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INQUIRY INTO DATA CENTRES

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Inquiry into Data Centres

Component-Level Efficiency: An Overlooked Lever in Data Centre Sustainability

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Submission by Kordz

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Executive Summary

Data centres have rapidly become critical infrastructure that underpins the digital economy. They support cloud computing, artificial intelligence, financial services, government systems and a growing range of data-driven technologies. As demand for digital services accelerates, New South Wales is emerging as a major regional hub for digital infrastructure, with significant new data centre investment expected over the coming decade.

However, the expansion of data centre infrastructure presents complex sustainability challenges. Data centres require large and continuous electricity supply, generate significant heat loads and rely on cooling systems that can place pressure on energy and water resources. Addressing these challenges will require improvements in both facility-level technologies and the broader systems that support efficient operation.

While policy discussions often focus on electricity supply and cooling technologies, this submission highlights that component-level infrastructure design within data centres can also influence overall efficiency outcomes. Physical infrastructure within server environments, including cabling systems, rack configuration and installation practices, can affect airflow management, thermal performance and cooling demand.

When these factors are replicated across thousands of server racks in large-scale facilities, even relatively small inefficiencies can have meaningful cumulative impacts on energy consumption and operational costs. As computing density continues to increase with the growth of artificial intelligence workloads and high-performance computing, the efficiency of rack-level infrastructure and airflow management is likely to become an increasingly important factor in maintaining sustainable data centre operations.

This submission therefore argues that improving the sustainability of data centre infrastructure requires a holistic approach that considers both facility-level systems and the internal infrastructure that supports them. Design practices that improve airflow efficiency, reduce infrastructure density and support effective thermal management may complement existing efforts to improve cooling efficiency and reduce energy consumption.

In addition to operational efficiency, the sustainability of digital infrastructure is increasingly influenced by lifecycle considerations. Materials selection, manufacturing processes, product durability and supply chain transparency all contribute to the overall environmental footprint of infrastructure deployments. Greater transparency around lifecycle impacts, including embodied carbon, may support more sustainable procurement and infrastructure development practices.

Drawing on connectivity engineering experience and infrastructure design considerations, this submission proposes a set of practical measures that may assist policymakers and industry stakeholders in improving the efficiency and sustainability of data centre infrastructure.

Key recommendations include to:

1. **Recognise the role of internal infrastructure design in data centre efficiency**, alongside building-level cooling systems and energy infrastructure.
2. **Encourage best-practice airflow and infrastructure design standards** in high-density computing environments.
3. **Improve transparency around thermal performance and infrastructure efficiency**, including rack-level airflow optimisation strategies.
4. **Encourage lifecycle sustainability and embodied carbon transparency** in digital infrastructure supply chains.
5. **Support the development of best-practice guidance for sustainable data centre infrastructure**, including airflow management, infrastructure density and lifecycle sustainability considerations.

Together, these measures may support a more holistic approach to improving data centre efficiency while helping New South Wales position itself as a leader in responsible and sustainable digital infrastructure development.

About Kordz

Kordz is an Australian-founded manufacturer of professional-grade connectivity products. Built by experienced former systems integrators, Kordz has spent more than 20 years developing connectivity solutions designed to deliver reliable installation, predictable performance and long service life across professional AV, networking and related technology environments. Kordz' product development approach is informed by practical installation experience and a focus on usability, durability and efficiency in the field. The company has also publicly identified sustainability, materials efficiency, packaging reduction and product longevity as important areas of ongoing development. This submission is made from that perspective, as a connectivity manufacturer with practical connectivity engineering insight into how physical infrastructure and rack design can contribute to more efficient and sustainable data centre environments.

Introduction

Data centres have rapidly become critical strategic infrastructure for New South Wales, and therefore Australia, because they underpin the digital economy that powers cloud computing, artificial intelligence, financial services, e-commerce, government services and advanced research. NSW already hosts more than 90 operational data centres with 20 more in assessment and significant new investment underway, reflecting the state's role as Australia's primary digital hub and gateway to Asia-Pacific digital networks[1].

As demand for AI, automation and data-intensive services accelerates, data centre infrastructure is expected to attract tens of billions of dollars in investment and enable technologies that could contribute up to $600 billion to Australia's GDP by 2030, making it a key enabler of national productivity, innovation and economic competitiveness[2].

Given its established connectivity and infrastructure, further strategically located, efficiently designed data centres therefore position NSW not only as a key part of Australia's digital economy, but also as an emerging regional hub for cloud, AI and high-performance computing within the Asia-Pacific.

However, this strategic opportunity is accompanied by complex sustainability and infrastructure challenges. Data centres require large and continuous electricity supply, generate significant heat loads that must be managed through energy and water-intensive cooling systems, and can place pressure on surrounding infrastructure and communities.

As governments, operators and industry work to support continued digital growth, improving the efficiency of data centre design and operation - including the often overlooked physical infrastructure within server environments - will be critical to balancing economic development with environmental responsibility.

This submission outlines considerations from the perspective of an Australian connectivity manufacturer and contributes a connectivity engineering perspective on how component-level infrastructure design can influence data centre efficiency and sustainability outcomes.

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[1] https://www.nsw.gov.au/ministerial-releases/minns-labor-government-welcomes-openais-investment-to-nsw

[2] https://www.cefc.com.au/insights/market-reports/data-centre-growth-and-the-energy-transition/

Data Centre Sustainability Challenges

From a connectivity engineering and infrastructure design perspective, several of the challenges considered in this Inquiry intersect with the physical design and operation of data centre environments. While large-scale factors such as electricity supply, cooling technologies and planning frameworks play a central role in determining their environmental footprints, infrastructure design decisions within facilities can also influence overall operational efficiency and thermal performance. The following considerations highlight areas where infrastructure design and installation practices may complement broader efforts to improve sustainable data centre development.

Electricity Demand and Emissions Reduction

Data centres are increasingly recognised as critical infrastructure supporting the digital economy, but they are also significant consumers of electricity. Globally, data centres are estimated to account for approximately 1.5% of total electricity consumption, with that demand expected to double by 2030 as cloud computing, artificial intelligence and digital services continue to expand.[3]

A substantial portion of this energy consumption is associated with the cooling systems required to remove heat generated by servers and networking equipment operating in high-density environments. Research suggests that in efficient hyperscale data centres this may fall below 7%, but in less-efficient facilities, cooling systems can account for more than 30% of total energy use.[4] Because nearly all electrical energy consumed by computing equipment ultimately converts to heat that must be removed through cooling systems, thermal management is therefore a central consideration in data centre design and operation.

Infrastructure design decisions - including those affecting airflow pathways, cable density and equipment layout - may influence the effectiveness of cooling systems within server environments. Design approaches that minimise airflow obstruction within racks and cable pathways can support more efficient cooling performance. Considering infrastructure design alongside mechanical cooling systems may therefore provide additional opportunities to improve energy efficiency and support emissions reduction objectives.

Water Usage and Cooling

In addition to electricity demand, cooling systems can also create significant water demand in data centre facilities. Many cooling technologies rely on evaporative or water-assisted processes to dissipate heat generated by computing equipment. Depending on the cooling technologies deployed and local climatic conditions, data centres can require substantial volumes of water to support cooling operations.

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[3] International Energy Agency (IEA). *Energy and AI*.
[4] International Energy Agency (IEA). *Energy and AI*.

Reducing the total heat load within data centre environments can help reduce the cooling capacity required and therefore the associated water demand in facilities where water-intensive cooling systems are used. Infrastructure design and installation practices that support effective airflow management may therefore also play a supporting role in reducing cooling demand.

As data centre development continues to expand, design approaches that contribute to lower cooling loads may help mitigate pressures on water resources and improve the resilience of data centre operations in the context of water security and climate variability, particularly in regions experiencing increasing climate variability.

Local Environmental Impacts

Data centre facilities can have local environmental impacts associated with heat rejection, electricity demand and built infrastructure. Concentrated computing loads generate significant heat that must be dissipated through cooling systems, which can contribute to localised heat effects and increase reliance on mechanical cooling.

Large-scale developments can also place additional demand on local electricity networks and require substantial supporting infrastructure, including cooling plant and backup power systems, influencing land use, built form and, in some cases, noise.

While building design and cooling technologies remain the primary mechanisms for managing these impacts, internal infrastructure efficiency can play a supporting role. Improving airflow and thermal performance within rack environments may help reduce the overall cooling load that facilities must manage.

Economic Outcomes

Operational efficiency is closely linked to the long-term economic performance of data centre infrastructure. Electricity costs represent a major component of operating expenses, meaning improvements in thermal efficiency and energy management can contribute to lower lifecycle operating costs.

Beyond energy use, infrastructure design also influences maintenance requirements, equipment longevity and overall system reliability. More efficient, well-designed environments can reduce service complexity, minimise rework and support more stable long-term performance.

Encouraging design approaches that improve infrastructure efficiency and thermal performance may therefore strengthen both the operational economics of individual facilities and the broader competitiveness of data centre development in New South Wales. The adoption of recognised best-practice approaches to sustainable digital infrastructure may also support NSW in positioning itself as a leader in efficient and responsible data centre development as the sector continues to grow.

The Role of Physical Infrastructure in Efficiency

While discussions about data centre sustainability often focus on energy generation, cooling technologies and server performance, the design and management of physical infrastructure within data centre environments also plays an important role in operational efficiency. The physical layer - including cabling systems, server rack infrastructure and installation practices - can influence airflow management, thermal performance and long-term maintainability within high-density computing environments.

Based on experience designing and manufacturing connectivity products used in high-density installations, the physical organisation of cabling within rack environments can materially influence airflow pathways and long-term maintenance access over the lifecycle of an installation.

Modern data centres rely on carefully controlled airflow patterns to remove heat generated by servers and networking equipment. These environments are typically designed around structured airflow models, such as hot aisle and cold aisle containment, to maintain efficient cooling and stable operating conditions. However, the effectiveness of these systems can be influenced by the layout and density of physical infrastructure within server racks and pathways.

Connectivity infrastructure in particular can affect airflow in several ways. High cable density, large cable diameters and poorly managed cable bundles can obstruct airflow pathways within racks and cabinets, potentially reducing cooling efficiency and increasing the energy required to maintain stable operating temperatures.

In high-density rack environments containing hundreds of cables, relatively small increases in cable diameter or unmanaged bundling reduce the available space for airflow within rack pathways. Even modest airflow obstruction can require higher fan speeds in servers and networking equipment to maintain safe operating temperatures, increasing the electrical energy consumed by internal cooling fans and contributing additional heat within the rack environment. When replicated across thousands of racks in large-scale facilities, these incremental inefficiencies can materially contribute to increased cooling energy demand.

Conversely, well-designed cable management practices, appropriate cable sizing and disciplined installation to industry standards can minimise airflow obstruction and support more effective cooling performance. Even relatively small improvements in airflow management can have meaningful cumulative effects over the lifetime of facilities, and as they scale to support increasing computing demand.

As computing density continues to increase with the growth of artificial intelligence workloads and high-performance computing, effective airflow management and rack-level infrastructure design are likely to become increasingly important factors in maintaining efficient data centre operation.

For these reasons, physical infrastructure design and installation practices should be considered as part of the broader system of measures that support efficient and sustainable data centre operation. Encouraging best-practice approaches to cable management, infrastructure layout and installation discipline may complement other efforts to improve thermal efficiency and reduce the environmental footprint of data centre development.

Improving efficiency at the infrastructure and rack level may therefore contribute to reducing overall water and electricity demand, and associated carbon emissions, in large-scale data centre operations.

Connectivity Design Considerations for Efficient Data Centre Environments

Connectivity infrastructure forms a critical component of data centre environments, enabling the high-speed transmission of data between servers, networking equipment and external systems. While cabling systems represent a relatively small portion of overall data centre infrastructure, their design and installation can influence both thermal performance and spatial efficiency within high-density computing environments.

Data centres typically operate within tightly controlled thermal parameters, where airflow management plays a central role in maintaining stable operating temperatures. In these environments, the physical footprint of connectivity infrastructure, including cable diameter, routing pathways and bundling practices, can affect the available space for airflow within racks and cable pathways.

In copper-based systems, particularly where power is transmitted alongside data, cable bundling and density can contribute to heat build-up. Elevated temperatures may affect performance stability and reliability, reinforcing the need to balance electrical performance, special efficiency and thermal management in connectivity design.

Connectivity design therefore requires careful consideration of several competing factors. For example, smaller-diameter cables can support improved airflow and space efficiency in high-density installations by reducing airflow obstruction within racks. However, reducing cable diameter may introduce trade-offs related to electrical performance and heat generation in copper-based systems. Achieving optimal outcomes requires balancing these considerations to ensure that connectivity infrastructure supports reliable data transmission together with efficient thermal management and spatial efficiency.

Installation practices also play an important role in maintaining efficient airflow and long-term system performance. Poorly organised cabling or excessive bundling can restrict airflow and complicate maintenance, while well-structured cable pathways and disciplined installation practices can support improved airflow management and easier long-term system management.

Material selection may also influence the durability and thermal resilience of connectivity infrastructure. Components designed to maintain stable performance under elevated temperatures can support reliable operation in high-density computing environments where sustained heat loads are common.

As data centre environments continue to scale and densify, the design and management of connectivity infrastructure may therefore play a supporting role in improving operational efficiency. Considering connectivity design alongside other factors - such as server performance, cooling technologies and facility-level energy management - can help ensure that data centre environments operate as efficiently and sustainably as possible.

Sustainability and Lifecycle Considerations

In addition to operational efficiency, the sustainability profile of data centre infrastructure is increasingly shaped by lifecycle considerations associated with the manufacture, use and disposal of equipment and materials. While much attention is often directed toward electricity consumption and cooling technologies, the environmental footprint of digital infrastructure can also be influenced by the materials used in infrastructure components.

One important concept in this context is embodied carbon, which refers to the greenhouse gas emissions associated with the extraction of raw materials, manufacturing processes, transportation and disposal of products across their lifecycle. Embodied carbon is increasingly recognised as a significant component and lever in the reduction of the environmental footprint of Australian infrastructure, particularly as operational energy systems become more efficient and increasingly powered by renewable energy sources[5].

Materials engineering and product durability therefore play an important role in supporting more sustainable infrastructure development. Connectivity infrastructure that is designed for long service life, reliable performance under demanding operating conditions and reduced replacement frequency may contribute to lowering the lifecycle environmental impact of infrastructure installations. Similarly, the use of materials that can be recycled or recovered at the end of their service life may help reduce waste associated with infrastructure upgrades and equipment turnover.

Manufacturing practices and supply chain transparency are also increasingly relevant considerations in sustainable infrastructure development. Data centre operators and infrastructure developers are placing greater emphasis on responsible sourcing of materials, environmental performance within manufacturing processes, and clearer reporting of environmental impacts across supply chains. Improving transparency around the lifecycle impacts of infrastructure components may support better-informed procurement decisions and contribute to broader sustainability objectives within the digital infrastructure sector.

Finally, opportunities may also exist to reduce environmental impacts through improved packaging efficiency and waste reduction within infrastructure supply chains. Large-scale infrastructure deployments can involve substantial quantities of packaging materials associated with equipment delivery and installation. Reducing unnecessary packaging, improving recyclability of packaging materials, and designing logistics processes that minimise waste may therefore represent additional opportunities to improve the overall sustainability profile of data centre infrastructure projects.

Together, these lifecycle considerations highlight that the sustainability of data centre infrastructure extends beyond operational energy and water usage alone. Design choices that reduce material intensity, improve packaging efficiency and increase recovery or recyclability at end of life may also reduce waste to landfill and improve the broader environmental performance of infrastructure supply chains. Addressing both operational

[5] Infrastructure Australia. *Embodied Carbon Projections for Australian Infrastructure and Buildings*.

efficiency and the lifecycle environmental impacts of infrastructure components may support more comprehensive approaches to sustainable digital infrastructure development.

Recommendations

The NSW Government should recognise that infrastructure design within data centre environments can influence facility-level efficiency, cooling demand and broader sustainability outcomes.

The following recommendations outline practical measures that may assist policymakers and industry stakeholders in improving the efficiency and sustainability of data centre infrastructure.

Recommendation 1:

Recognise the role of internal infrastructure design in data centre efficiency

The NSW Government should recognise that infrastructure design within data centre environments can influence overall facility efficiency and sustainability outcomes.

Policy discussions regarding data centre sustainability often focus on electricity generation, cooling technologies and building-level design. However, the internal physical infrastructure of data centres - including server rack configuration, connectivity systems and installation practices - can also influence airflow efficiency, thermal performance and cooling demand.

Recognising the role of rack-level infrastructure design in policy frameworks may encourage a more holistic and multi-pronged approach to improving the efficiency of data centre operations.

Recommendation 2

Encourage best-practice airflow and infrastructure design standards in high-density computing environments

The NSW Government should encourage the adoption of best-practice design and installation standards that support efficient airflow management in high-density computing environments.

Excessive cable density, poorly managed cabling and obstructed airflow pathways can reduce cooling efficiency and increase the energy required to maintain safe operating temperatures. In large-scale facilities with decades-long lifespans, relatively small airflow inefficiencies can scale across thousands of racks over tens of years, contributing to increased cooling demand and electricity consumption.

Encouraging industry adoption of engineering-led infrastructure design standards, including best-practice cable management and rack layout, may support improved thermal performance and reduce cooling energy requirements.

Recommendation 3

Improve transparency around thermal performance and infrastructure efficiency

The NSW Government should consider mechanisms to improve transparency around thermal efficiency strategies within data centre developments.

Current policy discussions tend to focus on building-level cooling systems and electricity supply, but the efficiency of cooling systems is also influenced by internal airflow management and infrastructure layout. Requiring greater transparency around thermal management strategies, including rack-level airflow optimisation and infrastructure design considerations, may support more informed planning and operational decision-making.

Recommendation 4

Encourage lifecycle sustainability and embodied carbon transparency in digital infrastructure supply chains

The NSW Government should encourage greater consideration of lifecycle environmental impacts associated with infrastructure components used in data centre developments. Procurement approaches should consider not only upfront cost, but also durability, reliability, service life, recyclability and broader lifecycle impacts.

The concept of embodied carbon - representing emissions associated with the extraction, manufacture and transportation of materials - is increasingly recognised as an important component of infrastructure sustainability. Improving transparency around lifecycle environmental impacts, including embodied carbon and recyclability, may support more sustainable procurement decisions within the digital infrastructure sector.

Recommendation 5

Support the development of best-practice guidance for sustainable data centre infrastructure

The NSW Government could consider supporting the development of best-practice design guidance for sustainable data centre infrastructure.

Such guidance could assist industry participants in identifying practical approaches to improving thermal efficiency, reducing cooling demand and improving lifecycle sustainability. Areas that may benefit from further guidance include airflow management, infrastructure density, installation practices, and lifecycle environmental impacts of infrastructure components.

Developing recognised best-practice guidance may also help position New South Wales as a leader in responsible and efficient digital infrastructure development.

Conclusion

Data centres are a critical component of the digital infrastructure supporting modern economies. As the sector continues to expand in New South Wales and across Australia, ensuring that this growth occurs in an efficient and sustainable manner will be increasingly important.

While much attention is rightly focused on energy supply and cooling technologies, this submission highlights that infrastructure design within data centre environments can also influence thermal efficiency, cooling demand and lifecycle sustainability outcomes.

Considering these factors alongside broader planning and energy considerations may support more holistic approaches to sustainable data centre development. Kordz welcomes the opportunity to contribute technical insights about connectivity to this discussion and would be pleased to assist the Committee with any further information that may be useful to the Inquiry.

References

1. **International Energy Agency (IEA),** *Energy and AI*, available at:

   https://www.iea.org/reports/energy-and-ai

2. **Infrastructure Australia,** *Embodied Carbon Projections for Australian Infrastructure and Buildings*, available at:

   https://www.infrastructureaustralia.gov.au/sites/default/files/2024-08/IA24_Embodied%20Carbon%20Report_09-08-24.pdf