to increasingly prioritise environmentally-friendly operations. Client demands from corporations with sustainability goals preferring vendors with net-zero or low-carbon commitments and those demonstrating sustainable backup systems could provide a valuable competitive edge.

76 Mayor of London (2025) 'OPDC Announces Hemiko as development and funding partner for innovative New Heat Network'.

## Case study on Singapore's incentives for data centre efficiency and innovation

- To address the rising electricity demand from data centres and promote increased efficiency, Singapore has implemented a series of innovative policies and funding mechanisms that prioritise energy efficiency and green innovation in the sector.
- **Green Data Centre Roadmap:** The Singapore government released its Green Data Centre Roadmap in 2024.[77] The roadmap outlines specific targets over the next 10 years, which the government will aim to achieve through collaboration and support schemes with industry. The government aims to achieve PUE ≤1.3 and Water Usage Effectiveness of 2.0 $m^3$/MWh or lower for all data centres in the country.
- **Support for Innovation:** To accelerate data centres' energy efficiency and put in place best-in-class technologies, they have established some support schemes including:
  - **Energy efficiency grant:** New scheme offering up to $30,000 per company in the data centre sector to support their adoption of pre-approved energy-efficient IT equipment.
  - **Economic Development Board's enhanced Resource Efficiency Grant for Emissions:** Up to 50% of qualifying costs to support manufacturing facilities and data centres to undertake eligible emissions reduction projects to sustain competitiveness in a low-carbon future.
  - **Investment Allowance for Emissions Reduction:** Funding granted based on the capital expenditure incurred for energy-efficient or green data centre projects.
- **Capacity Allocation Tenders:** New data centres must compete for grid connection rights in Singapore, assessed against criteria including energy efficiency and sustainability best practices.[78] This process ensures that only projects demonstrating the highest environmental and economic value are approved, prioritising innovation in data centre operations.

77 Infocomm Media Development Authority (2025) 'Green Data Centre (DC) Roadmap'.
78 Infocomm Media Development Authority (2025) 'Four data centre proposals selected as part of pilot Data Centre Call for Application'.

## Section 4

# The role of policy in driving sustainable data centre growth

## Chapter overview:

The opportunities and challenges of data centre growth are now squarely on the policy agenda and a suite of responses are starting to be considered, developed and implemented. While many major data centre developers are already proactively managing their electricity system impacts voluntarily, it will be essential that the policy environment is fit-for-purpose to protect consumers from adverse impacts, while still attracting investment in the industry.

In particular, government can play a role in delivering:

- **Locational coordination:** driving data centre investment into locations with the network capacity to accommodate them, or regions which are otherwise strategic;
- **Clean energy:** incentivising and enabling data centres to bring new clean energy investment into the electricity market to reduce their impact on electricity prices and emissions;
- **Visibility:** improving transparency of the expected electricity load from data centres over time, to facilitate planning and manage network capacity;
- **System security:** ensuring the right system settings are in place to understand and manage any technical impacts of connecting large load, and incentivising demand flexibility.

Different actors are responsible for delivering these outcomes, and the Australian, State and Territory governments could play a role in providing coordinated direction for the sector, ensuring a consistent and clearly communicated position going forward.

While Australia's policy response must reflect its unique local context, there is an opportunity to learn from the numerous governments globally that have introduced or are developing policy responses. In this report, we have highlighted key measures introduced by Ireland, the EU, Singapore and the US state of Georgia, which illustrate four distinct approaches, noting there are many other examples abroad.

A range of policy levers could be implemented to drive sustainable growth in the data centre industry. **It will be important that governments and other actors in this sector take a coordinated, targeted and proportionate approach to policy decisions, developed in consultation with the data centre industry, electricity sector and end users.**

The preceding Chapters of this report have illustrated the potential growth of data centre load in Australia, the impacts this new load could have on the electricity sector and transition, and opportunities to mitigate these challenges and leverage innovation. In this Chapter, we explore the potential role of policy to manage the negative impacts of data centres (and large load, more generally) while unlocking the opportunities that come with enabling the growth of this industry.

As the impacts of data centre growth have emerged, a growing number of governments around the world have introduced, or are developing, policy responses to manage these impacts and drive more sustainable industry growth. Australia is now amongst the countries for which this policy area is gaining attention.

While blunt policy measures to temporarily put the brakes on new data centre investment have been implemented in areas including Amsterdam and Singapore, the scale and growth rate of data centre demand in Australia, relative to the scale of total demand, is substantially lower and such a response is not warranted at scale here.[79]

**79** The NSW Government has announced a ban on new data centres in Macquarie Park, a suburb of Sydney, however a wider-reaching ban has not been proposed.

With the right policy settings in place, governments can foster the sustainable development of this emerging industry in Australia to enable the benefits in terms of economic growth. At the same time, government can play a role in mitigating some of the impacts of data centre demand on electricity costs, network congestion and emissions, to reduce the impact on consumers and the environment.

In particular, policy levers can be used to deliver:

- **Locational coordination:** driving data centre investment into locations with the network capacity to accommodate them, or regions which are otherwise strategic;
- **Clean energy:** incentivising and enabling data centres to bring new clean energy investment into the electricity market to reduce their impact on electricity prices and emissions;
- **Visibility:** improving transparency of the expected electricity load from data centres over time, to facilitate planning and manage network capacity;
- **System security:** ensuring the right system settings are in place to understand and manage any technical impacts of connecting large load, and incentivising demand flexibility.

This is likely to require a suite of complementary, targeted policy measures. As governments, network businesses and others in the market assess and respond to the growth of data centre load, it will be important to deliver a coordinated and proportionate approach that does not deter investment. Policy measures should be developed in consultation with the data centre industry, electricity sector and end users.

Given overarching responsibility for telecommunications and emissions reduction, there may be a specific role for the Australian Government in providing top-down coordination, setting and communicating a clear pathway forward to accommodate data centre growth in Australia. For example, a national policy statement or a data centre roadmap, developed in consultation with state governments and other key stakeholders, could provide direction and certainty, particularly if developed and released in the near term.

We have compiled a non-exhaustive list of potential policy levers which governments and market bodies could consider to drive sustainable data centre growth, summarised in Figure 18 below. Blue shading indicates the key policy levers discussed in this chapter.

Figure 18: **Table identifying a range of policy levers against the targeted outcomes for sustainable data centre growth and the primary actors most likely to implement the policies. Blue shading indicates the policy levers discussed in this chapter.**

| Targeted outcomes | Actors | | |
|---|---|---|---|
| | Government (federal, state or territory) | Market bodies | Network service providers |
| Locational coordination | Access policy<br>Data centre hubs | Enhanced locational information | |
| Clean energy | Definition of 'Green' Data Centres for:<br>• Financing requirements<br>• Licencing requirements<br>• Planning approvals<br>• Government procurement | | |
| Visibility | Industry engagement | Regulatory framework review | Grid connection application transparency |
| System security | Innovation funding<br>Energy efficiency transparency | Access standards<br>Demand response market incentives | Grid connection agreements prerequisite requirements |

Any policy options pursued by governments or energy market bodies require further interrogation, detailed design work and extensive stakeholder consultation.

## Policy levers to drive locational coordination

Spatially concentrated data centre load growth (and indeed the concentrated growth of any large load) risks using available network headroom in certain parts of the electricity network and delaying or complicating the opportunity for other load to connect or expand. This is particularly an issue in the context of decarbonisation and electrification policy agendas. These would be expected to drive electricity load from other industries, which may find that the timeliness and cost of electrification are impacted by lower network availability.

On the flip side, in areas with network capacity available for new load, attracting data centres could be strategic to local economic development. Adding new load in targeted areas could likewise reduce grid congestion and 'unlock' more network for new renewable energy generation to connect. The opportunities and challenges of connecting data centre load into different locations are illustrated in the 'Power market and grid impacts of data centre growth' chapter of this report.

Policy levers can steer investment away from areas without available network capacity or that are otherwise unsuitable and towards preferable locations. These locations can be defined by a range of parameters, including electricity network capacity, capacity of water or other required amenities, strategic land use planning, or economic development plans.

Key policy levers which could be considered further to drive locational coordination include:

- **Enhanced locational information:** Energy market bodies (such as AEMO), network service providers (NSPs), or others could publish further information illustrating relative network availability for connection of new load, to assist in guiding data centre developers into preferable locations. Many NSPs already publish this data and efforts have previously been made to aggregate it, but improving the accessibility and suitability of this data in the context of data centres could support more informed investment decisions. This would be similar in intent to the Enhanced Locational Information report already published by AEMO, which covers the transmission network and aims to enable more informed regulatory and investment decisions with regard to generation.
- **Data centre hubs:** Government could proactively identify data centre hub locations with the right network capacity, land zoning and availability, water access, data fibre, proximity to workforce and other conditions to sustain data centre growth. The government could introduce incentives through the planning framework to attract data centre developers to these locations, such as making government-held land available or enabling fast-tracked planning assessments. There is precedent in Australia for governments establishing infrastructure hubs to attract investment to particular locations for other industries. At the global level, the US Department of Energy has recently identified 16 federally owned sites for data centre hubs with complementary policies to facilitate their development.[80]
- **Access policy:** If state governments identify value in attracting data centre developers into Renewable Energy Zones (REZs) there may be an opportunity to amend and leverage access policies to enable this. For example, measures could be considered to enable additional generation to connect into a REZ or particular grid location, above and beyond the volume that would otherwise have been able to connect in the applicable access arrangements, if it connects alongside a new large load. While this policy lever is worth exploration, its potential ultimately depends on government and generators having confidence the load will remain in the system for the duration of the access scheme.

Data centre developers will typically make their locational decisions based on a range of criteria, including access to electricity, data fibre, qualified workforce, and water, site accessibility, and timeliness of connection (with this final factor being

80 U.S. Department of Energy (2025) 'DOE identifies 16 federal sites across the country for data center and AI infrastructure development'.

a particularly important driver). Depending on the use case for the data centre, proximity to end users and thus low latency may be critical. For others, however, it will be possible to locate further afield if enough criteria are met. REZs near the major cities—such as the Hunter-Central Coast REZ in NSW and the Central Highlands REZ in VIC—may be worth exploring as options if regional data centre hubs are being considered.

Market sounding will be needed before introducing measures to attract data centres to more remote locations, like the South-West REZ in NSW. Even though there will be system benefits to locating large load in more remote regions, with the potential to unlock more renewable energy projects, there may not be sufficient viability of these locations to garner strong uptake.

## Policy levers to drive clean energy

The sustainable growth of the data centre industry in Australia presents significant opportunities for economic development while also posing challenges for the electricity system and emissions reductions. Our analysis indicates that rapid growth in data centre load has the potential to result in increased electricity prices and higher greenhouse gas emissions if not offset by the development of additional renewable energy generation and storage. This is not specific to data centre load, but an inherent result of load growth tightening electricity supply in the short term. This risk is illustrated in the 'Power market and grid impacts of data centre growth' chapter, along with the potential to mitigate the impacts with additional renewable electricity and storage investment and supply.

Policy levers could be considered to incentivise or require data centres to procure green and/or firm electricity supply when they come online, to mitigate the market impacts of their load. However, any decision to do so must be accompanied by measures to enable this clean energy procurement—if there are not enough new renewable energy projects being developed in line with the timelines for data centre development or expansion, it will not be possible for data centres to comply with any such requirements.

As identified in the 'Potential for innovation' chapter of this report, the more sophisticated data centre developers are implementing innovative approaches to clean energy procurement and decarbonisation voluntarily, and policy decisions should consider the incremental benefit of policy options within this context.

Key policy levers that could be considered further to drive clean energy include:

- **Green definition:** Government could develop and introduce a definition of a 'green data centre', to be revised over time as innovation progresses. This definition could then be adopted through policy levers to incentivise data centres to meet this 'green standard'—for example, it could be applied in decisions to procure services, allocate grants or finance, or used to prioritise planning assessments. Existing frameworks provide a useful starting point, such as the Australian Government's data centre requirements, which require any data centre hosting government workload to be five-star NABERS rated regardless of whether the government directly contracted with them or not. Over time, this type of framework could be adopted across state and local governments to significantly drive industry standards. The Australian Sustainable Finance Taxonomy also now includes data centres in its high-level classification of green buildings, setting clear criteria such as minimum energy performance (see the case study below).[81] Finally, the EU's green taxonomy provides a precedent for how governments can embed sustainability into both operational standards and financing decisions (see the EU case study below).

81 Australian Sustainable Finance Institute (2025) 'Australian Sustainable Finance Taxonomy'.

## Case study on Australian Sustainable Finance Taxonomy for data centres

The Australian Sustainable Finance Taxonomy published by the Australian Sustainable Finance Institute in June 2025 provides an Australia-specific framework to define and verify sustainability requirements for data centres. This taxonomy defines a green data centre as a facility that:

- Has an energy intensity (PUE) at or below the published target (published by ASFI);
- Has no fossil fuel combustion on-site;
- Uses 100% renewable energy; and
- Has systems in place to measure and monitor water use, optimises the use of water-efficient cooling systems and uses systems to recycle rainwater while reducing water usage.

- **Green electricity supply requirements:** Government could consider requiring that data centres achieve a 'green' standard to mitigate some of the market impacts of their load—as demonstrated by the PPA scenarios in the 'Power market and grid impacts of data centre growth' chapter—if voluntary commitments are deemed insufficient. For example, new or expanding data centres could be required or incentivised to deliver a certain level of additional green electricity (e.g. via PPAs) as a precondition of receiving planning approval or to be fast-tracked through connection processes. As described in the Irish case study below, Ireland has introduced an electricity supply requirement for new data centres which provides interesting precedent, though did not require green supply. Any decision to implement such a policy should be cognisant of the current challenges of delivering new renewable energy in a timely manner. One of the most important roles government can play in enabling green electricity procurement by data centres is to continue to support and accelerate the energy transition. Delays to deploying renewable energy due to transmission network limitations, for example, can present a barrier to data centres sourcing renewable energy PPAs at the scale needed to meet their growing demand.

## Case study on EU green standard for data centres

The European Union (EU) has introduced a framework to promote sustainable data centre operations, establishing a range of new mechanisms. One such mechanism, the EU Taxonomy Regulation, sets stringent requirements for data centres to align with sustainability goals as well as requiring increased transparency of data centre energy use.

**Green Financing Incentives:** To encourage sustainable development, the EU has established a Taxonomy Regulation that enables data centres meeting its sustainability criteria to access green bonds and other forms of sustainable finance.[82] These financial instruments guide investment into "green" projects. Lower financing costs incentivise data centre projects to meet this "green" standard.

**Establishing a Green Standard:** The EU Taxonomy Regulation establishes criteria to identify environmentally sustainable economic activities that can qualify as eligible for green bonds in the EU. A green bond issuer must publish project details demonstrating alignment with the Taxonomy before issuing the bond, and this alignment must be verified by an independent reviewer. To be eligible to issue a green bond, a data centre must:

- Establish systems for measuring, recording, and reporting data and key performance indicators (KPIs) related to operational sustainability.
- Ensure that operations do not adversely impact EU environmental objectives such as water use, pollution prevention, biodiversity protection, and circular economy practices.
- Implement relevant practices from the European Code of Conduct and verify these at least every three years.[83] The European Code of Conduct programme is an initiative that data centre operators can opt into. These practices include benchmarks for power usage effectiveness and investment in renewable energy sources.

**Reporting and transparency:** New EU sustainability directives require data centres to, among other things, report to a centralised database on sustainability metrics such as power demand, water use and renewable energy consumption, which will be publicly available at an aggregated level.[84]

82 European Commission (2025) 'EU taxonomy for sustainable activities'.
83 European Commission (2023) 'The EU Code of Conduct for Data Centres – towards more innovative, sustainable, and secure data centre facilities'.
84 European Commission (2024) 'Data centres in Europe – reporting scheme'.

## Case study on Ireland's large energy user connection policy requirements

To address the growing electricity demands of data centres, accounting for 21% of Ireland's electricity consumption in 2023, the Commission for Regulation of Utilities (CRU)—the Irish electricity sector regulator—has proposed significant reforms to the Large Energy User connection policy.[85]

Under the CRU's proposed new framework, all new data centres must provide on-site or proximate dispatchable electricity generation or storage to supply electricity capacity equivalent to their peak demand. This generation capacity must meet grid reliability standards and be "future-proofed" for low-emission technologies, such as hydrogen-compatible generators. Further, the generators must operate independently within the wholesale electricity market through separate grid connections to the demand site, in order to maximise renewable energy integration and system-wide efficiency. The System Operator would have the ability to reduce the electricity import capacity of a data centre if the associated generator does not meet contractual reliability obligations (i.e. does not deliver the required volume of generation).

This policy aims to alleviate pressure on the grid and mitigate reliability issues. However, the requirement poses investment challenges for data centres and raises broader concerns over potential reliance on fossil-fuel dispatchable generation, in conflict with Ireland's decarbonisation agenda.

While this policy is not directly suitable for the Australian context and enabling sustainable data centre growth, this Irish case study provides interesting precedent for the introduction of requirements for data centres to drive development of new generation.

## Policy levers to drive visibility

A key challenge for governments, market bodies and NSPs is uncertainty around the anticipated volume of network connections and load. Anecdotally, multiple network connections may be sought for a single data centre (for example, numerous connection options pursued while the preferred location is being assessed). Data centres will often also seek a network connection based on their plans to scale, with the initial request for connection capacity much larger than their expected near-term electricity demand.

It is now widely understood that the number of connection enquiries and the volume of connection capacity secured by data centres does not reflect the actual near-term electricity demand from the industry. However, it is also well-accepted that it is challenging to establish alternative numbers with any certainty. Relatedly, there is currently no clear methodology for NSPs and others to adopt to provide consistency of their respective data centre-associated load forecasts.

85 Commission for Regulation of Utilities (2025) 'Review of Large Energy Users Connection Policy'.

The lack of visibility of anticipated data centre demand over the forward horizon is particularly challenging for whole-of-system planning, to which demand forecasts are central, and for network planning, which likewise depends on localised demand forecasts. These plans then inform decisions about augmentation and investments. In the case of network planning, demand forecasts directly inform network needs and the regulated revenues these networks require to cover these costs. Over-estimated data centre demand forecasts risk resulting in unnecessary network expenditure and price increases for consumers.[86]

There will inevitably be a degree of uncertainty about data centre load growth projections. Still, measures can be introduced to provide clarity on the volume of network connection enquiries that are actually expected to be pursued and the actual load ramp-up expected over time, and to ensure consistency in how load forecasts should account for data centre load.

Key policy levers which could be considered further to drive greater visibility include:

- **Industry engagement:** Governments or energy market bodies could introduce a centrally coordinated approach to facilitating more effective and open engagement with data centre developers to better understand the anticipated future demand. Central coordination would reduce the number of different entities with which data centres need to engage and could enable the efficient sharing of consistent information and feedback between decision makers. Genuine consultation could provide fruitful guidance on the approach data centres take to seeking grid connection and scaling their facilities, noting that commercial sensitivities may limit how transparent data centre developers are willing and able to be.
- **Network regulatory framework review:** Broadly, the existing network regulatory framework in the NEM protects consumers from most costs associated with the connection of large load and provides NSPs the flexibility to manage these connections. However, given the potential scale of large load connecting to the network at distribution and likely transmission levels in the coming years, a review of the regulatory framework may be warranted to ensure data centre connections and the associated cost recovery are managed consistently between networks and across voltages to ensure consumers are protected.

Data centre demand forecasts will likely continue to be uncertain, due to the commercial sensitivity of information sharing and—more so—due to this being a rapidly evolving and transforming sector. Nevertheless, greater visibility through effective stakeholder engagement should allow for a step up in certainty from the current situation. Broadly, visibility could benefit consumers by ensuring the network is planned for the load growth most reasonably expected to materialise, protecting consumers from unnecessary network costs and enabling more efficient network utilisation.

In some other markets, including Georgia in the US (see the case study below), cost allocation has proven to be an issue of concern and where reforms have been needed. In the Australian context, however, the current network regulation arrangements for recovery of costs associated with large load growth appear to be broadly suitable to protect consumers already. Large load connections are typically required to fund the costs associated with their connection including some deep augmentation costs. Nonetheless, given the magnitude of the data centre pipeline and the load growth trajectory, a review of the regulatory framework could be warranted to ensure costs are fairly allocated.

86 Costs of augmentations associated with connecting a new data centre are largely if not solely recovered from the data centre itself. However, shared network costs could be elevated by over-estimated load growth if this translates through to a final revenue determination.

## Case study of Georgia's cost allocation framework for data centres

To address rising electricity load from data centres and ensure fair distribution of costs, the US state of Georgia's Public Service Commission (PSC) implemented new rules in 2025, focused on improving resource visibility, transmission planning, and equitable cost allocation.

**Visibility and Cost Allocation for Large Loads:** Data centre development proposals with anticipated peak demand exceeding 100 MW must be submitted to the Public Services Commission for review and approval. These data centre projects can be subject to specific tariffs "beyond those used for standard customers" aimed at recovering site-specific connection costs and upstream infrastructure expenses directly from these projects. This aims to protect households and smaller commercial customers from bearing the financial burden of grid upgrades driven by large energy users.

**Enhanced Contractual Terms:** Long-term service agreement contracts of up to 15 years are now required for high-load customers, ensuring grid investments are secured. Additionally, minimum billing clauses were introduced to prevent financial losses in cases of early contract termination.

## Policy levers to drive system security

The connection of large load, of any industry type, has the potential to introduce system security challenges for the electricity grid to which it is connecting. In simple terms, the larger the load, the greater the impact it can have on the grid and market—for example, if the load drops offline unexpectedly or does not respond to a disturbance as expected.

There has been attention focused recently on the potential risks data centres pose to electricity security, however, it is also important to recognise that data centres themselves are dependent on reliable and secure electricity supply. A secure grid is critical to data centre operations. As a result, efforts to safeguard system security in the context of large load can be and should be approached collaboratively, as working towards measures that ensure a secure grid is in the interests of both the market operator and the data centres.

There has been a recent recognition that the existing regulatory arrangements for large load connections, including access standards, are not fit-for-purpose in the current context. Policy reforms are progressing through the energy market bodies in the NEM to introduce system security and reliability measures specifically for large loads with data centre connections in mind.[87] This includes, for example, fit-for-purpose disturbance ride-through requirements to manage the risk of data centres simultaneously dropping offline in response to a voltage disturbance.

Key policy levers that could be considered further to drive system security include:

- **Access Standards:** the current work program underway to address system security concerns related to the connection of large load should continue to be progressed in close consultation with data centre proponents.

As identified in the 'Potential for innovation' chapter of this report, there are numerous areas of innovation in the data centre industry, including innovation in demand flexibility and demand reduction, which can have implications for system reliability and security.

87 See, e.g., Australian Energy Market Commission (2025) 'Improving the NEM access standards – Package 2'.

In Ireland, recent reforms have addressed system security challenges with high data centre concentration in Dublin. For example, the Transmission System Operator can prescribe a required level of demand flexibility for individual data centres on a case-by-case basis, based on the local system needs. Any consideration of equivalent requirements in Australia would need to be progressed in close consultation with data centre proponents to understand the opportunities and limitations of flexibility for the data centre types and use cases in Australia, with an intention to enable sustainable industry growth and not deter investment.

In Singapore, the government has introduced grant programs to encourage energy efficiency and emissions reductions. Any consideration of innovation grants in Australia should be cognisant of the program of innovation being pursued by major data centre developers voluntarily already, and consider the incremental value of additional financial support.

While we have not highlighted a specific key policy lever to incentivise or require flexibility or demand reduction, government, market bodies and network service providers can continue to engage with data centre providers to investigate and implement ways to enable technical and operational innovation without deterring investment. This may include things like incentivising participation in demand response mechanisms or the uptake of flexible network connections.

## A consultative policy approach

The sustainable growth of the data centre industry in Australia presents significant opportunities for economic development while also posing challenges for the electricity system and emissions reductions. A targeted, coordinated and proportionate approach to policy development is essential to managing the potential impacts of data centre growth while continuing to foster investment.

Work to introduce new policy measures, by government agencies or energy market bodies, should be progressed in close consultation with data centre proponents themselves. In many cases, these proponents have strong incentives to mitigate these impacts themselves, including through their corporate decarbonisation commitments, ambition to scale quickly (and therefore connect where the grid can more readily accommodate them), and a fundamental need for reliable and secure electricity supply. A consultative approach to Australia's policy response will have the best chance of facilitating sustainable data centre growth and unlocking the benefits of the growing digital economy for Australians.

## Section 5

# Conclusion

# Conclusion

Data centres are critical infrastructure, expected to deliver significant benefits across the economy. AI and automation alone could generate up to $600 billion for Australia's GDP by 2030.[88] To realise this potential, it is critical to foster a positive investment climate while actively mitigating environmental and electricity system risks. The good news is that a significant proportion of these risks can be mitigated through efficient operations, procurement of clean energy and the use of innovation. Technology is readily available now, with further innovations expected. Investors, policymakers and industry all have an important role to play.

## Investors

Investors should use their influence to incentivise data centres to minimise environmental and system impacts and adopt green data centre operations. Capital should be directed towards projects and companies that prioritise ESG factors. Taxonomy definitions can be utilised to set standards and ensure that green bonds and loans with preferential terms are offered to projects that meet the highest standards.

Sustainability-linked loans and ESG funds—with rigorous due diligence and reporting—can act as important triggers, enabling data centre providers to offer a competitive edge to customers increasingly interested in ensuring sustainable operations. The use of innovation should become expected best practice and be rewarded through lower costs and greater recognition.

## Policymakers

As explored in 'The role of policy in driving sustainable data centre growth' chapter, government should ensure the regulatory environment is fit for purpose—reducing risk, maximising the benefits of data centre deployment while ensuring Australia remains a top-tier option for investment.

The four key areas where government and market body intervention is likely to have the biggest impact are as follows:

- **Locational coordination:** driving data centre investment into locations with the network capacity to accommodate them, or regions which are otherwise strategic;
- **Clean energy:** incentivising and enabling data centres to invest in new clean energy and storage to reduce their impact on electricity prices and emissions;
- **Visibility:** improving transparency of the expected electricity load from data centres over time, to facilitate planning and manage network capacity;
- **System security:** ensuring the right system settings are in place to understand and manage any technical impacts of connecting large load, and incentivising demand flexibility.

## Industry

In order to continue successful development, data centre operators and customers need to maintain their social licence to operate. The risks of data centre development at the rate expected have the potential to be significant without proper mitigations. Industry should take responsibility for ensuring efficient and sustainable operations, which means reducing impacts at a local level.

Clean energy procurement in Australia to match operational demand, development of energy storage solutions, effective use of innovation to increase efficiency and reducing fossil fuel backup systems should be prioritised. Delivering wider community benefits should also be considered.

Data centre operators should coordinate closely with customers to understand their needs and limitations to develop effective solutions to maximise efficiency and flexibility, adopting innovative new business models where possible. Customers with ESG requirements should ensure operations meet minimum standards, with robust due diligence and reporting undertaken. These incentives should ensure that data centres adopting best practice solutions can offer a clear competitive edge.

**88** Department of Industry, Science and Resources (2024) Developing a National AI Capability Plan.

# Appendices

# Appendix 1: Methodologies

## Data centre growth

The purpose of the growth scenarios in this report is to illustrate two potential future states with additional demand for data centres and representative locations, to quantify grid impacts. To get a representative split of locations, these views were informed by desktop research of publicly announced projects as of March 31 2025.

The high case assumes strong growth in Australian data centre capacity with few deterrents reducing this pipeline capacity as it becomes operational. This is modelled by assuming the rate of new projects (in rated capacity terms) which are built from 2030 to 2035, is equal to the average level of rated capacity built from 2026 to 2030. This represents sustained rapid expansion as has been seen in recent years.

The central case assumes that any projects with approval will come online, however beyond this, new announced capacity growth slows to 50% of what it is in the high case. This cooling off in new data centre demand could be driven by capacity banking, changes in hubs across the APAC region, limited power and land supply, developers' response to increasing electricity prices, changes in AI demand or restricted development due to regulatory and permitting barriers.

Each data centre is assumed to be either a hyperscale, colocation or edge facility based on the desktop research conducted. Then, considering each data centre's type and size, a ramp-up period is applied. The length of the ramp-up is taken from AEMO's preliminary data centre estimations through the Forecasting Reference Group in April 2025 which can be seen in Table 5.[89] Note that the ramp periods used for data centres over 250 MW were amended to be equal to that of data centres of between 100 and 250 MW. Edge data centres were assigned ramp-up periods within the 'Unknown' category. In the first year of operation, a data centre is assumed to have 25% of its capacity operational as per the power load outlined in the methodology of the Mandala Empowering Australia's Digital Future report. Data centres were assumed to ramp up to 65% of their operational capacity over their assigned ramp period. This was to ensure that the rated capacity realisation was in line with the IEA's recent estimates.[90]

Table 5: **Ramp-up periods in years for data centres by type and size**[91]

| | Hyperscale | Colocation | Edge/Unknown |
|---|---|---|---|
| **<50 MW** | 3 | 5 | 8 |
| **50–100 MW** | 14 | 20 | 14 |
| **100–250 MW** | 9 | 14 | 15 |
| **>250 MW** | 9 | 14 | – |

In order to calculate the energy consumption of these data centres, the following formula was applied:

- Annual data centre electricity consumption (MWh) = Operational data centre capacity (MW) * PUE * Hours per year (hr)
- The PUE was equal to 1.3 and was also sourced from the Mandala Empowering Australia's Digital Future report.

89 AEMO (2025) FRG Meeting Pack 1.
90 International Energy Agency (2025) 'AI is set to drive surging demand from data centres while offering the potential to transform how the energy sector works'.
91 AEMO (2025) FRG Meeting Pack 1.

## Grid impacts—prices and emissions

The base case of this methodology is the Baringa Q1 2025 reference case. Table 6 outlines the Baringa reference case assumptions, and the changes made in relation to this analysis. All other assumptions are held constant. The modelling to create outputs was completed in PLEXOS. Load-weighted prices were calculated using both the load and price calculated within PLEXOS, with emissions and renewable generation sourced directly from PLEXOS outputs.

Table 6: **Description of modelling scenarios**

| Scenario name | Scenario overview | Description | Assumptions |
|---|---|---|---|
| **Baseline** | Baringa Reference Case | Baringa Q1 2025 Reference Case provides bankable scenario-based analysis of the Australian power markets based on Baringa's view of current trends, policies, and economic factors. | Builds on the 2024 ESOO demand and includes AEMO's data centre sensitivity, disaggregated by state based on Baringa's view of where these data centres are located.<br>Includes assumptions on the renewable generation buildout based on economic factors. |
| **Scenario 1** | Central case with no mitigations | Models the impact of additional data centre demand under the central case, with no mitigations such as increased renewables or storage. | Baringa Reference Case assumptions maintained. |
| **Scenario 2** | Central case with additional renewable energy generation | Models the impact of additional data centre demand alongside additional renewable energy generation of equivalent annual consumption. Assumes PPAs support additional grid-connected renewable projects. | Same as scenario 1, with an additional 3.2 GW of renewable generation added to the NEM by 2035 (1.5 GW solar, 1.7 GW wind). |
| **Scenario 3** | Central case with additional renewable energy generation and storage (50%) | Models the impact of data centre demand alongside renewable energy generation of equivalent annual consumption and four-hour storage totalling 50% of equivalent capacity. Additional storage and renewables are grid-connected. | Same as scenario 2, with ~0.95 GW of additional storage to the NEM by 2035 (0.6 GW in NSW, 0.08 GW in Qld, 0.27 GW in VIC, and 0.003 GW in SA). |
| **Scenario 4** | Central case with additional renewable generation and storage (100%) | Models the impact of data centre demand alongside renewable generation of equivalent annual consumption and four-hour storage of equivalent capacity. Additional storage and renewables projects are grid-connected. | Same as scenario 2, with ~1.9 GW of additional storage to the NEM by 2035 (1.2 GW in NSW, 0.16 GW in Qld, 0.54 GW in VIC, and 0.007 GW in SA). |

In addition to the scenarios listed above, Baringa also undertook some modelling of load shifting. Taking the inputs to Scenario 4, data centre demand was altered such that 10% of their load was shifted away from peak price periods and towards midday price troughs at times of peak renewable generation.

## Network impacts

Substation demand: Where available, demand for 2024–25 is sourced from Distribution Annual Planning Reports (DAPR) published by Ausgrid, Endeavour Energy, Essential Energy and Energex, as well as Transgrid's Transmission Annual Planning Report (TAPR). These were accessed in March 2025. These demand forecasts used are provided with a probability of Exceedance (PoE) of 50%. If not available, demand is sourced from Baringa's Q4 2024 MLF and Curtailment model.

Network capacity: Capacity was sourced from DAPRs and TAPRs where available, or alternatively sourced within Baringa's Q4 2024 MLF and Curtailment model.

Table 7: **Substation information**

| Name | Network | Region | Network element | Voltage High | Voltage Low |
|---|---|---|---|---|---|
| **Kemps Creek** | Transgrid | Western Sydney | TS | 500 | 330 |
| **Sydney West** | Endeavour Energy | Western Sydney | BSP | 330 | 132 |
| **Regentville** | Endeavour Energy | Western Sydney | BSP | 330 | 132 |
| **Bayswater** | Transgrid | Hunter-Central Coast REZ | TS | 500 | 330 |
| **Eraring** | Transgrid | Hunter-Central Coast REZ | TS | 500 | 330 |
| **Muswellbrook** | Ausgrid | Hunter-Central Coast REZ | BSP | 330 | 132 |
| **Buronga** | Transgrid | South-West REZ | TS | 330 | 220 |
| **Darlington Point** | Essential Energy | South-West REZ | BSP | 330 | 132 |
| **Coleambally** | Essential Energy | South-West REZ | BSP | 132 | 33 |
| **South Pine** | Powerlink | North Brisbane | S | 275 | 110 |
| **Woolgoolga** | Powerlink | North Brisbane | S | 275 | 110 |
| **Palmwoods** | Powerlink | North Brisbane | S | 275 | 110 |
| **Homebush** | Ausgrid | Greater Sydney | STS | 132 | 33 |
| **Mount Druitt** | Endeavour Energy | Greater Sydney | STS | 132 | 33 |
| **Penrith** | Endeavour Energy | Greater Sydney | STS | 132 | 33 |
| **Kurri** | Ausgrid | Hunter-Central Coast REZ | STS | 132 | 33 |
| **Muswellbrook** | Ausgrid | Hunter-Central Coast REZ | STS | 132 | 33 |
| **Waratah 2** | Ausgrid | Hunter-Central Coast REZ | STS | 132 | 33 |
| **Hay** | Essential Energy | South-West REZ | STS | 132 | 33 |
| **Moulamein** | Essential Energy | South-West REZ | STS | 66 | 22 |
| **Buronga Town** | Essential Energy | South-West REZ | STS | 66 | 22 |
| **Brendale** | Energex | North Brisbane | BS | 110 | 33 |
| **Griffen** | Energex | North Brisbane | BS | 110 | 33 |
| **Sandgate** | Energex | North Brisbane | BS | 110 | 33 |

# Appendix 2: Location factors

As outlined in Table 8 below, there are a number of factors that determine the location of data centres.

Table 8: **Factors determining data centre locations**

| Factor | Description |
|---|---|
| **Close to business and household activity** | The distance from the end users of data has a significant impact on the latency or speed at which the data can be accessed. As you can see from Figure 19 below, a majority of data centre activity requires low latency and therefore needs to be located close to the end user. The exception to this is some of the more energy intensive, newer data centre applications such as AI training, which has a lower latency requirement, enabling these services to be located further from the end user. |
| **Infrastructure (fibre, cloud, subsea cables, grid connections, water)** | **Proximity to high-speed fibre cables** for data transmission is a critical consideration for all types of data centres.<br><br>**Availability of cloud:** Data centres require cloud availability to ensure continuous, resilient, and geographically distributed digital services. Cloud Availability Zones are physically separate data centre locations within a region that are interconnected through low-latency, high-bandwidth links. Data centres need to be located close to each other—typically within a few tens of kilometres—for cloud availability and resilience reasons. Proximity allows cloud providers to build redundant systems that are far enough apart to avoid simultaneous failure, yet close enough to ensure seamless failover and high availability, meeting business continuity and uptime requirements.<br><br>**Proximity to subsea cables** to enable a data centre-enabled landing station where a submarine internet cable comes ashore and integrates with data centre infrastructure allowing for high-speed, low-latency data transmission from international locations.<br><br>**Capacity and availability of grid connections** along with grid configuration options and the potential feasibility of dual power supply is a key consideration for developers.<br><br>**Reliable water source** is also essential. Data centres with water-based cooling systems require a reliable, high-capacity water supply and appropriate wastewater management. |
| **Workforce** | Technical trades such as electricians and mechanical engineers, make up between 10% and 30% of the data centre workforce. ICT professionals, such as software and process engineers make up an additional 30%. These are highly skilled jobs for which there is a national shortage. The availability of workforce, which tend to be concentrated in urban areas is an important factor when considering where to develop data centres. |

The data centre use case also has a significant impact on the suitability of locations, with resiliency, latency, fibre and energy requirements varying depending on the end use of the data as illustrated in Figure 19.[92]

Figure 19: **Data centre activity requirements—drivers of DC location and infrastructure**[93]

| | Use case | Example | Resiliency (% uptime) | Latency (milliseconds) | Bandwidth (giga vs terabits/s) | Energy density (kW per rack) |
|---|---|---|---|---|---|---|
| High Performance Computing (HPC) | Energy-intensive activities | | | | | |
| | AI training | GPT, self-driving models | | | | |
| | AI inference | Virtual assistants (Alexa) | | | | |
| | Blockchain & cryptocurrency | Bitcoin mining, Ethereum | | | | |
| | Video rendering | CGI, animated movies (Pixar) | | | | |
| Traditional data centre activities | High resiliency and latency-sensitive activities | | | | | |
| | Real-time applications | Online gaming, Zoom | | | | |
| | Content delivery networks | Netflix, YouTube | | | | |
| | Databases | Financial systems, Epic | | | | |
| | E-commerce and payments | Amazon, Paypal | | | | |
| | IoT processing | Smart homes, industrial sensors | | | | |
| | Web hosting | Wordpress, Shopify | | | | |
| | Internet service providers | Comcast, AT&T | | | | |
| | Cloud virtualization | AWS EC2, Microsoft Azure VMS | | | | |
| | Backup and archival storage | Cold storage, AWS glacier | | | | |
| | App dev. and testing | Dev-ops platforms (Jenkins, Gitlab) | | | | |

**Key:** Primary driver ■ ■ ■ ■ ■ Secondary driver

92 Note that in the context of resiliency, a Tier 1 data centre has minimal redundancy and infrastructure to mitigate against disruptions. Meanwhile, a Tier 4 data centre has sufficient infrastructure to withstand both planned and unplanned outages to ensure the highest level of reliability.

93 Source: Baringa analysis

As data centre capacity expands across Australia and the broader APAC region, key factors outlined in Table 9 will likely constrain the rate of growth unless action is taken to find new opportunities to accommodate future development.

Table 9: **Description of factors that could constrain data centre growth**

| Factor | Description |
|---|---|
| **Growing Hubs** | Given their proximity to subsea cables, cloud infrastructure and dense populations, Australian data centre growth is concentrated in specific areas of Sydney and Melbourne. Without strategically diverting some of this development to other cities and regional areas, the power and land available in these key growth corridors will become increasingly constrained, limiting future growth. A similar trend is arising throughout the APAC region, as other countries look to expand beyond their hubs to reduce constraints. |
| **Availability of power** | The immense amount of power required by data centres could strain supply within the grid at key locations of growth, as the rise in data centres increases demand for power significantly. If supply does not increase at the same rate, this could place upward pressure on electricity prices as more expensive generation methods are used to meet total demand, which would in turn make development of data centres less appealing in these areas. Power supply is a serious concern across the APAC region. In Malaysia, a lack of investment in grid upgrades could cause data centre investment to outstrip the grid's capacity, while Japan and South Korea both look to push their development outside of key hubs where power is already constrained.<br><br>It is also worth noting that data centres require a very reliable power supply, with most operating to a concurrently maintainable level (N+1) where backup components are available to maintain supply. For data centres, this generally includes the provision of backup power generation such as a diesel generator. |
| **Grid connection** | Data centres can only connect when there is sufficient headroom on either the transmission or distribution network to accommodate the additional load. As data centre connections increase, the transmission and distribution networks may become increasingly constrained. Data centres located in urban hubs such as the Western Sydney corridor will also be competing for capacity alongside increased demand from other industries looking to electrify, such as transport. |
| **Development costs** | High inflation and construction costs across Australia have led to the per MW cost of data centre development being the third most expensive within the APAC region, behind Japan and Singapore. Furthermore, Australian data centre developers are subject to slow approval and construction processes. As a result of these factors, data centre growth in Australia could be redirected to neighbouring countries in which developers can build their projects at a reduced cost. |

# Appendix 3: Electricity network headroom availability

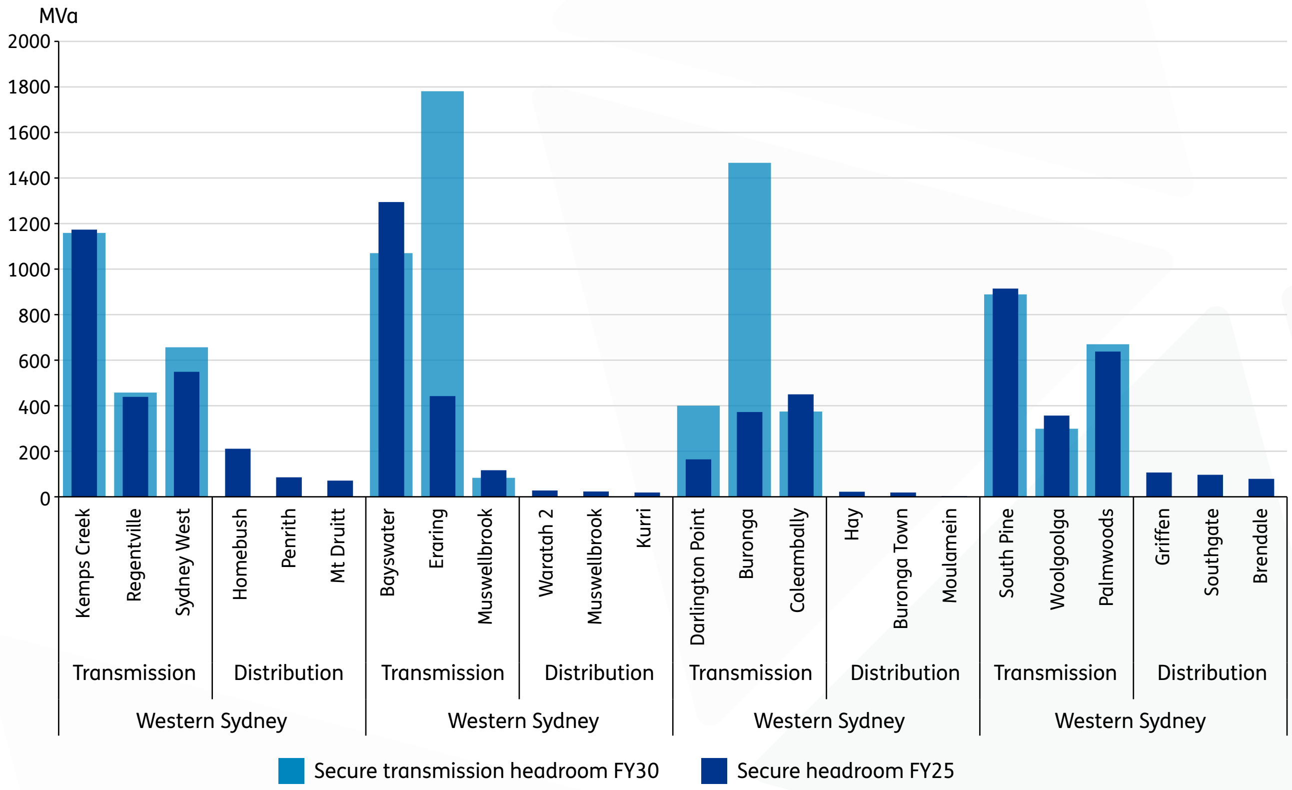
We sought data (March 2024) from a number of substations and supply bulk points to determine headroom at a number of sites within the four representative geographic areas.

Table 10: **Classification of locations**

| Location | Location type | Sampled transmission-level substations and bulk supply points | Sampled distribution-level substations |
|---|---|---|---|
| **Western Sydney** | Urban | Kemps Creek<br>Sydney West<br>Regentville | Homebush<br>Mount Druitt<br>Penrith |
| **Hunter Central-Coast REZ** | Regional | Bayswater<br>Eraring<br>Muswellbrook | Kurri<br>Muswellbrook<br>Waratah 2 |
| **South-West REZ** | Remote | Buronga<br>Darlington Point<br>Coleambally | Hay<br>Buronga Town<br>Moulamein |
| **Brisbane North** | Urban | South Pine<br>Woolgoolga<br>Palmwoods | Brendale<br>Griffen<br>Sandgate |

As illustrated in Figure 20 below, these locations represent a range of current and future headroom, as of March 2025.

Figure 20: **Current (2025) transmission and distribution headroom, and future (2030) transmission headroom**



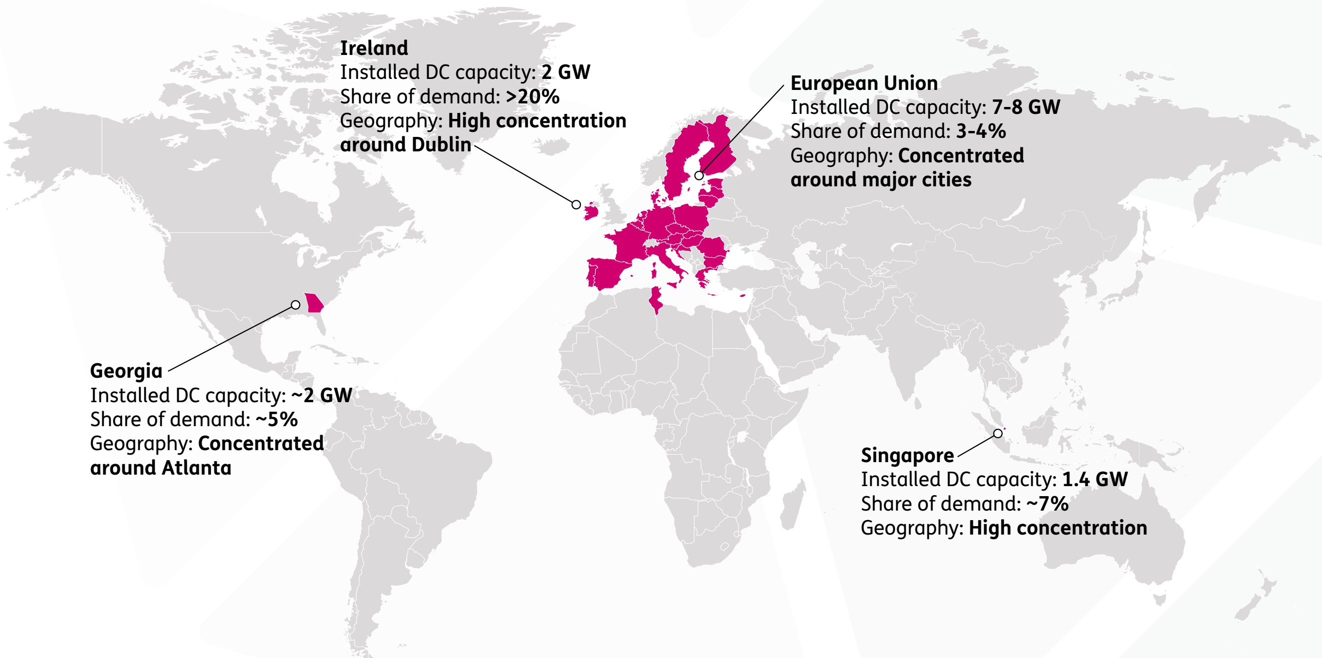

# Appendix 4: International Policy Case Studies

The recent and rapid growth in the number and size of data centres has become an issue of concern in many regions around the world, particularly where data centre 'hubs' have emerged in cities and regions with particularly attractive conditions for growth.

In response to this growth and in anticipation of further industry expansion, a number of governments and intergovernmental bodies have developed, or are developing, policy responses to manage the impacts of the industry. These policy responses provide useful examples of the types of policy levers which could be considered in the Australian context, noting that each is responding to unique challenges and market conditions which do not directly mirror those in Australia.

While there are dozens of governments with policy mechanisms in place or in progress, we have chosen four case studies for this report which showcase a suite of different responses which have been formerly introduced. The four case studies—Ireland, the European Union, Georgia and Singapore—relate to regions which have experienced, or are expecting, very high growth of data centre demand. The aim of these international case studies is to identify some of the practical issues faced elsewhere as a result of data centre growth and to understand the policy responses introduced.

Figure 21: **Map of case study areas**




Each of the four case study regions has already seen significant data centre development. In Ireland and Singapore, in particular, electricity demand from data centres now makes up a significant share of the total electricity demand. The governments in these countries have stepped in with quite blunt policy interventions in response to the substantial growth which has already occurred. By contrast, Australian data centre development and electricity demand are still relatively minimal in the context of total demand. Importantly, this means that governments in Australia still have the opportunity to be proactive in their policy response, learning from the experience of others to develop a targeted and proportionate response that makes sense in the local context.

Table 11: **Ireland: Commission for Regulation of Utilities proposed decision on large energy users connection policy**

| Region | Policy focus | Key mechanisms | Positives and negatives |
|---|---|---|---|
| Ireland | Grid connection policy | Requires data centres to build dispatchable generation capacity to cover their electricity demand | + Can mitigate reliability risks<br>– Lack of emissions limits on the requirement allows fossil fuel use, increasing emissions |
| | | Transmission system operator can consider system security impacts before awarding grid connection | + Can mitigate security risks<br>– Data centres are relatively inflexible and requirements may deter investment |
| | | Enhanced locational information of grid constraints | + Enables better coordination between grid and new load |
| | | Emissions reporting requirements | + Can publicly highlight emissions caused by industry<br>– Without any enforced requirements for emissions intensity, this may not reduce emissions |

In Ireland, the share of electricity consumed by data centres has grown from 5% of total national demand in 2015 to 21% in 2023 and is expected to represent 30% by 2030 (if no additional data centres are contracted over and above what is already signed up).[94] This growth presents challenges for sustainability, electricity reliability, network capacity and the wider economy in Ireland.

Ireland has a legislated target of a 51% reduction in emissions by 2030 (compared to 2018 levels), which it is at risk of missing due to the substantial demand increase from data centres in the country.
In addition to decarbonisation, the Commission for Regulation of Utilities (CRU)—the Irish electricity sector regulator—has expressed concern for the security of supply, network constraints and wider economic impacts (e.g. water usage and housing) of continued data centre growth. The Dublin area is highlighted as facing particular network constraints and short circuit issues due to the geographical concentration of data centres near the country's largest population hub.

In response to this, grid connection approvals for data centres have slowed dramatically, with only one significant offer being made since 2020 which was outside of Dublin. The CRU has published a proposed decision on the new approach to connecting Large Energy Users, primarily focusing on data centres, which outlines significant changes to the connection policy. In particular, connection applications will be assessed by the System Operator (SO) against the requirements of this new policy before a connection offer is issued, and contracts will only be offered if these requirements have been satisfied.

The following key policies are proposed to apply to data centres:

### 1. On-site (or proximate) electricity generation capacity

All new data centres would be required to have dispatchable generation or storage on-site (or close to the site) of a capacity equivalent to or greater than their anticipated maximum import capacity on a MW basis (subject to some derating). Approval to scale up a data centre would be dependent on the data centre developing the associated additional electricity generation or storage capacity in advance. This new generation or storage capacity would then be required to participate in the wholesale electricity market as standalone capacity, with separate metering to the data centre (not behind the meter).

94 Commission for Regulation of Utilities (2025) 'Review of Large Energy Users Connection Policy'.

The CRU argues this would ensure efficient operation of the assets and alignment with system requirements as well as allowing maximum renewable generation to be used. The technology used would be required to be "sufficiently future proofed" in relation to facilitating a low/zero emission future (e.g., gas-fired generation compatible with hydrogen). The CRU is also proposing a requirement for multiple dispatchable generator units depending on the site's Maximum Import Capacity (MIC) (i.e. two 250 MW units for a 500 MW demand centre) but has not specified the details of this requirement.

The System Operator would have the ability to reduce the import capacity of a data centre if this on-site generation does not meet contractual reliability obligations (i.e. does not deliver the required generation).

### 2. Demand flexibility

Existing policy allows the System Operator to instruct some Large Energy Users to reduce or remove their demand from the system during System Emergency States, with at least a 60-minute notice ("Mandatory Demand Curtailment" (MDC)). The CRU is proposing that data centres would not be required to sign up to MDC as their newly required on-site generation capacity contributes to meeting their own demand requirements. However, the System Operators would have the power to prescribe a required level of demand flexibility for individual data centres on a case-by-case basis, based on the local system needs (e.g. 20% flexibility over X amount of hours), to be remunerated through a System Operator's local demand scheme.

Outside of this new connection policy, electricity market rules allow demand centres to provide demand flexibility and ancillary services to the Irish grid.

### 3. Locational considerations

The CRU has proposed that System Operators consider locational constraints in evaluating whether a connection offer could be made to a data centre.

To ensure visibility of these constraints to both parties, the CRU would require electricity and gas System Operators to conduct a "market intelligence exercise" to gather information from the data centre industry on prospective demand for connections beyond currently known projects.

Under EU law, the System Operators must publish regular, up-to-date, locational information on the availability of capacity on the network and network constraints. The future format of this will be determined through further engagement but would include capacity maps and network development plans across a 10-year horizon, building in the information gathered through market sounding, as well as details on capacity with current connection requests.

### 4. Energy and emissions reporting

Data centres would be required to report annually to the System Operator their renewable energy use and emission offsets, which the System Operator will publish. The proposed decision would require data centre providers to provide the following information on each site:

- Scope 1 and scope 2 emissions on an hourly and annual basis
- Abatement of emissions through additional renewable electricity produced/contracted on an hourly and annual basis
- Details of planned measures to achieve zero emissions (with timelines)
- Details of capacity contracted in demand flexibility schemes.

Some of these requirements align with new EU laws on data centre reporting requirements as outlined in the following section. However, the proposed granularity of information to be published by the CRU is significantly greater, which would be at a user level rather than aggregated at the state level.

Table 12: **EU data centre sustainability directives**

| Region | Policy focus | Key mechanisms | Positives and negatives |
|---|---|---|---|
| **European Union** | Sustainability taxonomy and green financing | Combining state-level sustainability targets, standardised reporting requirements and KPIs, to incentivise new data centres to be increasingly sustainable | + Public reporting and targets allow for an informed market to benchmark and invest in the most sustainable technology<br>– Without binding project-level targets, sustainability improvements will rely mostly on voluntary commercial commitments |
| | | Regulations on green funding aim to incentivise favourable investment decisions for sustainable data centres | + Increased funding options make it more appealing to choose to develop sufficiently sustainable data centres |

The EU has established overarching Union-level sustainability targets that each member state is required to meet by 2030. Recognising the potentially significant impact data centre growth could have on reaching these targets—as substantial new electricity demand—a range of subordinate policies have been developed directly addressing data centre sustainability performance.

In particular, the EU has introduced a range of directives and schemes that aim to incentivise investment decisions to address climate change and other environmental issues. In the case of data centres specifically, the EU intends to drive investment in data centres that are more energy efficient and sustainable. Energy efficiency targets and mandatory data centre KPI reporting establish long-term investment signals at a union level. Additionally, the EU's taxonomy for sustainable data centres steers favourable green financing conditions for sustainable project investment. These policies send clear signals to the market that the energy efficiency and sustainability of data centres are important investment considerations.

## Digital Decade Policy Programme 2030

In 2022, the EU established their plan to achieve a digital transformation "for people, business and the environment" by setting out general objectives and digital targets for 2030. This signalled a commitment to growth in digitisation across the decade including specific targets for broad access, education and deployment of digital services such as cloud services and AI. From a data centre point of view, this was a policy commitment to growing the industry.

## Directive on energy efficiency

In lieu of this policy programme, the Energy Efficiency directive (2023/1791) was established to ensure the growing digital economy was efficient and sustainable. This directive sets energy efficiency targets at Union-level and establishes a common framework of measures to promote energy efficiency within the Union. The directive set the EU energy efficiency target for Member States to collectively ensure a reduction in EU final energy consumption of 11.7% by 2030, compared to the projected energy use for 2030 (based on the 2020 reference scenario).

The policy also established a common scheme for rating the sustainability of data centres and includes requirements to collect and publish data annually on energy performance, water footprint, and demand-side flexibility. Under the directive, the collected data is to be used to measure basic dimensions of a sustainable data centre.

## First phase of the establishment of a common Union rating scheme for data centres

In 2024, the EU established the information and methodology for reporting to the European database and the data centre sustainability rating scheme. The published data will be aggregated and serve as a transparent benchmark to compare data centre standards across countries. Data centres are now required to report through the EU database on many sustainability indicators including (but not limited to) the following:

- Power demand
- Energy consumption and renewable energy consumption
- Floor area
- Electricity grid support functions and battery capacity
- Water and heat usage.

## Green bonds and the EU taxonomy

Bonds are typically considered a low-risk fixed-income financial instrument that allow governments, corporations or other large entities to raise capital to fund investment (e.g. infrastructure, debt servicing, or operational/fiscal expenses).

Structurally, 'Green Bonds' are like traditional bonds, paying interest and returning the principal after a fixed period, but the capital raised must be used for projects with environmental benefits. Impacts must be reported using credible measurement and disclosure methods (e.g. EU Green Bond Standard).

Sustainability-linked bonds differ slightly in that returns are contingent on the projects demonstrating impact or meeting sustainability KPIs.

These financial instruments provide an alternative source of financing and can offer more favourable financing terms (e.g. a lower cost of capital) compared to mainstream financial markets. In 2024, green bonds made up 6.9% of all bonds issued in the EU, indicating a strong appetite to finance sustainable initiatives. Money raised through EU Green Bonds can only finance projects that meet the "green investment" standards set by EU regulation.

EU Taxonomy Regulation establishes a framework to identify environmentally sustainable economic activities that can qualify for eligible Green Bonds and other forms of sustainable finance in the EU. A green bond issuer must publish project details before issuing the bond and for any ongoing fund allocation to highlight alignment with the Taxonomy. An independent reviewer must also verify the details to align with the Taxonomy. The purpose of this is to establish clear rules to prevent "greenwashing" and ensure projects that receive financing through green bonds are sufficiently sustainable.

For data centre owners/investors/operators, a lower cost of capital can improve the internal rate of return (rather than IRR) on new energy storage or other expansion activities.

Technical screening criteria of the EU Taxonomy require data centres to meet the following criteria to be eligible:

- Establish systems for measuring, recording, and reporting data and key performance indicators (KPIs) related to operational sustainability. It is likely that this will now be in line with the broader established regulatory framework described above.
- Ensure that operations do not adversely impact EU environmental objectives such as water use, pollution prevention, biodiversity protection, and circular economy practices.
- Implement relevant practices from the European Code of Conduct and verify at least every three years. The European Code of Conduct programme is an initiative that data centre operators can opt into. These practices include benchmarks for power usage effectiveness and investment in renewable energy sources.

Table 13: **Georgia (USA)—Rule to Allow New Power Usage Terms for Data Centres**

| Region | Policy focus | Key mechanisms | Positives and negatives |
|---|---|---|---|
| Georgia USA | Network cost allocation and contracting | Allocate the financial cost associated with significant network and capacity build to large-load customers if they are the main beneficiaries | + Prevents smaller consumers from being disproportionately impacted by higher system costs caused by substantial growth in large energy users<br>– May be difficult for data centre developers to predict costs without transparency |

Georgia's electricity market is traditionally regulated and vertically integrated, with a small degree of wholesale competition. This means Georgia Power, the largest utility company in the state, owns or contracts directly with generation assets, transmission network assets and distribution network assets, passing the costs through to electricity consumers through approved tariff rates.

In early 2025, Georgia's Public Service Commission (PSC), the public utilities regulator in the state, implemented major rule changes primarily to ensure the costs of data centre growth are not unduly borne by household consumers. This is in response to significant forecast growth from data centres and the risk that transmission augmentations will disproportionately increase consumers' bills other than the data centres.

In their latest projection for electricity demand, Georgia Power forecast that demand would increase by 8.2 GW over the next 6 years to 2030, reaching nearly 6 GW of additional load as early as the winter of 2028–29. This latest figure contrasts with the previous forecast which anticipated 6.6 GW more by 2030 and the 2022 forecast of only 400 MW additional demand by 2030. Importantly, most of the demand is anticipated to come from data centres and other large energy users, which deviates significantly from the historical precedent for connections in the area.

Accommodating this level of demand growth on the grid will incur significant site-specific and upstream costs on Georgia Power to ensure adequate generation, transmission and distribution infrastructure is built. These costs would ultimately be passed on to system users through tariffs under historical cost allocation arrangements. Accordingly, Georgia Power and the Public Service Commission have introduced modifications to the rules and regulations to ensure the costs incurred to serve the large loads are largely recovered from those loads. The new arrangements will apply specifically to customers with an expected peak demand of 100 MW or greater and will be introduced through new tariff calculations and grid connection agreements.

## Cost allocation

The new Georgia Power rule states that new customers using more than 100 MW of energy can be billed using terms and conditions "beyond those used for standard customers" to address the financial risk associated with serving these users. This will allow Georgia Power to pass on site-specific connection asset construction costs and upstream costs for related generation or network infrastructure directly to the data centre. The central aim is to protect household and other commercial/ industrial customers from high costs required to upgrade the grid and increase generation capacity.

## Contractual obligations

The new rule also contains a number of contractual changes that are intended to provide Georgia Power (and ultimately consumers) with greater protection against the risk of high-cost asset construction. The rule change allows:

- **Longer contract lengths:** Electric service agreement contracts, equivalent to grid connection agreements, will increase from 5-year contracts to 15-year contracts for high-load customers.

- **Minimum billing requirements:** If a large energy user terminates their contract with the network to which they are connected before the costs associated with their connection are fully recovered, they would be required to pay the remainder before exiting the contract.

The rule change also states that any new application to Georgia Power for a contract with a project over 100 MW in size must be submitted to the Public Services Commission for review. This is significant as the Commission's remit is to ensure that consumers receive "safe, reliable and reasonably priced services".

Table 14: **Singapore—Capacity Allocation and Green Data Centres**

| Region | Policy focus | Key mechanisms | Positives and negatives |
| --- | --- | --- | --- |
| Singapore | Grid connection policy | Capacity allocation tenders – allocating grid access capacity through competitive tenders as the sole route to market for new data centres | + Prevents uncontrolled growth which previously placed significant stress on Singapore's grid and increased emissions<br>– Without significant coordination, prevents investment in crucial digital infrastructure |
| | | Energy efficiency targets and sustainability funding | + Prevents uncontrolled growth |

The Singapore Green Plan dictates the national 2030 emissions targets for Singapore, with five pillars: City in Nature, Energy Reset, Sustainable Living, Green Economy and Resilient Future. Singapore currently has an energy grid highly reliant on fossil fuel generation with around 94% of the country's fuel mix coming from natural gas.[95] Due to the significant challenges in replacing so much of the country's generation capacity in the near term, the focus since 2014 has been on improving efficiency alongside plans to gradually increase its use of renewable energy through onshore and, particularly, offshore projects.

The influx of data centres into the Singapore market in recent years has materially elevated its electricity demand and made the transition to a lower-carbon electricity system more challenging. To date, with the current dependence on natural gas for electricity, the growth in data centres has resulted directly in an increase in emissions, with an almost linear increase in natural gas generation to serve the facilities.

In 2019, Singapore paused new data centre connections to respond to the rapidly evolving new industry. This country-wide moratorium allowed the government to work with stakeholders to understand the growing industry, impacts, and opportunities to facilitate a more sustainable data centre industry.

Singapore has since signalled its commitment to advancing the growth of data centres in the country. It has now reopened the door with a clear emphasis on their need to provide both sustainability and economic value.

## Competitive tenders for data centre connection rights

When it lifted the moratorium in 2022, the government began a pilot Data Centre Call for Application (DC-CFA) competitive process. In July 2023, 80 MW of new capacity was offered to new data centre connections after assessing all proposals. Proposals were assessed against three criteria:

- Best practices for sustainability and energy efficiency
- Strengthening international and regional connectivity
- Contributing to broader economic objectives.

95 Statista (2025) 'Natural gas industry in Singapore – statistics & facts'.

Four data centres were awarded the data centre connection rights through this pilot. Following this pilot, the government established an ongoing process in which proponents wishing to establish data centre connections must participate in competitive tenders for data centre connection rights. At the announcement of this new process, the government committed to award at least 300 MW in the near future, starting over the next 12 to 18 months. However, a second batch of capacity has not yet been awarded. The government may reassess the criteria against which they will compare applications in these future rounds.

## Green mark for data centres

Government authorities have established certification schemes for data centres in Singapore to signify their level of sustainability and environmental impact. This scheme awards certificates based on a rating system that evaluates data centres across various criteria, including energy efficiency, sustainable design, and operational practices. This was developed to allow the market to confidently differentiate between the sustainability of data centres as well as update the benchmark for what constitutes the most sustainable standards.

## Green data centre roadmap

The Singapore government released its Green Data Centre Roadmap in 2024. The roadmap outlines specific targets over the next 10 years which the government will aim to achieve through collaboration and support schemes with industry.

Singapore aims to achieve a Power Usage Effectiveness rating of no more than 1.3 and a Water Usage Effectiveness rating of no more than 2.0 over the next 10 years for all data centres in the country. To accelerate data centres' energy efficiency and put in place best-in-class technologies, they have established some support schemes including:

- **Energy efficiency grant:** New scheme offering up to $30,000 per company in the data centre sector to support their adoption of pre-approved energy-efficient IT equipment
- **Economic development board's enhanced resource efficiency grant for emissions:** Up to 50% of qualifying costs to support manufacturing facilities and data centres to undertake eligible emissions reduction projects to sustain competitiveness in a low-carbon future
- **Investment allowance for emissions reduction:** Funding granted based on the capital expenditure incurred for energy-efficient or green data centre projects.

As well as energy efficiency, Singapore aims to accelerate the use of green energy by expanding generation capacity. Though the Roadmap does not highlight specific requirements for green energy, it does specify that the future data centre connection rights allocation exercises will be structured to favour proposals from data centre proponents using viable low-carbon energy sources. The Roadmap also lists initial sources that will be considered as "green energy": bioenergy, fuel cells with carbon capture, low-carbon hydrogen and ammonia, and building-integrated solar PV.

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