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DISCUSSION PAPER

FROM GRID TO GREATNESS: POSITIONING NZ AT THE HEART OF THE AI ECONOMY

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THOMAS SCRIMGEOUR AND DR PAUL HENDERSON

Table of Contents

About the authors

Dr Paul Henderson, Senior Research Fellow. Paul's background is in education. Working from DPMC, under John Key, he was secretary to a cross-party committee tasked to review school choice and educational reform. He holds degrees from Aberdeen, Cambridge, Laidlaw College, and a PhD from Australian Catholic University. His research focuses on human and artificial intelligence.

Thomas Scrimgeour, Researcher. Thomas is a public policy researcher at Maxim with a background in the trades and community sector. His research interests include social cohesion, New Zealand nationhood, and how communities adapt to a rapidly changing world.

A note on our research method: To explore the potential usefulness of AI, we prepared this paper with limited, selective use of ChatGPT 4o and Gemini 2.5 Flash.

We asked these programmes questions such as: “Who are the main industry players in the New Zealand data centre industry?”, “What comparative advantages does New Zealand have to potentially become a data centre hub?”, and “What is the relationship between artificial intelligence programmes and data centres?”

The responses did not introduce new information or alter our earlier literature review, which forms the basis of this paper. Rather, they assisted in structuring our argument and clarifying the key points we wished to make.

A note on our endnotes: There is a large and rapidly expanding body of research on the uses, risks, and opportunities that come with AI. The most useful sources that we found in our literature review have been placed in the endnotes of this paper. We refrained from placing many quotations in the body of the text to make the paper more readable. However, interested readers will find a wealth of further material and quotations in the endnotes.

The paper in summary...

The AI revolution is already making its mark on the physical world. Behind every digital breakthrough are massive data centres—warehouse-scale computers that power the training and deployment of AI models. These facilities consume staggering amounts of electricity, accounting for about 2% of global demand. This is projected to double before 2030, outpacing clean energy growth. This offers New Zealand a rare opportunity: to become the sustainable data centre hub of the Asia-Pacific.

The opportunity

New Zealand has several competitive advantages:

- **A cool, stable climate:** Ideal for naturally cooling servers, reducing energy costs.
- **Political stability and data sovereignty:** A trusted jurisdiction with robust privacy protections and strong rule of law.
- **A renewable energy grid:** Nearly 90% of our electricity is already low carbon, a selling point for climate-conscious clients.

Hyperscalers such as Amazon and Microsoft, and some smaller providers, are already investing in New Zealand. With the right policy settings, this sector could generate high-value jobs, attract billions in foreign direct investment, and cement New Zealand's reputation for sustainability.

The constraints: Power, connectivity, and regulation

New Zealand's total electricity generation is a significant obstacle to leveraging this opportunity. Data centres need vast amounts of affordable, reliable power; New Zealand has high electricity prices. In addition, our international connectivity relies on a small number of undersea cables, creating latency and redundancy risks for global clients. Regulatory complexity and approval delays, along with strong competition from Australia, Singapore, and emerging Southeast Asian hubs, further threaten our position.

The solution: Strategic investment and reform

To meet these challenges, we must:

- **Double conventional geothermal output,** taking advantage of a proven, low-carbon, baseload source.
- **Explore emerging technologies.** Current contenders include:
  - Supercritical geothermal, which goes deeper to unlock massive reserves of energy, and
  - Small modular reactors (SMRs), next-generation nuclear technology that offers safe, scalable, zero carbon power.
- **Encourage public-private partnerships (PPPs)** to finance new grid and generation projects.
- **Streamline consenting and regulatory processes** to cut project timelines and costs.
- **Expand international connectivity** through additional submarine cables and satellites for added redundancy.
- **Introduce targeted fiscal incentives** to attract and retain data centre investment.

In short, New Zealand can lead in sustainable AI infrastructure, but the window of opportunity is closing quickly. The decision is about more than just energy policy; it is about securing our place in a fiercely competitive global market. The choices we make now will determine whether New Zealand becomes a leader in the AI economy or is stuck competing for what's left.

1. INTRODUCTION

This is the fifth in a series of reports on Artificial Intelligence (AI). Previously, Maxim Institute has written on AI and agriculture, education, democratic processes, and employment.[1] It continues the themes of productivity and employment developed earlier, focusing on the opportunity New Zealand has for becoming a data centre hub. It necessarily touches on the use, cost, and development of energy and the infrastructure supporting it.

Background: The growing global demand for AI-driven computing and the role of data centres in sustaining AI advancements

The rapid expansion of artificial intelligence (AI) and cloud computing has significantly increased the global demand for high-performance data centres.[2] These facilities are essential for training and deploying AI models, processing massive datasets, and supporting real-time applications across industry. As AI continues to advance, the need for scalable, energy-efficient, and secure data infrastructure is becoming a critical concern.[3]

However, the cost and the environmental impact of AI-driven data centres have become pressing issues. Studies indicate that AI infrastructure is being deployed at a much faster rate (12-18 months) than clean energy projects can be developed (3-7 years), leading to capacity shortfalls in key data hubs worldwide.[4] If not addressed, this misalignment will undermine decarbonisation efforts and AI's potential. While the former is under increasing political pressure, which will likely lead to a reduction in commitments to specific goals in the near term, it is probable that the life cycle of governments will bring renewed interest in green policies within the next decade.

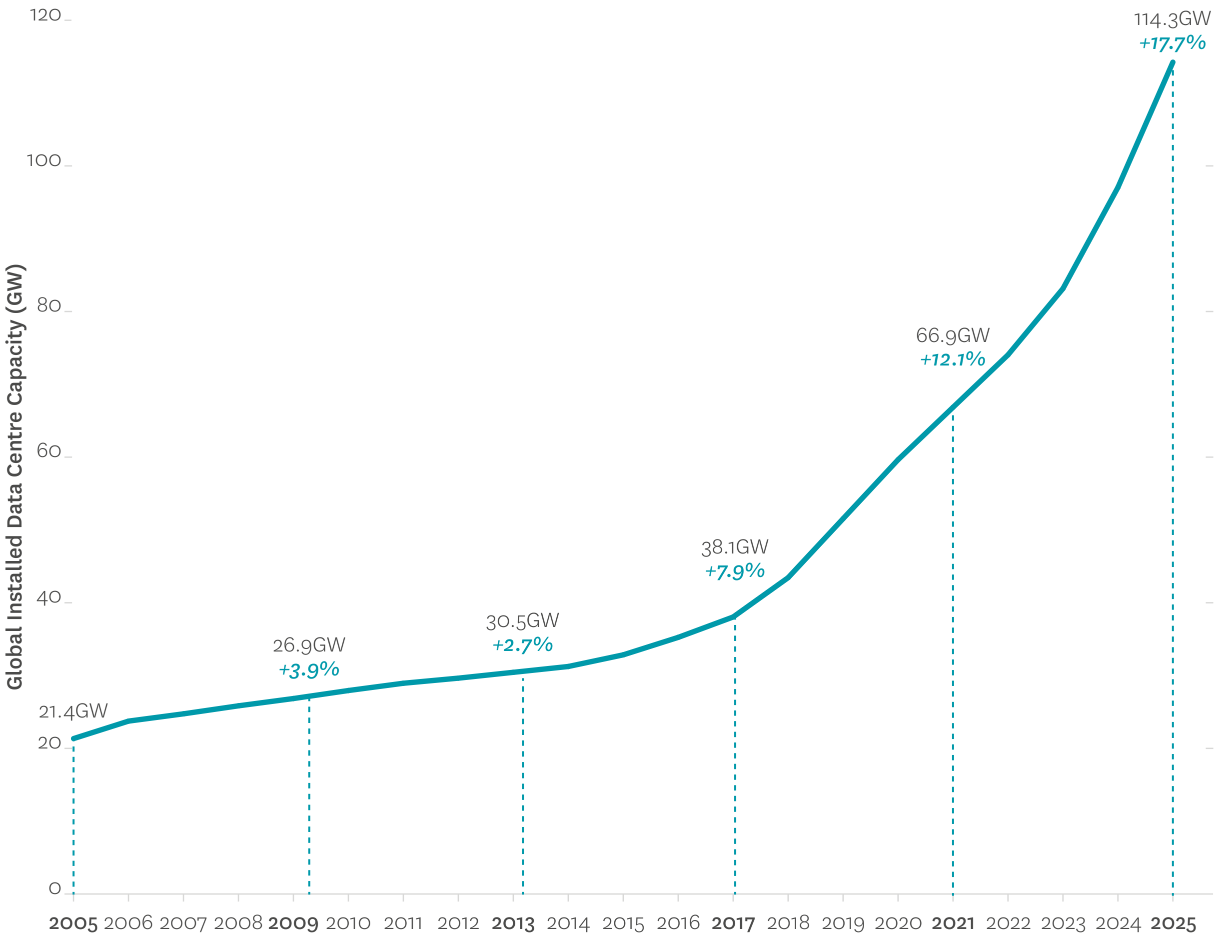

Figure 1. The world's growth of installed data center capacity.

The opportunity

Aotearoa New Zealand could become a data centre hub due to its breadth of energy resources, grid infrastructure, workforce, cool climate, and political stability. Unlike regions where fossil fuel dependency remains high—such as India, where AI-driven energy demand is projected to generate up to 550 kg CO_2e/MWh (megawatt-hour, the energy produced or consumed by one megawatt of power over an hour) by 2034—New Zealand's hydro and geothermal energy provides a distinct sustainability advantage, both economic and environmental.[5] However, for New Zealand to capitalise on this opportunity, it needs strategic investments and policy adjustments to reduce its high energy costs.

Scope and structure

This report addresses New Zealand's potential to become a data centre hub for the Asia-Pacific. Section 1 provides an overview of how data centres operate and consume resources in order to evaluate New Zealand's readiness for large-scale AI deployment. It focuses on the role of data centres in supporting AI advancements, the country's energy infrastructure, and the investment required to enhance its competitive position internationally.

Section 2 describes the fundamental importance of data centres in enabling AI applications, highlighting the specific computational and energy demands associated with AI training and inference. Its point is that AI is largely data centre-dependent.

The following section examines the current state of data centre infrastructure in New Zealand, identifying major industry players, existing infrastructure, and regional connectivity strengths and weaknesses. The assessment provides a foundation for understanding the country's current data centre capacity and how and where this capacity can be increased.

Section 4 explains data centre energy costs in relation to AI training and inferencing, infrastructure and cooling, data transmission and high-speed interconnects, and storage. AI training and operations, which will only increase in the foreseeable future, are energy-intensive.

Section 5 is central to the argument of the report. It gives an overview of New Zealand's electricity sources and reviews its grid and transmission costs because the country's success in the use of AI and sale of business via its data centres is dependent on reliable, cheap energy. Dependable, competitively priced energy is not only crucial to productivity but also for attracting international investment as clients look for places to host their data and AI workflows.

The following section highlights the investment needed in New Zealand's grid infrastructure and energy resources to make its electricity pricing and delivery more attractive and beneficial to users. The section also considers models for financing—government-funded, private sector, or hybrid—touching on the pros and cons of each.

Section 7 returns to the challenges New Zealand faces if it determines to compete in the data hub space. It notes that geographical remoteness, the cost of electricity, regulatory hurdles, and the speed of builds undermine the advantages the nation has as a stable democracy with a cool climate and tight privacy laws.

Section 8 describes the actions required for New Zealand to become a key data centre hub, including investment in renewable energy, grid modernisation, regulatory adjustments, and international data connectivity enhancements.

The final section provides actionable policy recommendations to foster long-term growth and sustainability in the data centre sector.

2. THE IMPORTANCE OF DATA CENTRES FOR AI

Data centres play a crucial role in supporting the rapid growth of artificial intelligence, providing the essential computational power for AI development and deployment. As AI applications continue to evolve, they place increasing demands on data infrastructure, necessitating efficient and scalable data centre operations.

This section explores the fundamental importance of data centres for AI. It highlights their computational and energy needs, and touches on issues of data sovereignty and security.

AI's computational demands

The rapid growth of AI technology has greatly increased the need for powerful computing resources to train and run advanced machine learning models like ChatGPT and DALL-E. Generative AI applications such as language processing, image recognition, and automated decision-making require huge amounts of data.[6] This means they rely on specialised hardware such as Graphics Processing Units (GPUs) and Tensor Processing Units (TPUs) housed in modern data centres. GPUs, originally designed for video games and graphics, are used for AI because they can handle trillions of calculations per second, making them ideal for deep learning.[7] TPUs, created by Google, are even more specialised for AI tasks.[8] With their high throughput, they are designed to process the complex mathematics behind neural networks faster and more efficiently than more general-purpose GPUs. As AI models become more advanced, the demand for these high-performance computing systems continues to grow, leading to new developments in energy-efficient chips, cloud computing, and large-scale AI infrastructure.

Cloud computing and distributed processing help AI systems run smoothly and handle large amounts of data efficiently.[9] Many companies use multiple cloud providers to spread out their computing tasks, to save money and minimise the risk of system failure. Instead of relying on just one provider, they switch between different services to keep their systems running efficiently.

As with video streaming, a big challenge in AI is latency, which is the delay between sending and receiving data. This delay is problematic for things like self-driving cars, factory robots, and other AI-powered systems that need to make split-second decisions. To reduce these delays, companies are using edge computing.[10] This means processing data closer to where it's created, like a local cell tower instead of a far-away cloud server. This helps AI respond faster to queries and reduces the amount of data that needs to travel over the internet.

Other new approaches, like federated learning, allow AI models to learn from multiple devices without sending private data to a central location.

Despite advances in edge computing and various forms of distributed processing, difficulties remain. Companies need to ensure data security, improve how different cloud systems work together, and make AI systems more energy efficient as they continue to grow in power.

Energy-intensive nature of AI

The training and inference processes for AI models require extensive computational resources. For instance, training a recent model like GPT-4 is estimated to consume up to 50,000 MWh of electricity—enough to power 7,000 New Zealand homes for a year. As AI applications scale globally, the demand for energy-intensive GPUs and TPUs is going to rise.[11] The Ministry of Business, Innovation and Employment notes that total data centre demand capacity will reach 233 MW by 2029.[12]

Recent studies highlight how this surge in electricity demand is outpacing the deployment of clean energy infrastructure. In Northern Virginia, one of the world's largest data centre hubs, AI-driven energy consumption is expected to triple by 2029, while clean energy capacity is projected to only double by 2030.[13] This disparity could lead to a 2.5 GW shortfall by 2034, highlighting the urgency for regions like New Zealand to plan ahead for AI-driven energy expansion.[14]

New Zealand's cool climate offers an advantage in mitigating one of AI's major energy challenges: cooling infrastructure. In regions such as Singapore, AI workloads have pushed cooling energy demands higher. Leveraging natural cooling solutions could help offset costs while maintaining high energy efficiency.[15]

AI inference (generating an answer to a question), although generally less demanding, also requires continuous power to process real-time data, particularly for applications such as healthcare diagnostics and financial market analysis. Smart surveillance systems, too, rely on AI to analyse video feeds in real time, detecting anomalies, tracking movement, and enhancing security. Moreover, voice assistants and real-time language translation services depend on AI inference to process speech instantly and generate accurate responses. And personalised content recommendations, streaming platforms, and e-commerce sites leverage AI inference to analyse user behaviour and deliver personalised suggestions instantly. These examples underscore the continuous energy demands of AI inference across multiple industries.[16]

Studies estimate that data centres worldwide already consume up to 2% of global electricity. With the rapid growth of artificial intelligence and other data-intensive applications, energy consumption by data centres is projected to increase significantly, necessitating solutions for sustainability. The International Energy Agency (IEA) reported that in 2022 data centres consumed approximately 460 terawatt-hours (TWh) of electricity, accounting for about 2% of global electricity usage. It expects data centre power use to double by 2026, depending on factors such as the pace of deployment, efficiency improvements, and trends in artificial intelligence and cryptocurrency.[17] New Zealand's use of renewable energy provides an opportunity to mitigate the impact of such demands, but additional investments in energy generation, energy-efficient cooling systems, optimised server architectures, and AI-driven energy management tools will be necessary to further its advantage.[18] By leveraging geothermal, hydroelectric, and wind energy sources, New Zealand can position itself as a leader in sustainable AI computing infrastructure, even if the mood globally is to place less emphasis on reducing global emissions. Nuclear energy, while commonly vilified, is also efficient and should be considered in a sustainable cheap energy mix.[19]

Data sovereignty and security

As AI-driven enterprises expand their digital operations, the question of data sovereignty has become increasingly critical. Businesses and organisations must decide whether to store data locally or internationally, balancing accessibility with regulatory compliance. Hosting data locally can offer better compliance with national laws, improved latency for users, and reduced risks associated with international data transfer policies. However, it may also limit access to advanced cloud services that are primarily hosted overseas.

Laws such as the General Data Protection Regulation (GDPR) and the New Zealand Privacy Act impose stringent requirements on data handling, influencing the selection of data centre locations. Ensuring data security through robust encryption, compliance measures, and infrastructure resilience is vital for maintaining trust and safeguarding sensitive information in AI-driven ecosystems. Additionally, geopolitical considerations play a role in data sovereignty, as governments and enterprises prioritise secure and reliable infrastructure to protect against cyber threats and ensure business continuity. By these measures New Zealand has good standing.

Summary

Data centres are fundamental to the growth of AI, but their high energy consumption and infrastructure demands pose challenges. New Zealand's use of renewable energy offers a competitive advantage, but it needs further investment, as does its storage, connectivity, and energy management. Furthermore, doubling down on its data sovereignty measures and sustainable energy practices will be important in the long term to position the country as a leader in AI-driven data infrastructure.

3. LOCATIONS AND INFRASTRUCTURE

If New Zealand decides to establish itself as a sustainable data centre hub, it needs to address key infrastructure challenges and build on its renewable energy advantages. Comparisons to overseas AI hubs highlight the importance of proactive energy planning. For example, the Nordic region maintains more than 80% renewable energy integration despite AI demand growing by 25% annually, demonstrating that high-performance computing can be powered sustainably with the right policies in place.[20]

Locations

This section outlines key data centre locations, major players, and infrastructure trends shaping the industry.

Auckland

The city of Auckland is home to two hyperscale data centre projects: (1) with Microsoft, which is developing a hyperscale data centre region in Auckland with more than 100 MW (megawatts) of IT capacity, and (2) with Amazon Web Services (AWS), which has committed an estimated NZ$7.5 billion investment over 15 years for a dedicated cloud region.[21] Auckland is therefore the focal point of New Zealand's data infrastructure growth.[22]

Figure 2. Auckland Data Centres

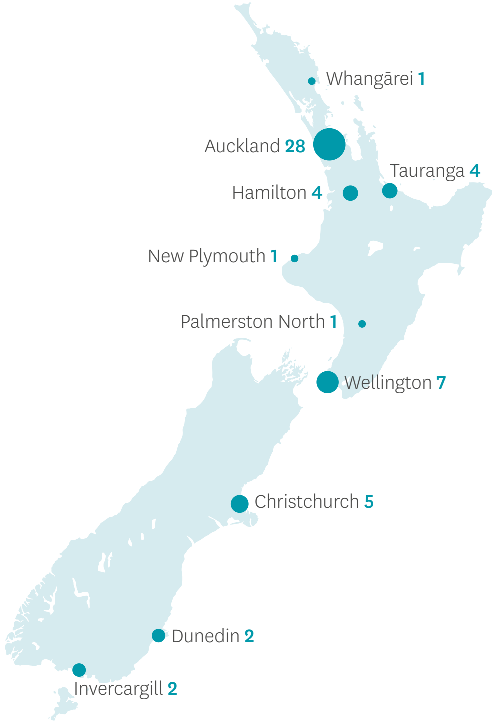

Figure 3. National Data Centres

The city also has multiple co-location facilities operated by Datacom, Spark Revera, and CDC Data Centres, an Australian firm that is looking to expand with a planned 100 MW data centre campus. Notably, CDC is prioritising sustainability, with its New Zealand operations largely powered by renewable energy sources, further emphasising its commitment to large-scale, secure cloud services.

Wellington

As the political and regulatory capital, Wellington's data centres primarily serve government agencies and enterprise clients. Facilities here emphasise data sovereignty and security while benefiting from a stable energy grid and proximity to national regulatory institutions.

- Datacom operates a Tier III-certified facility, serving government agencies, financial institutions, and business clients.
- Spark's Revera Cloud Services, a subsidiary of Spark New Zealand, manages data centres across the country. It provides more than 10 MW of IT capacity, including in Wellington, focusing on corporate and government clients. These facilities advantageously leverage Spark's nationwide fibre-optic network for low-latency, high-availability services.[23]

Christchurch

Serving as a secondary hub for South Island businesses, Christchurch's data centres support disaster recovery, business continuity, and regional cloud computing needs. The city's relatively cool climate provides a natural advantage for data centre cooling, reducing operational costs and improving energy efficiency. Future investment in Christchurch's data centre sector is expected to strengthen redundancy (more backup infrastructure, reducing the risk of data loss or downtime in the event of system failures, power outages, or cyberattacks), enhance network connectivity, and increase energy-efficient infrastructure.

- Datacom operates a Tier III-certified data centre, offering colocation and cloud services.
- Spark Revera has been upgrading its Christchurch-based data centre to accommodate increasing enterprise and government demand.[24]

Hamilton

Emerging as a strategic alternative to Auckland, Hamilton is witnessing increased data centre activity, driven by lower land costs, access to renewable energy sources, and proximity to Auckland's digital economy. The development of data centres in Hamilton aims to alleviate "congestion" in Auckland while leveraging New Zealand's strong renewable energy mix for sustainable operations.

- Datacom has expressed interest in expanding operations in Hamilton due to its strategic location and energy efficiency potential (hydropower with the Waikato River and geothermal power).
- CDC Data Centres is evaluating opportunities for expanding into the region to complement its hyperscale operations in Auckland.[25]

Growth trends and competitive positioning

New Zealand's data centre market is expanding rapidly, driven by increased cloud adoption, AI workloads, big data analytics, digital platforms and recommender systems. Hyperscale investments from AWS and Microsoft will significantly boost capacity, with regional expansion in Hamilton and Christchurch alleviating congestion in Auckland.

Compared with regional competitors such as Australia and Singapore, New Zealand benefits from renewable energy and strong data sovereignty protections. However, its electricity is expensive and it faces challenges in international connectivity and market scale. Strengthening undersea cable links and incentivising further investment will be crucial for positioning New Zealand as a competitive data centre destination in the Asia-Pacific region.

Data centres offer tier certification.[26] Overseas clients will pay close attention to redundancy (more backup infrastructure, reducing the risk of data loss or downtime in the event of system failures, power outages, or cyberattacks) and uptime details. Downtime incurs losses. The certification signals how much confidence clients can have in a given data centre's arrangements. It is a key consideration for businesses and government agencies when selecting data centre providers, as it directly impacts service reliability and business continuity.

Summary

New Zealand's data centre landscape is evolving, with Auckland leading hyperscale developments, while Wellington and Christchurch serve enterprise and government clients. Hamilton's emergence as an alternative hub highlights the industry's regional diversification. As international investments grow, continued focus on energy efficiency, connectivity, high-tier certification, and competitive pricing will be critical for expansion. Geothermal and especially hydropower generation could play a crucial part in all this.

4. ENERGY CONSUMPTION OF DATA CENTRES

As AI-driven workloads continue to grow, data centres are facing increasing energy demands. The power requirements for training and running AI models, maintaining high-performance computing infrastructure, and ensuring continuous operations contribute significantly to electricity consumption. This section examines the electricity needs of AI-focused data centres, the costs associated with their operation, and how New Zealand compares with other nations in terms of energy efficiency and sustainability.

Demand and costs

Electricity demand of data centres

Data centres globally consumed approximately 460 TWh of electricity in 2022, accounting for about 2% of worldwide electricity usage (International Energy Agency). Given the pace of AI expansion, this figure is expected to more than double to 1,050 TWh by 2026, placing immense pressure on electricity grids.[27]

Current projections show that while some regions, like Dublin and the Nordic countries, are improving their carbon intensity, others face challenges due to fossil fuel dependency. By 2034, carbon intensity levels will range from 15 kg CO_2e/MWh in the Nordic region to 550 kg CO_2e/MWh in India, underscoring the disparity between environmentally sustainable and high-emission AI hubs.[28] New Zealand, with its hydro and geothermal energy, is well-positioned to emerge as a low-carbon AI hub if it invests strategically in energy infrastructure expansion.[29]

AI training vs AI inferencing costs

Training AI models is an energy-intensive process, requiring extensive computational resources over extended periods. For instance, training GPT-3 (an early iteration of the technology) with 175 billion parameters is estimated to have used just under 1,300 megawatt-hours (MWh) of electricity, roughly equivalent to the annual power consumption of 180 New Zealand homes.[30] GPT-4 is rumoured to have 1.8 trillion parameters and to have used up to 65,000 MWh—roughly equivalent to the annual power consumption of 9,000 New Zealand homes.[31] The costs look to be coming down with LLaMA 3 using 600 MWh for training. But even a platform like Deep Seek is thought to have used approximately 15,000 MWh to train.[32]

Inference, the process of deploying trained models to make predictions (answering questions), generally consumes less energy per operation. However, energy use can still become significant due to the high frequency of inferences in real-world applications. While each individual inference may consume less energy than the training phase, the cumulative cost over time is substantial, especially with widespread deployment. In coming months, as the technology is more widely used, even greater demands will be made on the nation's grid.[33]

Cooling costs and challenges

Cooling is also a major component of data centre energy consumption. It is necessary to maintain optimal operating temperatures for hardware. Traditional air-cooling methods can be energy-intensive, especially in warmer climates. Liquid cooling solutions, such as direct-to-chip and immersion cooling, offer improved efficiency, potentially reducing cooling energy requirements by up to 45%. While initial capital expenditures for liquid cooling systems can range from $1,000 to $2,000 per kW cooled, operational savings through reduced energy consumption and lower maintenance costs can lead to a return on investment (ROI) within three to five years.[34] New Zealand's cool climate and high average rainfall provide additional advantages that lower the energy consumption of data centres, offering an opportunity for natural cooling strategies, which can further enhance energy efficiency.[35]

Cooling represents a significant portion of energy costs in data centres. Regions such as Singapore have had to invest heavily in alternative cooling strategies, including floating solar farms and offshore cooling systems, to mitigate the heat generated by AI workloads. In contrast, the Nordic region has leveraged its cold climate to reduce energy costs, a strategy that New Zealand could adopt given its similar environmental conditions.[36]

Infrastructure costs

Infrastructure costs in data centres encompass expenses related to hardware acquisition, redundancy systems, and facility maintenance. According to Uptime Institute, the range for capital expenditures (CapEx) for a Tier III data centre is US$7-12 million per MW, while operational expenditures (OpEx) can range from US$120,000 to

US$200,000 per MW annually.[37] These costs are influenced by factors such as the choice of cooling systems, power distribution architecture, and the implementation of energy-efficient technologies. For example, liquid cooling systems, while offering improved thermal efficiency, can increase capital expenditure by 30–50% compared with traditional air-cooling systems.[38] However, investments in advanced cooling and power management systems can lead to long-term savings, with energy-efficient designs reducing power usage effectiveness (PUE) from a typical 1.5 to as low as 1.1, translating into annual savings of US$1–3 million per MW.[39]

Electricity costs

Electricity pricing is a critical factor in data centre operations. In New Zealand, electricity costs are influenced by the country's energy mix, which includes a significant proportion of renewable sources such as hydroelectric and geothermal power. As of 2024, the average electricity price range for industrial consumers in New Zealand was NZ$80–120 per MWh.[40] While this contributes to a lower carbon footprint, the actual cost per MWh can vary based on factors like grid infrastructure and market dynamics. Comparatively, countries with abundant and inexpensive renewable energy sources, such as Iceland (NZ$50–70 per MWh) and Norway (NZ$60–90 per MWh), offer more competitive electricity pricing for data centre operations.[41] In contrast, data centres in regions reliant on fossil fuels, such as parts of Australia, face electricity costs exceeding NZ$150 per MWh due to carbon pricing and higher generation costs (Australian Energy Market Operator, 2024).[42] That said, New Zealand's electricity is still the fourth most expensive in the Asia Pacific region.

Network, interconnects, storage, and bandwidth

AI models and applications—for example, in finance, security, or driverless vehicles—require rapid communication between GPUs, CPUs, and storage systems, making high-speed interconnects like InfiniBand (400 Gbps), NVLink (900 Gbps), and Ethernet (100–400 Gbps) essential.[43] The cost of deploying these high-performance networks varies, depending on speed and scalability. For example, a 200 Gbps InfiniBand switch costs US$10,000–40,000 per unit, while data centre-scale implementations can exceed US$1 million for full-rack deployment. High-speed networking also requires specialised network interface cards (NICs), which can cost US$2,000–6,000 per GPU node, significantly increasing capital expenditures.[44]

Furthermore, AI workloads generate and process extensive amounts of data, necessitating high-performance storage solutions such as NVMe SSDs, distributed storage architectures, and object storage systems. A single NVMe enterprise-grade SSD (e.g., 7.68TB) costs between US$1,500 and US$3,000, while large-scale deployments using all-flash arrays or NVMe-over-Fabric (NVMe-oF) solutions can exceed US$100,000 per petabyte.[45] Traditional HDD-based storage, while more cost-effective at US$100,000–200,000 per petabyte, cannot meet the performance demands of AI training, meaning most AI data centres will need to invest in flash-based storage.[46]

AI data centres also require high-bandwidth internet connections to handle distributed training, edge computing, and cloud integration. The cost of 1 Tbps dedicated internet connectivity ranges from US$30,000–100,000 per month, depending on the region and provider.[47] Additionally, data transfer fees for cloud-based AI workloads can add substantial operational costs. For example, AWS charges approximately US$90 per TB for data egress beyond 500 TB per month, which can lead to monthly expenses exceeding US$500,000 for large-scale AI training.[48]

In short, while implementing advanced storage technologies and high-speed networking equipment increases capital expenditures, these investments are necessary to meet the computational and throughput demands of AI. Failure to invest in low-latency, high-bandwidth infrastructure leads to bottlenecks, increased training times, and inefficient resource utilisation, ultimately impacting operational efficiency and increasing long-term costs. AI-focused data centres must balance upfront capital investments with operational efficiencies, considering factors such as energy-efficient storage, network optimisations, and scalable architectures to maintain cost-effectiveness in AI-driven operations.

International comparison of costs

When comparing AI data centre operating costs, factors such as electricity pricing, cooling efficiency, and infrastructure expenses play pivotal roles. For instance, countries such as the United States and Singapore have established data centre industries with competitive energy pricing and advanced infrastructure. New Zealand's advantages include its renewable energy resources and

Figure 4. The power cost of a 20MW data centre (PUE 1.5)

Sub-Region	Market	Tarif USD (cents)	Annual Power Cost (millions)	Monthly Power Cost S/kW
SEA	Singapore	19.19	50.4	138
ANZ	New Zealand (Akl)	14.94	39.3	108
North Asia	Japan (Tokyo)	14.22	37.4	102
Gr. China	Taiwan	13.81	36.3	99
SEA	Philippines (Metro Manila)	13.59	35.7	98
SEA	Indonesia (Jakarta)	12.23	32.1	88
ANZ	Australia (Sydney)	11.97	31.5	86
SEA	Thailand (Bangkok)	10.48	27.5	75
Gr. China	China (Shanghai)	10.09	26.5	73
Gr. China	Hong Kong (Kowloon)	9.82	25.8	71
North Asia	South Korea (Seoul)	9.14	24	66
SEA	Malaysia (Kuala Lumpur)	7.32	19.2	53
SEA	Vietnam (HCMC)	7.21	18.9	52
SEA	India (Mumbai)	6.71	17.6	48
Average		**11.48**	**30.2**	**83**

favourable climate for natural cooling, which can offset some costs. However, challenges such as its geographical remoteness and its transmission costs need to be addressed.

Summary

While AI-focused data centres are energy-intensive, New Zealand's renewable energy resources and cool climate offer opportunities to mitigate some of the associated costs. Strategic investments in energy production, energy-efficient technologies and infrastructure are essential to enhance the country's competitiveness as a data centre hub.

5. NEW ZEALAND'S ENERGY LANDSCAPE

Energy production is a major input factor for industrial data centres. Affordable and reliable power are the cornerstones of a viable industry, and energy produced in an environmentally sustainable way offers a comparative advantage. New Zealand's energy landscape plays a crucial role in determining the viability of its data centre industry in addition to its general productivity. Comparatively green energy production is a strength; however, total capacity and reliability present challenges for growth.

Globally, the transition to clean energy is highly variable. J.P. Morgan's Michael Cambalest observed that even after a "$9 trillion [spend] globally over the last decade on wind, solar, electric vehicles, energy storage, electrified heat and power grids, the renewable transition is still a linear one." He estimated that its share of final energy consumption has grown from about 14% in 2012 to only just over 18%, advancing just 0.3%–0.6% per year. At this rate, we would achieve 100% carbon-free after 2200.[49] Political commitment to climate targets is softening around the globe, exacerbated by geopolitical tensions, trade disputes and conflicts in Ukraine and the Middle East. New Zealand may follow global trends and deprioritise decarbonisation, or clean energy production could prove to be an even greater comparative advantage. This report assumes that a preference for clean energy will remain a feature of New Zealand's energy policy for the foreseeable future.

New Zealand's significant use of renewable energy is a key differentiator in the AI-driven data centre industry. Despite most major tech companies' commitment to ambitious climate goals,[50] the global surge in data centres has led to a significant uptick in natural gas consumption.[51] In the USA and China, which are the two largest data centre markets, most of the electricity consumed by data centres is from fossil fuels.[52] Northern Virginia, the world's largest data centre hub, plans to generate carbon-free electricity by 2045.[53] By contrast, the vast majority of New Zealand's electricity production is already from low or zero carbon sources. New Zealand has set a target of 100% renewable electricity by 2030.[54] Currently, 54% of electricity is sourced from hydro and 18% from geothermal,[55] and the country has one of the lowest carbon footprints among competitor data centre hubs. It has a unique opportunity to position itself as a leader in cheap, sustainable data centre operations. While global commitment to climate targets is presently weak, it is likely that decarbonisation will remain a feature of global consumer preferences.

Comparing New Zealand with other AI data centre aspirants reveals a stark contrast in carbon intensity trends. If the policy commitments of governments and businesses overseas are weighted towards renewable energy over the next decade, New Zealand might be an attractive location for data centres. To capitalise on this opportunity, it must balance energy demand with reliable supply, cost efficiency, and infrastructure improvements, plan carefully, and take swift action. Grid capacity expansion and storage solutions must be prioritised to ensure AI-driven demand does not lead to wider energy shortages.

This section examines the composition of New Zealand's energy mix, the cost of electricity, and the strategic opportunities for expanding power generation to support future data centre growth.

Electricity sources

Electricity markets experience variable demand, pricing and mode of generation. These factors change throughout the day and across the year. To evaluate electricity markets, we must identify both baseload and peak production requirements. Additionally, each mode of power generation has a different cost profile and environmental impact.

Hydroelectricity

Hydroelectric power contributes around 61% of New Zealand's energy supply, with major dams in both the North and South Islands.[56] Hydroelectric dams have a high capital cost, but the marginal cost of energy production is low, so it is an affordable ongoing source of energy. It is also highly controllable in the short term. Power production can be rapidly increased in response to demand peaks and faces no time-of-day limitations. It is excellent for baseload power generation and peak demand management.

However, it is dependent on rainfall, so generation during dry periods is variable. Climate changes also create uncertainty for weather-dependent industries. However, MBIE modelling suggests that total water catchments are likely to remain relatively constant and future seasonal shifts may better match electricity demand than at present.[57] Regardless, seasonal constraints undermine stable electricity supply, particularly as energy demands continue to grow.

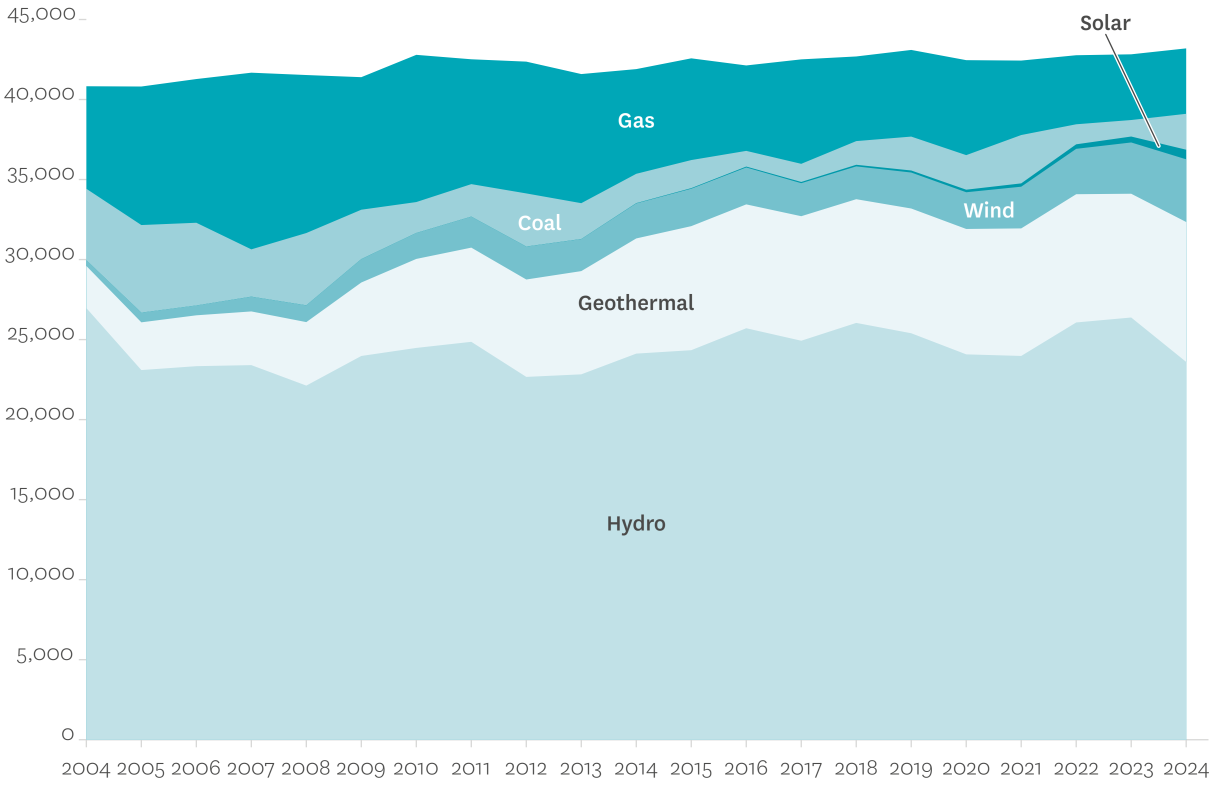

Figure 5. New Zealand's Annual electricity generation (Gigawatt hours, GWh), 2004-2024. SRC: MBIE

Hydropower also has limited capacity for expansion. It is environmentally friendly at a macro level, but dam construction has significant local environmental costs. New Zealand's regulatory system and public interest in conservation are unlikely to tolerate new dam construction, even if viable sites could be found. The Energy Efficiency and Conservation Authority does not expect hydroelectric production to grow significantly in the foreseeable future.[58]

Hydro is a major element of New Zealand's electricity mix, and an excellent source of clean and generally reliable power. However, constraints on increasing production mean it is unlikely to expand.

Geothermal

Geothermal energy is another key component of New Zealand's energy mix. It uses natural energy from within the earth that is relatively abundant and easy to access in New Zealand. Production is concentrated in the Taupō Volcanic Zone. Currently, geothermal contributes 900 MW of electricity, or approximately 18% of national production, making New Zealand the fifth-largest producer of geothermal energy globally.[59]

Like hydro, geothermal power provides a reliable baseload supply, making it an attractive energy source for large-scale industrial applications.[60] Likewise, it offers relatively cheap marginal power production but high initial capital costs. Unlike hydro, geothermal energy is not weather-dependent. It is, however, subject to local geological shifts and to depletion. Therefore it is not entirely renewable, but such changes span decades.

Geothermal power is not carbon neutral, however emissions are significantly lower than from fossil fuel sources and technological improvements are likely to further reduce its carbon intensity. Geothermal production can be incorporated into an environmentally conscious energy mix.

Current estimates suggest that New Zealand could double conventional geothermal production.[61] This would face regulatory hurdles from sources such as the Resource Management Act, which is currently under revision. Significant sections of suitable land are also under Māori title. Māori land faces additional obstacles to securing investment capital, even when owners want to develop it for industrial use.[62]

In addition to conventional geothermal technology, there is an experimental development that has the potential to increase geothermal output. "Super-critical geothermal" would drill deeper into the earth's crust, tapping into more abundant power. This technology is yet unproven, with the earliest timeframes for commercialisation from 2037.[63] Should super-critical geothermal become viable, it could solve the power generation trilemma by producing cheap, green, and reliable electricity. Policymakers should keep a close eye on this emerging technology.

Wind

Wind energy accounts for roughly 5% of the country's electricity, with significant growth potential.[64] Existing onshore installations, such as those in the Tararua Ranges and Southland, have demonstrated the viability of wind power in New Zealand's energy landscape without subsidy. The expansion of wind energy—particularly offshore wind projects—could provide additional capacity while supporting sustainability goals. The government's current fast-track legislation explicitly favours wind farm production.[65] While power production is zero carbon, advancing sustainability goals, end-of-life disposal costs are not adequately factored in.[66] In addition, disposal costs are greater for offshore wind farms.

Wind power is naturally variable, both day to day and throughout the year. Annual production peaks in spring and troughs in winter—when electricity demand is highest—with the seasonal difference in production around 20%.[67] While seasonal variation is relatively predictable, and therefore manageable, daily variation means that actual generation is often far below capacity. The Electricity Authority found that generation in 2022 exceeded 50% of installed capacity only about 9% of the time.[68] It dropped below 10% of capacity 16% of the time.[69]

The variable nature makes it challenging to integrate wind power into wider energy production landscapes, and it is unsuitable for baseload generation. Operational costs and end-of-life disposal challenges contribute to questions about whether or not wind farms produce sufficiently competitive yields. Regulatory barriers should not impede wind power, and it is a positive addition to diverse production modes, however, it offers little strategic value for data centres and others that require industrial power production.

Solar

Solar farm expansion could significantly increase power production as photovoltaic (PV) costs decrease and efficiency increases. Regions such as Canterbury and Hawke's Bay, in particular, have strong solar irradiation levels. Globally, solar production is increasing rapidly, with solar uptake exceeding international energy agency forecasts every year for the last decade.[70] However, the rapid global increase in solar output, especially in China, has not resulted in a decrease in fossil fuel production.[71]

Like wind, solar production is highly variable throughout days and seasons, and—unlike wind—generation drops to zero overnight. As with wind, there is a large gap between total capacity and actual production. Even excluding night-time values, generation falls below 10% a full 20% of the time, and tops 50% just 28% of the time.[72] The seasonal differential is also significant, with troughs coinciding with peak demand. Average generation is 32% lower in winter than in summer.[73] However, solar's high production in summer does balance hydroelectric's deficits in dry years.

Although solar contributes less than 1% of the country's electricity mix, recent investments indicate growing interest in utility-scale solar projects.[74] Companies like Lodestone Energy are leading initiatives to develop large-scale solar farms, with projects expected to add hundreds of megawatts to the grid.[75] Expanding solar capacity could enhance energy diversity, provide a complementary power source to hydro and wind, and improve grid stability while reducing reliance on fossil-fuel-based peaking plants. But like wind energy, questions about yield and end-of-life disposal remain. Solar is unlikely to significantly support energy-intensive industry, such as data centres.

Fossil fuel and thermal generation

Despite New Zealand's commitment to renewable energy, fossil fuels still play a role in ensuring energy security and grid stability—particularly during periods of low hydro and wind generation. Natural gas accounts for approximately 14% of the country's electricity supply, mainly used in peaking power plants to balance fluctuations in renewable energy production.[76] Globally, natural gas is useful to help transition away from coal, producing about half the carbon emissions.[77]

Coal generation in New Zealand, although it has reduced significantly, is still used when hydroelectric output is insufficient. As the country transitions towards renewable electricity, the intention is to reduce dependence on fossil fuels through battery storage, demand-response technologies, and increased investment in sustainable energy sources. Government policies and industry initiatives aim to phase out fossil fuel use by 2030, in line with New Zealand's net-zero carbon goals. However, given the challenges renewables face in times of peak demand, and the global de-emphasis on decarbonisation, gas and coal may continue to feature in the nation's energy mix.

As part of its climate agenda, the sixth Labour government announced a ban on oil and gas exploration in 2018. The current National-led government, as part of their coalition agreement with New Zealand First, reversed this ban. Future governments could reinstate it, deterring potential investors, so the government pledged $200 million of co-investment in the gas industry to make a future ban less palatable.[78] This reflects the level of industry concern about investment risk. However, such an investment is still unlikely to produce a large, viable gas industry because of the long timeframes to profitability and opportunities for natural gas investment elsewhere.

While natural gas and coal are an important element of New Zealand's energy landscape, and may remain so for some time, they are likely to decline. There is little scope to expand and support energy-intensive industry.

Battery storage

Battery technologies have improved significantly over recent years. Affordable and reliable energy storage provides a valuable opportunity to maximise affordable but variable power output from renewable systems, while providing resilience during peak demand. New Zealand had its first grid-scale battery finished in 2024, capable of producing 35 MWh.[79] Larger projects are also underway and expect to be online by 2026. The hope is that grid scale batteries can provide the necessary power at peak demand, facilitating the transition from gas and coal. Battery technology advances at pace and shows promise as a tool for peak demand management both in residential and industrial battery installations. However, present and near-future battery facilities could supply power for hours but not days, let alone weeks. Intermittent renewables paired with batteries are not a viable path to energy-intensive industrial use.

Electricity pricing and costs

Cost structure

The cost structure of electricity in New Zealand compared to global markets is shaped by its high reliance on renewable energy sources, regional transmission costs, and the regulatory framework. As of 2023, wholesale electricity prices in New Zealand range between NZ$100–150 per MWh,[80] which is competitive with some renewable-heavy markets like Germany but higher than hydropower-abundant countries such as Norway and Canada. Unlike regions with extensive fossil fuel or nuclear power generation, New Zealand's electricity costs are influenced by the variability of hydroelectric supply, which fluctuates seasonally. Additionally, transmission costs, which reflect the expenses of maintaining and upgrading the national grid, contribute to higher overall electricity prices. Compared to data centre hubs in the United States and Singapore—where electricity costs are lower due to subsidised energy markets, less weighting on renewable energy, and economies of scale—New Zealand's pricing structure presents a challenge for attracting large-scale data centre investments. However, its preference for renewable energy offers long-term sustainability benefits, positioning it as a low-carbon alternative for companies prioritising environmental goals.

Demand management

Because renewable sources are highly variable, and peak demand is met by more carbon-intensive alternatives such as gas, green energy policies rely on demand management.[81] This encourages consumers to reduce or time-shift power use to limit peak demand. This may be achieved by pricing, distributed energy resource markets (DERs, i.e. batteries), and smart tech (voluntary or mandated smart devices that time their consumption with off-peak times). Some power consumption can be easily moved, such as consumers timing their washing machines to run at different times of day, or smart chargers for electric vehicles running overnight. However, vulnerable populations are less able to move their power consumption.[82] Batteries are increasingly viable for domestic power consumption, allowing electricity to be bought off peak but consumed at peak times. However, batteries are not viable for industrial uses such as power centres. Overall, demand management risks becoming a shorthand for decreasing consumption, and therefore wellbeing, and so should not be the foundation of energy policy.

Grid and transmission costs

Grid fees and transmission costs are significant factors in determining electricity cost and competitiveness. In New Zealand, Transpower operates the national grid. The costs associated with maintaining, upgrading, and expanding transmission infrastructure are passed on to consumers, including data centre operators. These charges, which include connection fees, line charges, and transmission loss, account for about 8-10% of total electricity costs.[83] Compared with other nations, New Zealand's grid fees are relatively high due to the country's dispersed geography and reliance on long-distance transmission from renewable sources such as hydro and wind farms. Reducing these costs through investment in localised energy generation and improved grid efficiency will advance New Zealand as a competitive data centre destination.

Recommendations for increasing power generation

Expand conventional geothermal

Expanding New Zealand's geothermal energy capacity presents one of the most viable options for increasing power generation, particularly if the country continues towards a more sustainable and resilient energy grid. With over 80% of New Zealand's electricity already sourced from renewables,[84] geothermal power stands out as a baseload energy source, offering high-capacity factors (typically 85–95%). And, critically, it provides continuous electricity generation without reliance on variable weather conditions.

New Zealand has some of the world's most geologically active geothermal resources. They are primarily concentrated in the Taupō Volcanic Zone (TVZ), which extends from the Bay of Plenty to the central North Island. It currently generates around 1,000 MW of geothermal electricity, with key operational power plants including:

- Wairākei Geothermal Power Station (Taupō), one of the world's first large-scale geothermal plants, generating around 175 MW since the 1950s.
- Ngāwhā Geothermal Power Station (Northland)—a newer expansion, producing 57 MW, with potential for further development.
- Ohaaki Power Station (Taupō) that operates at 104 MW, leveraging deep geothermal resources.
- Kawerau Geothermal Power Station (Bay of Plenty), supplying 100 MW, primarily for industrial operations like pulp and paper mills.[85]

The ongoing RMA reforms present an important opportunity to reduce regulatory hurdles to expanding geothermal. In particular, the unique challenges that land in Māori title faces to receive significant capital investment should be examined.

Expanding geothermal energy not only strengthens New Zealand's energy security but also provides significant economic benefits. Reliable, low-cost geothermal power supports energy-intensive industries such as aluminium smelting, food processing, and hydrogen production. These all foster industrial growth. Geothermal power also emits 90% less CO_2 per MWh than fossil fuels, aligning with New Zealand's goal of 100% renewable electricity by 2035 and contributing to national decarbonisation efforts.[86] Furthermore, geothermal expansion would create many jobs in engineering, drilling, and plant maintenance, boosting local economies and providing long-term employment.

Emerging technologies

New Zealand can expand its geothermal power significantly by investing in advanced enhanced geothermal systems (EGS) and deep drilling technologies. EGS can access heat from deeper rock formations that were previously uneconomical, potentially unlocking an additional 2,500 MW of geothermal capacity across regions such as:

- Rotorua and Taupō, which have deep geothermal reservoirs with potential for new plant developments.
- Hawke's Bay and Gisborne, which are emerging geothermal zones with limited current utilisation but high potential.
- Northland (Ngāwhā Basin), where an expansion of existing geothermal infrastructure would support residential and industrial energy demand.[87]

Further, investment in binary cycle technology, which allows lower-temperature geothermal fields to generate electricity efficiently, could enable the development of smaller-scale, distributed geothermal plants in regions where conventional flash steam plants are not viable.

Integrating large-scale battery storage systems and demand-response programs will also increase grid reliability. Energy storage solutions such as pumped hydro and lithium-ion battery farms help manage fluctuations in renewable energy generation, ensuring consistent power availability for data centres and other high-demand users.

Explore modular nuclear reactors

Small modular reactors (SMRs) are emerging as a potential long-term energy solution for countries seeking stable, low-carbon electricity, particularly as they transition away from fossil fuels.[88] Unlike conventional large-scale nuclear reactors, SMRs are designed for modular construction, allowing for faster deployment and easier scalability to meet specific energy demands. They typically produce between 50 MW and 300 MW per unit, compared to the 1,000+ MW output of traditional reactors. This makes them suitable for remote locations, industrial applications, and grid support.[89]

One of the key advantages of SMRs is their lower capital investment compared with conventional nuclear plants. Traditional nuclear projects often face cost overruns and extended construction timelines, whereas SMRs are designed for factory assembly and standardised production, reducing upfront costs and construction risks. Costs for Britain's Hinkley Point C, a traditional nuclear reactor, have nearly doubled from the initial estimates. The project is now £17 billion over budget, with an expected final cost of £46 billion.[90] The estimated cost of deploying SMRs ranges from US$3,000–6,000 per kW, with total project costs projected at US$2 billion per reactor—a fraction of the cost of large-scale nuclear plants.[91] SMRs can also be deployed underground or in small, decentralised grids, reducing vulnerability to natural disasters, cyber threats, and grid instability.

Countries like Canada, the United States, and Japan are actively developing SMR technology, with pilot projects underway to assess commercial viability. Canada's Ontario Power Generation is leading the development of a 300 MW SMR at the Darlington nuclear site, expected to be operational by the early 2030s.[92] In the United States, NuScale Power has received regulatory approval for its 77 MW reactor design, with planned deployment in Idaho by 2030.[93] Japan, after years of nuclear hesitancy post-Fukushima, is rapidly investing in a next-generation SMR, high-temperature gas-cooled reactor (HTGR), with commercial deployment targeted for the 2040s. Additionally, companies such as Google and Meta have signed deals with SMR providers to ensure their data centres' viability.[94] France, too, is tapping into its nuclear power in a bid to win the AI arms race in Europe.[95]

Despite their promise, SMRs face challenges that include regulatory hurdles, fuel supply constraints, and negative public perception.[96] However, if successfully commercialised, SMRs will offer a flexible, low-carbon, resilient energy source, complementing renewables and enhancing energy security. For New Zealand, adopting nuclear power would require a significant policy shift from its nuclear-free stance. Public perception and regulatory barriers remain key challenges. However, SMRs have significantly lower capital costs and shorter installation time, which make the political obstacles less daunting than for conventional nuclear. While New Zealand's anti-nuclear weapons sentiment remains strong, hostility to nuclear power may be weakening as the memory of the Rainbow Warrior and the nuclear debates of the 1980s fade.

Given these obstacles, New Zealand will necessarily be a follower and not a leader in SMR power generation. We cannot rule out the possibility of breaking the nuclear taboo for ideological reasons. The conversation must begin now to build political will if there is to be a shift over the next generation. An ambitious government should commission a feasibility study to examine the potential for SMRs. Furthermore, public engagement and regulatory adjustments would be essential for any long-term nuclear energy plans.

Summary

New Zealand's energy landscape is heavily reliant on renewable sources, offering advantages for sustainable data centre operations. However, increasing energy demands necessitate strategic investments in expanding geothermal and possibly wind energy, optimising grid infrastructure, and exploring emerging technologies such as SMRs. While the country's commitment to renewables positions it well for future growth, maintaining energy affordability and reliability will be key challenges in supporting any large-scale data centre expansion.

6. INVESTMENT NEEDED IN INFRASTRUCTURE

The expansion of New Zealand's data centre industry will require significant investments in energy and infrastructure. As data centres become increasingly power-intensive, ensuring a stable and sustainable electricity supply is paramount. This section explores the financial and technological investments needed to support data centre growth, including grid modernisation, renewable energy expansion, and strategic collaborations between the government and private sector. Additionally, we touch on the role of AI-driven energy management systems in optimising grid efficiency as a key enabler of future energy resilience.

Financial and technological investments

Grid infrastructure

The modernisation of grid infrastructure involves upgrading outdated transmission lines, integrating smart grid technologies, and expanding high-voltage direct current (HVDC) connections to support rising electricity demands from data centres. With increasing digital infrastructure requirements, investments in real-time grid monitoring, automation, and predictive maintenance will be crucial in preventing outages and ensuring efficient power distribution. The adoption of AI-driven energy management systems can enhance grid efficiency by optimising load balancing and minimising energy losses. Additionally, strengthening grid interconnections between North and South Islands and improving substation resilience will provide greater energy security for high-energy consumers such as data centres.

Use of AI for grid efficiency and management

AI-driven analytics and automation are transforming grid management by optimising power distribution, improving demand forecasting, and minimising energy wastage.[97] AI can analyse swathes of real-time data and predict energy consumption patterns, allowing for more efficient grid operations and reduced reliance on backup generation.[98] Moreover, machine learning models can detect inefficiencies and adjust grid loads dynamically, ensuring that electricity is allocated where it is needed most.[99] Additionally, AI-powered automation can enhance fault detection and predictive maintenance, reducing the risk of outages and improving grid resilience. Companies such as Google have successfully used AI to reduce energy consumption in data centres by 15%, demonstrating the potential of intelligent energy management systems in high-demand environments.[100] In New Zealand, implementing AI-driven solutions across the national grid would enhance renewable energy use, integrate battery storage systems more effectively, and improve overall grid stability should data centre energy demand rise.

Strategic government and private sector collaboration for large-scale investment will be essential to developing New Zealand's data centre infrastructure and ensuring long-term energy security. The government can provide incentives such as tax benefits, grants, and streamlined regulatory approvals to encourage private investment in energy and grid modernisation projects. Public-private partnerships (PPPs) allow for cost-sharing and risk mitigation, with both sectors contributing expertise and resources.

Successful models include long-term power purchase agreements (PPAs) between data centre operators and renewable energy providers, which guarantee stable electricity costs while promoting sustainable power generation. Additionally, targeted investment funds for critical infrastructure, such as high-voltage transmission upgrades and battery storage systems, can attract global technology firms looking for low-carbon data centre locations. Aligning national energy strategies with private sector capabilities will be key to positioning New Zealand as a competitive, sustainable data centre hub.

Financing models for energy and infrastructure

Investments in renewable energy expansion are critical to sustaining AI-driven data centre growth. Saudi Arabia and the United Arab Emirates (UAE) are currently developing renewable energy projects tens of gigawatts in scale specifically for AI workloads, demonstrating how proactive energy planning is shaping AI sustainability worldwide.[101] New Zealand should adopt a similar long-term infrastructure strategy to remain competitive in the AI data centre industry.

Government-funded model

A government-funded model would involve public sector investment in energy and infrastructure projects to support data centre growth. This approach allows for long-term strategic planning, ensuring that national interests, energy security, and sustainability goals are prioritised. Government funding might take the form of direct capital investments, low-interest loans, or subsidies for renewable energy projects, enabling large-scale development without immediate reliance on private sector financing. Successful examples of government-led energy infrastructure projects can be seen in countries like Norway, Canada, and the UAE. Norway has leveraged its hydroelectric resources to achieve nearly 100% renewable electricity generation, and Canada has developed extensive hydropower and nuclear infrastructure, with strong government backing for SMR development. The UAE has successfully implemented nuclear power (Barakah Plant) and solar mega-projects (Mohammed bin Rashid Al Maktoum Solar Park) as part of its strategy to diversify away from fossil fuels and establish a clean energy economy.

Pros:

A government-funded model ensures national energy security by maintaining government control over critical infrastructure, allowing for large-scale renewable energy investments and long-term strategic planning. It also provides financial stability with lower borrowing costs compared with private financing, ensuring predictable energy pricing for data centres. Furthermore, it ensures alignment with the nation's goals of reducing carbon emissions and supporting energy independence.

Cons:

A government-funded model is an added burden on taxpayers. Public funding requires significant government expenditure while potentially diverting resources from other critical sectors, such as healthcare and education. Slower approval and implementation due to bureaucratic processes often leads to delays in project execution and increased administrative and project costs, as highlighted in the earlier subsection on nuclear power with reference to the UK, as government-led projects lack the agility and cost-effectiveness of private-sector initiatives. Inefficiencies in execution often add to budget overruns and operational inefficiencies as government-led projects lack the agility and cost-effectiveness of private-sector initiatives.

Private sector investment

Private sector investment already plays a crucial role in financing energy and infrastructure projects, offering advantages in efficiency, speed, and innovation. Unlike government-funded models, private investment is driven by market demand, leading to swift, cost-effective and performance-oriented results. Private companies, particularly large technology firms, are increasingly committing to sustainable energy initiatives to support their operations. For instance, multinational cloud providers such as Amazon Web Services (AWS) and Microsoft have signed long-term PPAs with renewable energy developers to ensure a stable, clean power supply for their data centres.[102]

Pros:

Private sector investment enables faster deployment of capital, reducing delays associated with public sector approval processes. Market-driven efficiency encourages innovation in energy technologies, such as AI-driven energy management, modular storage solutions, and high-efficiency cooling systems for data centres. Private funding alleviates the financial burden on governments and taxpayers, allowing previously allocated funds to be directed to their respective targets. Additionally, competitive market dynamics drive cost reductions and technological advancements, improving efficiency in energy production and distribution.

Cons:

Prioritising profit may contribute to higher energy costs, as private investors aim to maximise returns, which lead to increased electricity rates for consumers, including data centre operators. The risk of monopolisation exists when a few large corporations dominate energy production and distribution, reducing market competition and limiting access to affordable energy. Dependence on international corporations may lead to foreign control over critical infrastructure, raising concerns about national energy security and long-term economic stability. Additionally, private investors may prioritise short-term profitability over long-term sustainability, potentially slowing down investment in emerging energy technologies and grid modernisation efforts.

Balancing private sector involvement with regulatory oversight is critical to ensure even-handed and sustainable energy development in New Zealand's evolving data centre landscape.

Public-private partnerships (PPP)

Hybrid public-private partnerships (PPPs) integrate government oversight, regulatory support, and funding with private sector efficiency, innovation, and capital investment to develop critical energy infrastructure. This approach balances financial risk between the public and private sectors, enabling large-scale investments in grid modernisation and renewable energy without overburdening either party. Governments typically provide policy incentives, initial capital, and risk mitigation mechanisms, while private entities contribute technical expertise, operational efficiency, and additional funding.

PPPs have been successfully implemented in energy infrastructure worldwide. For example, the UK's offshore wind sector leveraged government-backed contracts to attract billions in private investment, accelerating deployment at scale.[103] Similar models could be adapted to different regulatory and economic contexts, such as New Zealand, where PPPs could drive energy expansion, high-voltage transmission upgrades, and AI-driven grid management systems. However, successful implementation depends on clear contractual frameworks, strong governance, and alignment between government objectives and corporate interests to ensure energy security and cost-effectiveness.

Pros:

One of the primary advantages of hybrid PPPs is that they balance private sector efficiency with public accountability. The private sector excels in project execution, cost management, and innovation, while government oversight ensures that public interests such as affordability, sustainability, and equitable energy access remain protected. This collaboration allows for a more streamlined and cost-effective approach to infrastructure development compared with purely public-led projects, which may be slowed by bureaucratic processes. Additionally, shared financial risk makes large-scale energy projects more feasible. Governments can use public funds strategically, leveraging private capital while providing incentives such as subsidies, risk guarantees, or tax benefits to attract investment. This financial model reduces the burden on taxpayers while making infrastructure projects more commercially viable.

Government oversight within PPPs also enhances energy security by ensuring infrastructure development aligns with the national interest. Public sector involvement can help prevent monopolistic pricing, ensure resilience against energy supply disruptions, and promote a mix of energy sources. Private sector participation stimulates innovation and brings in advanced technologies such as AI-driven grid management, smart meters, and energy storage solutions. The integration of new technologies improves operational efficiency and reduces long-term costs. Another key advantage is that private-sector efficiency leads to faster project completion. With clear regulatory frameworks and contractual terms, PPPs can accelerate energy infrastructure deployment in ways that neither sector could achieve independently.

Cons:

Despite these benefits, hybrid PPPs present challenges, particularly in the complexity of their contractual agreements. Because these projects require long-term commitments, contracts must clearly define risk-sharing mechanisms, performance expectations, and financial structures. Disputes over contract terms, cost escalations, or changes in regulations can lead to delays or legal challenges.[104] Additionally, the inherent differences between government and corporate objectives can create friction. While governments prioritise long-term energy security, affordability, and environmental sustainability, private companies are primarily profit-driven. If governance structures are weak, corporate interests may take precedence, leading to higher consumer costs or decisions that undermine long-term infrastructure resilience.

Another significant challenge is the uncertainty associated with long-term commitments in a constantly evolving energy market. Many PPP projects span decades, making them susceptible to political and regulatory shifts that alter project feasibility or profitability. Changes in government policy, energy pricing, or technological advancements may require renegotiation of contracts, resulting in financial disputes or project disruptions. Additionally, while PPPs distribute financial risk, they do not eliminate it. Cost overruns, delays, or project failures can still place a financial burden on taxpayers or lead to increased energy prices if contracts pass unforeseen costs onto consumers.

A final concern is the risk of reduced public control over critical infrastructure. Poorly structured PPP agreements may lead to excessive private sector influence over essential assets, limiting government flexibility in responding to economic, environmental, or national crises or security concerns. In extreme cases, privatised energy infrastructure may become difficult for governments to regulate or reclaim without incurring significant financial penalties. Ensuring that public interests remain protected requires strong contractual safeguards, regulatory oversight, and mechanisms to prevent private entities from prioritising short-term financial returns over long-term national energy goals.

Summary

Hybrid PPPs offer a strategic approach to advancing energy infrastructure by leveraging the strengths of both public and private sectors. When implemented effectively, they can enhance efficiency, reduce financial risk, and drive innovation while maintaining public oversight. They might represent the best option for expanding New Zealand's energy production and delivery infrastructure. However, their success depends on robust legal frameworks, clear governance structures, and well-aligned incentives to prevent conflicts of interest and ensure long-term energy security and cost-effectiveness. New Zealand, with ambitious renewable energy targets, would benefit significantly from well-structured PPPs, provided they proactively address potential risks through strong regulatory mechanisms and transparent contractual frameworks.

7. CHALLENGES TO NEW ZEALAND'S DATA CENTRE GROWTH

New Zealand's aspirations to become a data centre hub are hindered by structural and market challenges that impact infrastructure development, connectivity, and cost competitiveness. Regulatory complexities, high electricity prices, geographical isolation, and competition from regional data centre hubs create significant barriers to growth. Additionally, the country's reliance on limited international data links presents risks to network redundancy and latency, further complicating its position in the global digital economy.

Regulatory hurdles delaying infrastructure projects

The complex and often lengthy approval processes for energy and infrastructure projects pose a challenge for data centre expansion. Environmental regulations, land use approvals, consultation with iwi, issues with wāhi tapu, conceptions of kaitiakitanga, and then energy supply agreements require extensive assessments that delay investment decisions. Unlike regions such as Singapore, where regulatory frameworks are streamlined to support data infrastructure growth, New Zealand's processes can deter potential investors. Simplifying approval pathways for critical infrastructure while maintaining environmental safeguards is essential to facilitating sector growth. On 7 February 2025, the Fast-track Approvals Act came into effect, allowing project applications to proceed under an expedited framework.[105] The government has identified 149 projects spanning housing, renewable energy, transport, mining, quarrying, and the primary sector that are eligible for fast-tracking.[106] Expert panels have been established to consider these applications, facilitated by the Environmental Protection Authority. This system may expedite data centre growth.

High electricity costs impacting global competitiveness

One of the primary barriers to attracting data centre investments in New Zealand is electricity pricing. Electricity costs in New Zealand are among the highest in the Asia-Pacific region, driven largely by strong reliance on renewable energy sources and transmission costs. While the country benefits from a high proportion of hydro and wind power, supply constraints during periods of low generation lead to price volatility. Lessons from Dublin, which is expanding interconnectors to continental Europe, suggest that enhanced transmission and storage solutions are crucial for mitigating these cost fluctuations.[107] Compared with data centre hubs such as Singapore, where government incentives help mitigate energy costs, or Australia, which has access to assorted energy sources, New Zealand's pricing structure makes it less attractive for hyperscale investments. Ensuring stable, cost-effective power will be critical to remaining competitive in the global data centre market.

Geographical remoteness affecting connectivity speeds

New Zealand's physical isolation from major global markets introduces inherent latency challenges for data transmission. Most international traffic must traverse undersea cables to reach key digital economies in North America, Asia, and Australia. This increases round-trip data transmission times, limiting the country's attractiveness for latency-sensitive applications such as financial services, cloud computing, gaming, and real-time analytics. Without substantial investments in low-latency connectivity solutions, New Zealand risks being overlooked by global tech firms seeking optimal infrastructure locations.

Competition from other data centre hubs in Asia-Pacific

New Zealand competes with well-established data centre markets such as Singapore, Australia, and emerging players such as Indonesia and Malaysia. These locations offer strong government incentives, robust connectivity, and access to a mix of energy sources.

Singapore, for example, has positioned itself as a global digital hub with its Smart Nations Initiative and talent development through the TechSkills Accelerator (TeSA),[108] while Australia benefits from strong domestic demand and international network integration. Incorporating global best practices, such as Singapore's regional energy-sharing agreements and Dublin's renewable expansion initiatives, could provide a competitive edge. Without strategic advantages in cost, connectivity, or regulatory efficiency, New Zealand risks losing investment to these more established markets.

Challenges in international data connectivity

New Zealand relies heavily on a few submarine cables for international data transmission, creating a potential bottleneck for expansion. The Southern Cross Cable and Hawaiki Cable provide critical links to North America and Asia, but disruptions to these connections severely impact data traffic.[109] Additionally, limited redundancy in cable routes increases vulnerability to geopolitical risks, natural disasters, and infrastructure failures. Expanding international bandwidth, diversifying connectivity through additional submarine cables, and integrating satellite-based solutions are necessary to ensure New Zealand's digital infrastructure remains resilient and competitive.

Summary

New Zealand's ambition to establish itself as a data centre hub faces significant challenges related to infrastructure, connectivity, and cost competitiveness. Regulatory hurdles, including lengthy approval processes and environmental considerations, slow down project development, although the newly introduced fast-track approvals system may help expedite infrastructure growth. High electricity costs, driven by reliance on renewable energy and transmission expenses, make New Zealand less attractive compared with regional competitors such as Australia and Singapore. Geographical remoteness further compounds the issue, increasing data transmission latency and limiting the country's appeal for latency-sensitive industries. Strong competition from well-established data centre markets in Asia-Pacific and New Zealand's dependence on a few submarine cables for international connectivity pose risks to network redundancy and digital expansion. Addressing these structural and market constraints through policy reform, investment in energy and connectivity solutions, and strategic alignment with international best practices is crucial to positioning New Zealand as a viable data centre hub.

8. POLICIES AND ACTIONS FOR NEW ZEALAND'S SUCCESS

To position itself as a competitive data centre hub, New Zealand must implement strategic policies that address regulatory challenges, connectivity, and cost. Key priorities include streamlined approval processes, improved energy infrastructure, and financial incentives to attract investment. Expanding international connectivity through submarine cables and satellite solutions will also be critical to mitigating geographical disadvantages. By leveraging its renewable energy strengths and fostering a pro-investment environment, New Zealand can enhance its attractiveness in the global data centre market.

Streamlining regulatory approvals for energy and infrastructure projects

New Zealand's complex regulatory framework can deter investment by prolonging the approval process for new data centres and energy infrastructure. Monitoring and ensuring the efficacy of its fast-track approval system—particularly for projects aligned with national digital infrastructure goals—will reassure investors and reduce delays and encourage development. Learning from models such as Singapore's pro-business regulatory approach, New Zealand can continue to balance environmental oversight with efficiency to create a more investor-friendly landscape.

Support for energy generation through public-private partnerships

If the market is unwilling or unable to significantly increase total electricity generation to meet rising household, industrial, and data centre demand, the government ought to consider intervening in the market directly. Fostering partnerships between the public and private sectors will ensure a stable and cost-effective power supply. Encouraging investment in new geothermal, hydro, and potentially SMR and supercritical geothermal projects will help mitigate price volatility while ensuring a sustainable energy source for data centres. Long-term PPAs between data centre operators and renewable energy providers will also contribute to energy security, offering cost stability and supporting the country's carbon neutrality goals. The mismatch between AI deployment and clean energy project timelines underscores the need for long-term policy planning. Leveraging AI demand forecasting and grid optimisation models could ensure that energy supply remains stable as data centre operations scale.

Exploration of modular nuclear energy solutions

With data centres demanding large, stable power supplies, exploring alternative energy provision through SMRs might prove wise in terms of long-term sustainability. While nuclear energy is not currently part of New Zealand's energy mix, global advancements in SMR technology present an opportunity for discussion. By conducting feasibility studies and engaging with industry experts, New Zealand can assess whether nuclear energy could play a role in future energy security for general application and, in particular, data centre growth.

Development of fiscal incentives for data centre investments

To compete with established data centre hubs in Asia-Pacific, New Zealand could introduce targeted fiscal incentives. Countries such as Ireland, the Netherlands, France, Singapore, and Australia have successfully attracted hyperscale data centres through government-backed incentives that reduce capital expenditures and operational costs for businesses. Establishing policies that provide financial relief for energy-intensive operations, such as tax credits for renewable energy usage or infrastructure depreciation benefits, can make New Zealand a more attractive destination for data centre investments.

Expansion of submarine cable networks to improve latency

Increasing New Zealand's international connectivity is crucial for improving latency and reducing dependence on existing undersea cables. Investing in additional submarine cable routes linking New Zealand to North America, Asia, and Australia would enhance redundancy, reduce the risk of service disruptions, and improve global data exchange speeds. Public-private partnerships and government-backed infrastructure projects can support the development of new cable networks, ensuring long-term resilience.

Addressing risks related to undersea cable vulnerabilities

Given the critical role of undersea cables in New Zealand's digital infrastructure, proactive risk management is essential. Establishing redundancy through diversified cable routes, investing in cybersecurity measures, and collaborating with international partners to enhance cable security will be vital in mitigating geopolitical and environmental risks. Additionally, monitoring and maintenance programs should be strengthened to prevent disruptions and ensure long-term reliability in global data exchange.

Integration of satellite connectivity for redundancy

Satellite-based internet solutions, such as low-earth orbit (LEO) constellations, can complement undersea cables by providing backup connectivity and reducing dependency on physical infrastructure. Companies like Starlink and OneWeb are already deploying LEO networks capable of enhancing connectivity in remote regions. By integrating satellite technology into national digital infrastructure planning, New Zealand can improve network resilience and support emerging data centre projects in less connected areas.

9. CONCLUSION

New Zealand stands at a critical juncture in the evolving global data centre industry. With AI and cloud computing driving unprecedented demand for data storage and processing, the need for energy-efficient, scalable, and secure infrastructure has never been greater. New Zealand possesses significant natural advantages, including a high share of renewable energy, political stability, a cool climate conducive to data centre cooling, and strong data sovereignty protections. However, structural and market challenges—such as high electricity costs, regulatory delays, international connectivity limitations, and strong competition from other Asia-Pacific hubs—threaten its ability to capitalise on this opportunity.

To position itself as a competitive data centre hub, New Zealand must take decisive action in several key areas. Addressing its energy cost disadvantage through strategic investments in geothermal expansion, potential hydro projects, and long-term infrastructure planning is essential. Additionally, exploring alternative energy sources, including SMRs, could provide a stable and sustainable power supply over the long term. Strengthening international connectivity through expanded submarine cable networks and satellite solutions will mitigate the challenges of geographical remoteness, ensuring that New Zealand remains competitive in the global digital economy.

Regulatory efficiency is also a critical factor. While the introduction of fast-track approvals is a step in the right direction, continued regulatory reforms to streamline approvals for critical infrastructure projects will be necessary. Moreover, leveraging public-private partnerships to finance grid modernisation, energy expansion, and data centre infrastructure will help attract investment while balancing economic and sustainability concerns.

The international data centre market is evolving rapidly, and the window of opportunity for New Zealand to establish itself as a preferred hub will not remain open indefinitely. Competing regions are aggressively expanding their digital infrastructure, offering cost advantages, tax incentives, and strategic energy planning. Without proactive policy decisions and targeted investments, New Zealand risks being left behind. However, with the right mix of regulatory reforms, infrastructure improvements, and investment strategies, New Zealand can harness its renewable energy strengths to establish itself as a leader in sustainable, AI-driven data centre operations.

GLOSSARY

Capital expenditure (CapEx): Money spent on building or upgrading physical assets, such as constructing data centre buildings or buying servers and cooling systems.

Cloud computing: Storing data and running programs on remote servers via the internet instead of on a local computer. The report notes that companies often use multiple cloud providers to spread out computing tasks and reduce the risk of failure.

Co-location (colocation): A data-centre facility where different businesses can rent space for their own computer servers and share the building's power, cooling and security systems. Auckland has multiple co-location facilities operated by Datacom, Spark Revera and CDC Data Centres.

Data centre: A large building filled with computers and storage devices. These facilities provide power, cooling and network connections so that digital information can be processed and stored. The report notes that data centres are essential for AI development and deployment.

Data egress: The process of moving data out of a cloud provider's network or data centre. Cloud companies often charge fees for this outward data transfer. The report warns that data egress charges can add substantial costs to AI workloads—for example, AWS charges about US$90 per terabyte for data sent out beyond 500 TB per month.

Data sovereignty: The idea that digital data is subject to the laws of the country where it is stored. Businesses must decide whether to store information locally for better compliance and latency or internationally for improved access to services.

Distributed processing: Splitting computing tasks across many machines or servers so they can be completed more quickly and efficiently. This approach helps AI systems handle large amounts of data.

Edge computing: Processing data close to where it is created rather than sending it to a far-away server. For example, processing at a local cell tower can reduce latency and help AI respond faster.

Ethernet: A common way of connecting computers over cables to form a local network. In data centres there are high-speed versions of Ethernet (100–400 gigabits per second) used to connect servers and other equipment. The report notes that Ethernet, along with InfiniBand and NVLink, is essential for fast communication in AI data centres.

Federated learning: A way of training AI models on many devices without moving the raw data to a central server. Each device trains the model using its own data and shares only the updated model, helping to keep private data private.

Generative AI: A type of artificial intelligence that can make new things, such as writing text, creating pictures or making decisions. The report mentions that generative AI applications like language processing, image recognition and automated decision-making need a lot of data and specialised hardware.

General Data Protection Regulation (GDPR): A European Union law that sets strict rules for how personal information is collected, used, and protected. The report notes that GDPR and New Zealand's Privacy Act influence where companies choose to locate their data centres.

Graphics Processing Unit (GPU): A special computer chip originally designed for video games. GPUs can perform trillions of calculations per second, which makes them good for working with AI and training deep-learning models.

High-voltage direct current (HVDC): A way of transmitting electricity over long distances using direct current instead of alternating current. HVDC lines reduce energy losses and can help move renewable energy from remote areas to where it is needed.

Hyperscale data centre: A very large data-centre facility built by major technology companies to support massive cloud and AI workloads. The report mentions hyperscale facilities in Auckland with more than 100 MW of computing capacity.

InfiniBand: A very fast networking technology used inside data centres to link computers together. AI systems need these high-speed connections so GPUs, CPUs and storage devices can share data quickly. The report indicates AI models require high-speed interconnects like InfiniBand, which can transfer 400 gigabits per second and are costly to deploy.

Inference: After training an AI model, inference is the process of using the model to answer questions or make predictions. The report explains that AI inference generates answers and needs continuous power to handle real-time data.

Latency: The delay between sending data and getting a response. High latency is a problem for self-driving cars, factory robots, and other AI systems that must react quickly.

Megawatt (MW): A unit of power equal to one million watts. The report measures data-centre capacity and power plants in megawatts.

Megawatt-hour (MWh): A unit of energy equal to producing or using one megawatt (1 million watts) of power for one hour. The report uses MWh to describe the energy used when training AI models.

Network interface card (NIC): A small hardware component that enables a computer or server to connect to a network. High-speed data-centre networks need specialised NICs to handle large amounts of information, and these can cost thousands of dollars per server. The report mentions that high-speed networking requires these specialised NICs, adding to capital costs.

Non-Volatile Memory Express (NVMe): A fast technology for connecting solid-state drives (SSDs) to computers. NVMe storage allows data to be read and written much faster than with traditional hard drives, which is why it is used in AI data centres.

NVLink: A proprietary connection developed by Nvidia for linking GPUs directly to each other. It allows data to move even faster between graphics cards so they can work together on big AI problems. The report lists NVLink (up to 900 gigabits per second) as one of the high-speed interconnects needed in AI data centres.

Operational expenditure (OpEx): The ongoing costs of running a facility. In data centres this includes electricity bills, maintenance, and staff salaries.

Power Usage Effectiveness (PUE): A number used to measure how efficiently a data centre uses energy. It compares the total energy used by the facility to the energy actually used by the computing equipment. Lower PUE values mean less energy is wasted. Energy-efficient designs can reduce PUE from about 1.5 to 1.1.

Redundancy: Having extra backup systems in place so that services keep running even if part of the system fails. Redundancy reduces the risk of data loss or downtime during power outages or cyberattacks.

Small modular reactor (SMR): A type of nuclear power plant built in modular sections that produce 50–300 megawatts of electricity. SMRs are designed for faster deployment and easier scalability compared with large traditional reactors and could provide low-carbon power for data centres.

Tensor Processing Unit (TPU): A computer chip created by Google specifically for artificial-intelligence calculations. TPUs process the complex mathematics behind neural networks faster and more efficiently than general-purpose GPUs.

Terawatt-hour (TWh): A much larger unit of energy equal to one trillion watt-hours. In 2022, data centres worldwide consumed about 460 TWh of electricity.

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