Northern Data Group

Driving AI and data centre technology

Northern Data Group is a specialist provider of high-performance computing (HPC) infrastructure solutions. By leveraging a successful cryptocurrency mining heritage to fund global growth, the group has been able to expand into generative artificial intelligence (AI) cloud services and liquid-cooled data centre infrastructure. The European generative AI opportunity is substantial, where demand has surged but compute power remains limited. As the owner of Europe's largest AI data hardware cluster, and requisite specialised data centre housing, Northern Data can enable democratised access to this transformative technology. With its elite partnerships and access to scarce hardware, the group is positioned to capture underserved demand in the AI space for hardware and housing.

Three new divisions define strategy

Northern Data has pivoted from a pure cryptocurrency miner into a diversified provider of HPC infrastructure solutions, through its three business divisions: Taiga Cloud, Ardent Data Centers and Peak Mining. Taiga aims to democratise access to AI compute power, providing the hardware that start-ups, researchers and medium-sized organisations need to power generative AI models and cloud services. In 2023, Northern Data invested €730m to acquire NVIDIA's latest H100 Tensor Core GPUs. These are in limited supply and are 30 times more powerful than the GPUs used for training systems like ChatGPT, establishing a competitive edge. Ardent is looking to expand the group's portfolio of state-of-the-art, liquid-cooled data centres to initially house Taiga's NVIDIA hardware and then provide colocation services to the market. Peak will continue Northern Data's bitcoin mining operations.

Key milestones to demonstrate value

NVIDIA has confirmed that Northern Data owns Europe's largest A100 and H100 GPU cluster and that Taiga is an elite NVIDIA partner/cloud service provider. This should enable Taiga to effectively capture demand by providing infrastructure as a service (IaaS) in 2024, then successfully upsell additional managed services and software from 2025. Ardent's European data centres offer innovative, energy efficient and liquid-cooled environments, reducing latency and providing a compelling solution amid tightening data and environmental regulations. For Peak Mining, maintaining or growing market share will be key, particularly given the upcoming bitcoin halving, which the market expects around April 2024. Its US$150m investment in the latest bitcoin miners should support its positioning.

Valuation: Substantial upside if milestones are met

Northern Data has undergone significant change, causing internal disruption with FY22 results yet to be released. We are therefore unable to provide forecasts yet. Management guides to sales of €65–75m and an adjusted EBITDA loss of €5–20m in FY23, followed by €200–240m sales and €50–80m adjusted EBITDA in FY24, respectively. Management also sees FY25 sales and adjusted EBITDA potential of €520–570m and €300–350m, respectively. Later we provide several scenarios once full deployment of its hardware is achieved, with our base case indicating potential revenue of €572m, at the top-end of management's FY25 guidance.

Tech hardware and equipment

19 December 2023

| Price | €23.5 |
| Market cap | €745m |

Share price graph

Share details

Code	NB2
Listing	Frankfurt
Shares in issue	31.7m

Business description

Northern Data is a German-listed company, operating highly energy-efficient data centres across Europe and the US. The group is pivoting from a pure-play cryptocurrency miner into a diversified provider of high-performance computing solutions. Its updated strategy was marked with the launch of three new divisions: Peak Mining, Ardent Data Centers and Taiga Cloud, with each targeting a different area of the value chain.

Bull

- Data centres with strong efficiency, power and sustainability credentials, which are well equipped to face tightening regulation within the European landscape.
- Large inventory of the latest NVIDIA GPUs, which are in short supply, positioning the group to take advantage of the fast-evolving AI space.
- Strong track record in bitcoin mining provides consistency alongside new strategy.

Bear

- Unproven in the cloud computing space, creating execution risk without a track record of performance.
- Bitcoin price is highly volatile, creating cash flow lumpiness in the crypto mining division.
- Controversy, particularly around disclosures and reporting, creates uncertainty.

Analysts

Max Hayes	+44 (0)20 3077 5721
Katherine Thompson	+44 (0)20 3077 5730
Milosz Papst	+44 (0)20 3077 5700

tech@edisongroup.com
Edison profile page

Company description: Driving European generative AI

Northern Data, headquartered and listed in Germany, is a specialist technology company that provides HPC infrastructure solutions. The group owns and operates energy-efficient data centres across Europe and the US to power its bitcoin mining, generative AI and co-location services. Each centre is strategically situated to maximise sustainability and minimise operating costs, for example via natural cooling methods, while providing the infrastructure to optimise the compute power of the latest processors that power HPC. These factors provide a competitive edge amid tightening data protection and environmental regulation versus other leading colocation providers like Interxion, Equinix and NTT Data, alongside structural tailwinds underpinned by generative AI.

Since listing in 2018 as Northern Bitcoin, the company has transformed from a pure-play cryptocurrency miner into a diversified provider of HPC solutions. Following the merger with Texas-based blockchain infrastructure company Whinstone in 2019, the company rebranded to Northern Data, marking the beginning of its strategic shift. The group has since expanded its data centres across Europe in Sweden, Norway, the Netherlands and Germany, as well as North America in Georgia, Texas, New York and Quebec, both organically and through acquisition (see Exhibit 1). This expansion was facilitated using the proceeds from its successful mining operations, as well as those connected to the sale of Whinstone facility for c US$571m. We note that the group reported FY21 total output of €492m (revenue: €189.9m and other income of €303.0m relating to the Whinstone disposal) and adjusted EBITDA of €325m at a 66% margin. Northern Data's FY22 preliminary results indicate revenue of €195m and adjusted EBITDA of €40m at a margin of c 21%.

Exhibit 1: Northern Data deal summary, 2019–23

Target	Acquisition date	Consideration	Rationale
Acquisitions			
Whinstone	November 2019	N/A	To build foundational infrastructure to run AI and cloud-based applications.
Kelvin Emtech	April 2020	83k shares with three-year lock-up (c US$4.2m)	Provide additional compute power and expand North American data centre footprint.
Hydro66	January 2021	€4m cash €21m shares	Expands Northern Data's green data centres in Europe (now its Boden facility).
Decentric Europe	August 2021	€195m cash 2.3m new shares, c €170m	Further expansion of European GPU hardware, powered by 100% renewable energy.
Bitfield	September 2021	Stock-for-stock, total value €400m, 5.1m shares	Expands its bitcoin mining operations in the US and Canada.
Damoon*	September 2023	€400m shares and convertible bond issue	Acquired €400m worth of NVIDIA 10,000 H100 SXM Tensor Core GPUs.
Disposals			
Whinstone	April 2021	Sold to Riot Platforms for US$80m cash 11.8m new Riot shares, c US$571m	Move away from megasites to larger number of smaller data centres to drive HPC strategy.

Source: Northern Data Group. Note: *Pending regulatory approval, expected Q124 at the latest. Further details on Damoon acquisition under new business lines section.

In August 2023, management outlined its strategy with the launch of three divisions: Taiga Cloud, Ardent Data Centers and Peak Mining (see Exhibit 2). This change in reporting structure aligns with the commitment to drive HPC in three distinct areas, as well as the group's expectation for revenue to be shown under these segments in its FY23 results.

Exhibit 2: Divisional breakdown, indicating Northern Data's strategic direction
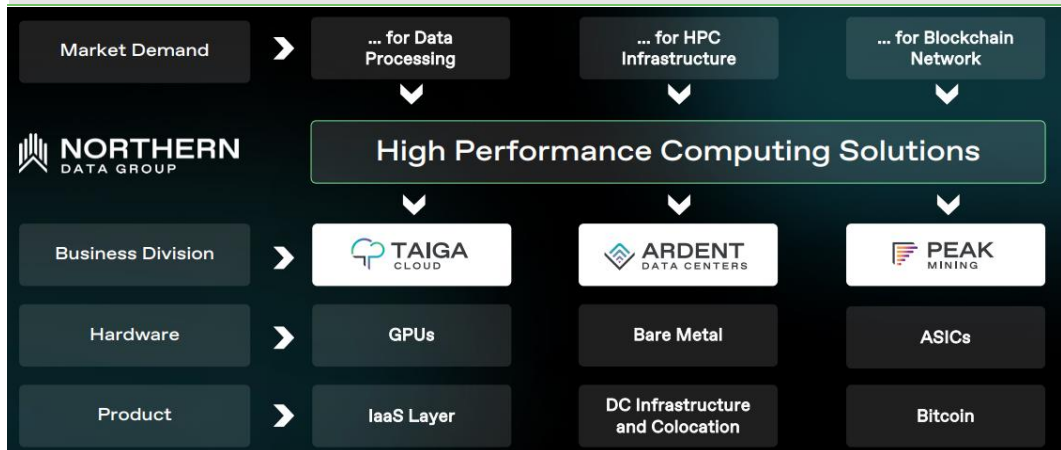
Source: Northern Data

On 4 December, Northern Data announced a €110m investment strategy for Ardent Data Centers, providing the funding for the division to build and operate the company's next generation of data centres. Ardent will first confirm that Taiga has the infrastructure to house its intake of NVIDIA GPUs in its existing European operations and through third-party colocation. Ardent has an established and growing pipeline of acquisition targets to ensure it has the capacity to house the expected surge in GPU supply, which will power the next wave of European generative AI and other data applications.

Northern Data has a strong bitcoin mining track record, so Peak provides continuity and cash flows that can be recycled to support its growing HPC operations.

The company believes that Taiga can become one of the top European cloud providers in 2024 and will target start-ups, research institutions and medium-sized enterprises, as a priority, rather than competing directly against leading hyperscalers like Microsoft and Amazon. Northern Data's recent acquisitions of the latest NVIDIA H100 GPUs (see H100 acquisition section) will support this ambition after solidifying the company's status of owning Europe's largest AI-focused data hardware cluster.

The creation of these divisions indicates where Northern Data sees the greatest opportunity in the HPC value chain. Peak allows investors to continue gaining exposure to the potentially high-growth bitcoin market, while Ardent and Taiga help mitigate sensitivity to bitcoin market swings. The company's entry into HPC is well-timed given the dynamic rise of AI and increasing reliance on cutting-edge data centre infrastructure, which management believes is currently lacking in the market.

New business lines indicate clear strategic focus

Since its inception, Northern Data's primary focus has been bitcoin mining, with 2021 a transformational year supported by record-high cryptocurrency prices. Leveraging its strong balance sheet, bolstered by the sale of the Whinstone facility to Riot Platforms (see Exhibit 1), the group has invested in the expansion of its data centres across Europe and North America, equipping them with the latest technology to drive efficiency and performance. Following this period, NVIDIA confirmed that Northern Data owned Europe's largest GPU cluster, positioning it to transition seamlessly into the AI market.

Management guides to FY23 revenue of €65–75m (FY22 unaudited: €195m) and an adjusted EBITDA loss of €5–20m (FY22 unaudited: €40m profit), reflecting disruption caused by the pivot towards cloud computing. The group expects significant growth in FY24 revenue to €200–240m

and an adjusted EBITDA of €50–80m, with the potential to reach €520–570m revenue and €300–350m adjusted EBITDA in FY25. For the purpose of the above guidance, EBITDA is adjusted for 1) stock option plan expenses, 2) lawsuits and other one-off legal fees, 3) cost of systems implementation, 4) trading losses/gains from cryptocurrency, 5) restructuring costs and 6) impairment losses related to third party bankruptcy. This should be driven by 1) hash rate expansion of Peak Mining, 2) expansion in Taiga Cloud's available last generation NVIDIA GPUs and 3) the acquisition and construction of further data centres by Ardent Data Centres (contributing to results from FY25 onwards).

Ardent Data Centers: Housing the next wave of AI

Ardent is a specialist data centre infrastructure provider, aiming to build on Northern Data's global portfolio of strategically located, highly efficient and sustainable facilities to offer colocation and related services. Currently, the division owns and operates the group's 40MW Boden facility and is working to reach 120MW capacity for its colocation portfolio in the near term. Beyond FY24, management is targeting the acquisition of greenfield and brownfield data centres that have capacity of more than 50MW. By diversifying across regions, the company mitigates risks related to energy supply, regulations and data sovereignty.

In the short term, Ardent aims to meet the computing needs of its parent company, Northern Data, particularly the Taiga division (as its anchor tenant). On 4 December, Northern Data announced a €110m investment strategy to acquire two new data centres in the US (agreed letters of intent) and one in the UK (preferred bidder), which are on track to be finalised by end-Q124. This is key to ensuring sufficient capacity for Taiga's incoming NVIDIA H100s. Successfully deploying all planned GPUs on time, while investing in data centres that provide specifications consistent with its current portfolio, are key milestones for the group.

The division's data centres currently employ state-of-the-art cooling technology leveraging naturally cold climates to achieve industry-leading power usage effectiveness (PUE) below 1.2, with Boden reaching 1.06 – well below the industry average of above 1.5. This translates to at least 50% less wasted energy compared to peers. All centres run on renewable energy and are carbon neutral, aligning with customer and stakeholder ESG priorities.

The high power demands of HPC and AI model training present infrastructure challenges. GPUs often require 700W each, while servers can surpass 10kW. Training advanced AI models may utilise hundreds of these power-hungry systems in parallel. This goes beyond the capacity of many data centre facilities, where, according to a Schneider Electric white paper, racks are typically limited to 10–20kW of power. For context, mid-size colocation facilities usually contain between 100 and 500 racks, with less than 1,000 racks even in larger deployments. To support the intensive compute demands of HPC and AI workloads, data centres need robust power and cooling capabilities to provide sufficient rack-level power densities of 50kW or more per rack.

Ardent's infrastructure is designed for next-generation HPC, with sites able to handle up to 100kW per cabinet, significantly higher than industry averages. To achieve such industry-leading power density, Ardent employs a hybrid of air and liquid cooling methods, including direct-to-chip approaches concentrating cooling on the chips rather than entire rooms. Management believes this combination can enable a 100% increase in chip power in some cases.

Exhibit 3: Walkthrough of Northern Data's high-performance data centre in Boden, Sweden
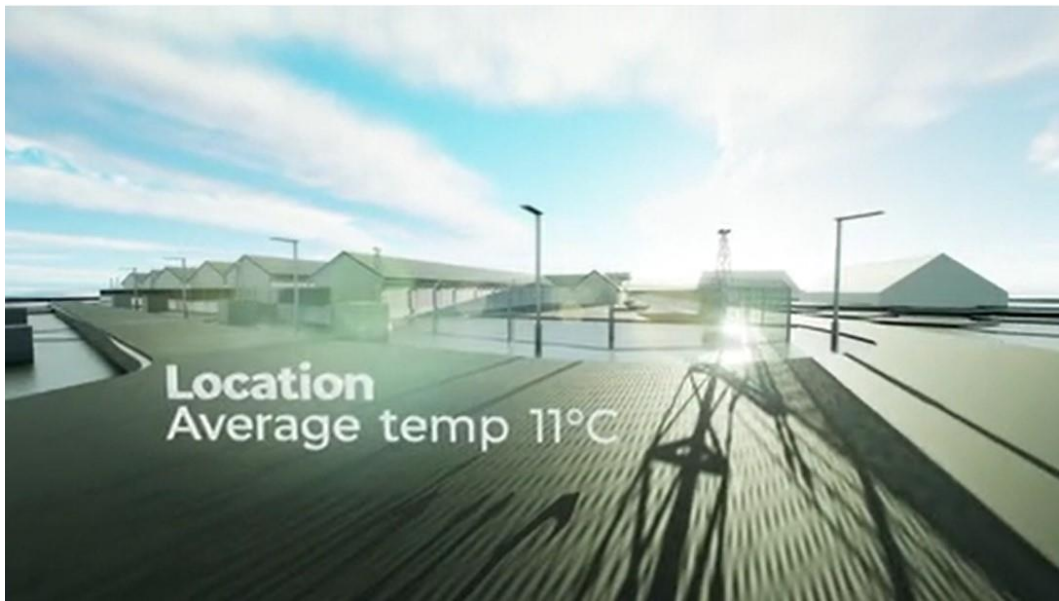
Source: Northern Data

Once Taiga's needs have been met, Ardent will continue to focus on the cloud computing opportunity in Europe, providing infrastructure for companies that want to move their servers off-premises to optimise efficiency, sustainability, latency and costs.

Ardent will initially target tier three customers that require single-digit megawatt (MW) power. Northern Data believes demand for compute power will continue growing among this underserved customer base as more companies seek to develop their own HPC and AI solutions. Ardent's capacity may allow it to expand to tier two customers, which are larger (requiring low double-digit MWs) but fewer in number.

Customers will be offered two contract types:

- Wholesale: typically 1–2MW over five to seven years with a base rent rate and usage-based pass-through rate per kW.
- Retail: sub-1MW, typically c 500kW and three years on average, with a base rent rate and an additional flat rate based on space occupied, rather than usage.

The M&A landscape is substantial, as enterprises have designed centres with 2N redundancy, meaning they have a minimum two fully redundant back-up systems. Although this offers reliability and power, the cost trade-off is often too high. This gives Northern Data options to acquire relatively new enterprise centres for quicker market entry. The company is also exploring greenfield options for entirely new sites, which have longer lead times (c 24 months) and higher upfront costs, but can be customised more to Ardent's needs and a design that is lower cost in the long run.

Taiga Cloud: Democratising HPC across Europe

Taiga Cloud's vision is to become Europe's first, largest and cleanest generative AI cloud service providers, aiming to democratise access to advanced compute power across organisations of all sizes. Previously the preserve of hyperscalers like Amazon and Google, or large multinationals like Adobe, advanced compute power has only been available to those with sufficient resources. Northern Data's strategy empowers groups including start-ups, research institutions and established companies to scale up their ability to tackle data-heavy applications quickly and independently, paving the way for exciting opportunities in:

- **generative AI:** large language models, image creation and automated recommendation systems;

- **life sciences research/drug design:** computational fluid dynamics, computer-aided biology/engineering, computational drug discovery, particle simulations;
- **3D rendering and visual content:** 3D modelling, gaming animation, previsualisations, configurators; and
- **digital twinning and synthetics:** operational optimisation, predictive maintenance and anomaly detection.

As highlighted by news publications at the time, Northern Data identified the need for GPUs to power AI applications more than two years ago, before the widespread adoption of generative AI seen in 2023. Before Taiga's launch, the company had built one of the largest European clusters of A100 and A6000 NVIDIA GPUs, establishing a strong position for Northern Data to take advantage of the market opportunity.

Exhibit 4: Edison TV introducing Taiga Cloud, filmed in September 2023

Source: Edison Investment Research

The diversity of locations throughout Europe, combined with its vast inventory of the latest NVIDIA GPUs, ensures clean, low-latency solutions, as well as data sovereignty. Not only does this support European digital autonomy, but it also makes it easier for companies to comply with EU privacy and data protection laws.

Contract lengths are flexible (ranging from one-month rolling up to 36-month reserved), providing accessible GPU compute without multi-year commitments. The company expects GPU utilisation to exceed 90% given the substantial demand for IaaS solutions in the market, which currently outstrips supply. Management anticipates robust cash flow, buoyed by its sizable target customer base of start-ups, many of which may have substantial cash reserves on their balance sheets to pay contracts upfront given venture capital investment in the space.

To acquire customers, Northern Data will leverage channel partners and programmes like NVIDIA's Inception Program for Startups, with plans to expand into more vertical specific channels like life sciences research institutions. The company notes that reprovisioning GPUs happens quickly, usually within a day, supporting maximal utilisation. The transition to cloud computing offers Northern Data considerable revenue visibility, as rental income is dictated by GPU costs that vary by model – H100 rentals yield the highest potential earnings, followed by A100 and then A6000 (see scenario testing). The configuration of GPUs will be dependent on use case and customer requirements.

To streamline development, NVIDIA GPUs come with NGC software including services, pretrained models and industry software development kits to accelerate building and deployment. Initially, Taiga will offer IaaS but will aim to move up the HPC stack by offering proprietary or third-party software services to help customers build models, adding potential upsell opportunities. Northern

Data highlighted that the division was able to ramp up sales from zero to €15m within 11 months and expects an annual run rate of €30m from Q124 from its NVIDIA A100 and A6000 GPUs only. Taiga also has four immediate contracts in its pipeline to deploy more than 6,000 NVIDIA H100 GPUs, potentially equating to more than €105m in annual revenue assuming €2 per hour and full utilisation.

NVIDIA H100 acquisitions secure its market-leading position

In August 2023, the company announced that it was more than doubling its GPU capabilities by acquiring Damoon, a Tether-controlled Irish shell company, for €400m. The deal will see Northern Data receive 10,000 of the highly in-demand NVIDIA H100 SXM Tensor Core GPUs (c 2% of the 550,000 allocation being shipped in 2023), which have a value equal to the consideration price. Management has stated that acquiring Damoon was the most effective method to secure the GPUs as quickly as possible.

Damoon was originally purchased by Tether, the company behind the USDT stablecoin, as part of Tether's strategy to diversify into high-growth technologies like AI. Under the terms of the deal, Tether will supply Northern Data with all the GPUs and, in exchange, will receive a 20% stake in Northern Data. Tether initially retained a 30% ownership stake in Damoon, while Northern Data will have a 70% majority stake. Tether's stake in Northern Data comes from newly issued shares and a convertible bond (see Exhibit 5). In September, Northern Data exercised its option to purchase Tether's remaining 30% in exchange for 6.6m new shares from a capital increase (transaction 3) and a €52.9m convertible bond issue.

We also note that Tether provided Northern Data with a €575m debt facility at attractive rates to support the latter's business development across the three divisions, in particular the expansion of its generative AI cloud service offering.

Exhibit 5: Assumed development of total shares issued following Damoon acquisition
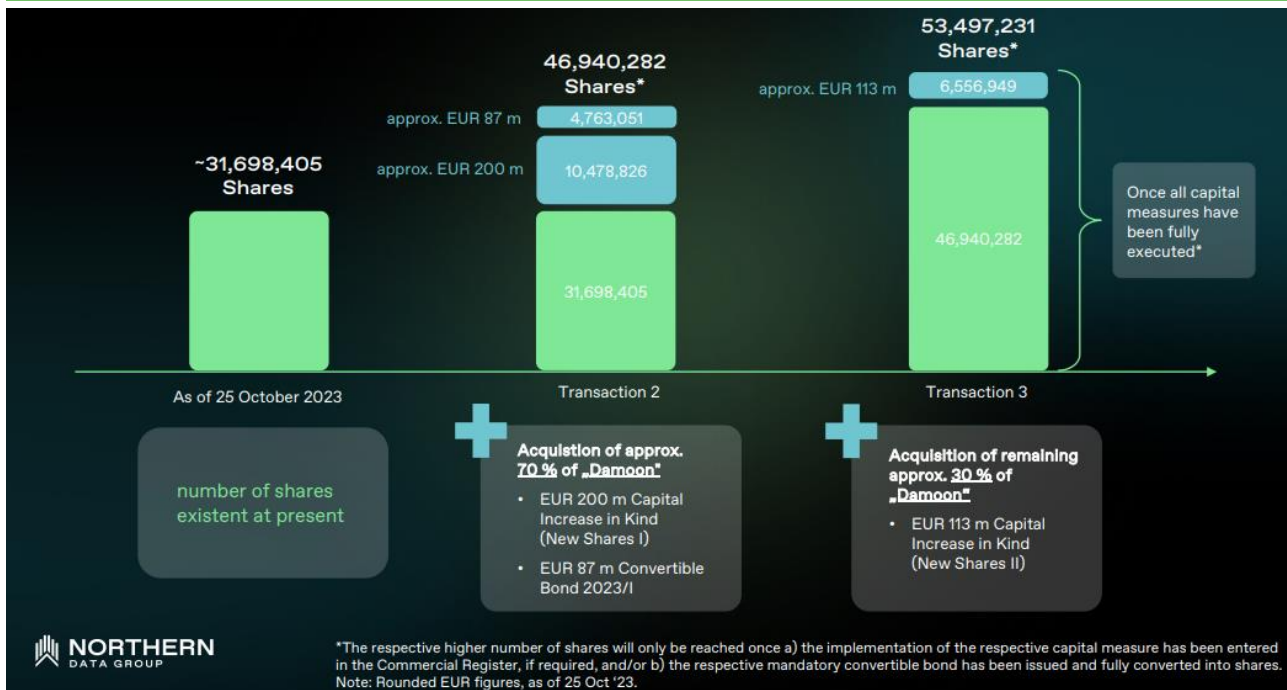
Source: Northern Data

Following final regulatory approval (expected by end-Q124 at the latest), Northern Data's acquisition of Damoon will provide it with a substantial share of NVIDIA H100s, which are in limited supply. The H100 SXM is the next iteration of the A100, the processor used to develop platforms like ChatGPT, and has been shown to be 30 times quicker in some instances, according to NVIDIA. Through its partnership with Gigabyte, the company has created innovative server configurations

using technologies like InfiniBand networking to enable faster interconnect speeds versus traditional Ethernet. As an elite partner of NVIDIA and its largest European customer, Northern Data looks set to cement its position as a market leader in the European AI cloud space. Deployment is expected to begin in Q423 and finish by mid-2024.

On 29 November, Northern Data announced that it had acquired 384 cabinets of Hewlett Packard Enterprise (HPE) Cray XD supercomputers for €330m, which include c 8,200 more H100s. Although the exact mechanism for this is yet to be announced given its early stages, deployment is expected to finish by end-FY24. The group is also part of the HPE Partner Ready Vantage programme, in place to support the business models of HPE customers, which could be a useful catalyst to Taiga's growth.

Taiga has been certified as one of only 15 elite partners of NVIDIA globally and an official cloud service provider in NVIDIA's Partner Network, reinforcing its position to deliver European compute power at scale.

Peak Mining: Maintaining its bitcoin heritage

Northern Data is continuing its bitcoin self-mining operations under the name Peak Mining, operating thousands of application-specific integrated circuit (ASIC) miners across seven locations (Exhibit 6). The table shows Peak's multi-site strategy to diversify geographic risk and vary size. Larger sites can provide operational leverage depending on location, while smaller sites tend to have more favourable power supply contracts.

Exhibit 6: Breakdown of mining data centres

Location	Power capacity (MW)	Additional notes
Georgia, US	18	Expanding to 120MW, currently in development
Texas, US	10	Hosting partner; another 100MW is in development in Texas
North Dakota, US	30	First site for deployment of new ASICs
Texas, US	100	Site for deployment of new ASICs. Can expand capacity to 300MW house potential future intakes of ASICs.
New York, US	28	Partner
Quebec, Canada	10	Owned
Boden, Sweden	40	Hybrid between cloud computing and mining, owned
Aurland, Norway	3	Owned
Total	**239**	
Total (following Georgia and Texas completion)	**659**	

Source: Peak Mining

For its own mining operations, Peak generates revenue by earning bitcoin rewards from the blocks it mines and validating bitcoin transactions. The process of bitcoin mining is as follows:

■ Transactions using bitcoin trigger the opening of a new block in the blockchain network, following which every transaction is bundled together over 10 minutes (a fixed block time).

■ The block then closes once transactions are bundled and a new hash number is created, including the encoded details from each transaction.

■ Miners then compete to solve cryptographic puzzles in a process called proof-of-work (PoW), which, if correct, validates the block and adds it to the previous block in the network, creating an immutable chain.

  – Validating the network through PoW is essential to maintaining the security of the network.

■ The winning miner is rewarded with newly minted bitcoin for supporting the network, with the prize currently standing for 6.25 bitcoins per block.

  – The amount of total bitcoin is fixed at 21m coins, so the block reward is halved roughly every four years to regulate supply and drive value. Approximately 19.5m coins have been mined to date.

In addition to earning block rewards, miners can generate revenue through transaction fees paid by the sender of each transaction. The demand for bitcoin correlates to the size of transaction fees,

where more demand equates to higher fees. As the total bitcoin supply approaches its limit of 21m and new block rewards decline, transaction fees will become increasingly important for miner revenue.

Mining difficulty can be measured by the network's overall hash rate, which increases as more miners join the network and deploy faster and more efficient hardware like ASICs, reflecting the greater reward per block. Each miner's individual hash rate reflects their market share of the total network.

As at end-October 2023, Northern Data had c 35,000 ASIC servers installed, equating to a mining capacity of c 3.3 exahashes per second (EH/s), or quintillion hashes per second. This represents c 0.7% of the total bitcoin network hash rate, which is considerable given the largest publicly listed bitcoin miner by market cap, Riot Platforms, deploys 95,904 miners at 10.7EH/s.

Currently, Northern Data utilises c 80% of its available ASIC capacity to mine bitcoin directly but believes the uptime for some its sites could expand to c 95%, which should lead to a significant increase in the number of bitcoins mined. In its October 2023 mining report, the company had mined a total of 1,992 bitcoin and sold 2,026 coins, generating €48.7m in revenue year to date. We note that the company can hold mined bitcoin on its balance sheet before selling at its discretion, allowing coins sold to exceed newly mined bitcoin in a given month. Northern Data will keep bitcoin on its balance sheet if it anticipates a price appreciation higher than the cost of capital of around 15%; otherwise, it sells.

To prepare for the next bitcoin halving, expected around April 2024, Peak has invested US$150m in the latest WhatsMiner models from MicroBT. As shown in our scenarios later, these miners significantly improve efficiency over Peak's current hardware, reducing power consumption for the same hash rate and expanding gross margins. As Exhibit 6 shows, Peak is constructing a 30MW North Dakota facility to house the first MicroBT ASIC intake, which management expects to be fully operational in Q124. Additionally, Peak acquired a 300MW Texas site, with the first 100MW build underway to house the remaining new ASICs from Q124. Peak has secured an option for another US$150m of MicroBT hardware, which will enable the company to fully utilise the site's full 300MW potential and ensure future hash rate targets are met.

Northern Data estimates that the new miners will translate into a hash rate for Peak of 7EH/s by Q124, which should increase further to 7.9EH/s by end-2024 on the back of existing portfolio enhancement (ie replacing existing hardware with more efficient ASICs, allowing for greater uptime), and potentially even to 14EH/s by end-2024 upon successful ASIC purchase negotiations (see Exhibit 7). The hash rate expansion is essential as next year's halving will lead to roughly twice the mining difficulty for the same bitcoin rewards. However, other miners are also ramping up ahead of the halving, so the market share and revenue impact is unclear. More importantly, Peak's end-to-end liquid cooling infrastructure will allow the new miners to overclock, which is the process of increasing the clock speed of computer components above manufacturer specifications to boost performance. This overclocking could potentially improve efficiency by a further 25%, leading to potential margin expansion.

Exhibit 7: Peak Mining's confirmed hash rate growth including pipeline

Source: Northern Data. Note: *Incremental hash rate through hardware replacement to more efficient machines. **Pipeline with high likelihood of succeeding/near signing. ASIC purchase contract negotiations for pipeline sites ongoing.

Additionally, Peak's longstanding relationship with MicroBT should allow it to obtain a supply of ASIC miners with more stable pricing than the market spot rate over multiple years. Peak can also generate revenue from power supply contracts by redirecting electricity from its ASICs to the grid during abrupt power demand shifts. According to management, minor fluctuations arise three to four times annually, while major ones occur approximately every four to five years. The choice to divert hinges on weighing the respective profitability of mining versus power supply viability.

Poised for the imminent evolution in HPC

The HPC market has seen a dramatic shift in recent years, primarily due to the emergence of generative AI. The emergence of GPUs as the primary chips to train AI models has enabled breakthroughs in the technology, allowing for neural networks to be trained with billions of parameters. Tightening environmental regulations and growing concerns over data privacy are also shifting Northern Data's relevant market landscape.

The question of GPUs versus CPUs

Central processing units (CPUs) have historically been the default chips for data centre servers, with the ability to execute a wide range of computational workloads. However, we believe GPUs, originally designed for specific tasks like graphics rendering, have emerged as the primary processors for AI workloads.

While CPUs are built on a few optimised cores, GPUs contain thousands of smaller cores working in parallel to handle immense volumes of specific mathematical operations simultaneously (see Exhibit 8).

Exhibit 8: CPUs (left) versus GPUs (right), illustrating the parallel architecture of GPUs to the matrix maths of neural networks
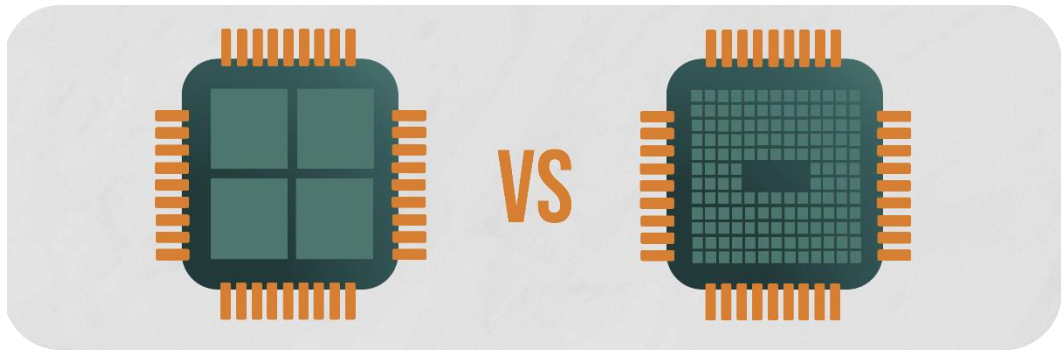
Source: Edison Investment Research

In early neural network development, CPUs could train simple models. However, as networks scaled up, the parallel architecture of GPUs proved more efficient at multiplying the large matrices underlying deep neural networks. For example, NVIDIA's GPUs trained breakthrough image model AlexNet more than 10 times faster than Intel's top CPUs. Subsequent generative models like ChatGPT and DALL-E have since relied on GPUs to reach billions of parameters.

Today, GPUs dominate the AI hardware market, particularly for training complex generative models, which require intense compute power during development. GPU efficiency improvements have been instrumental to the recent rise in generative AI capabilities, including text and image generation. The GPU market is set for substantial growth, with Statista expecting global revenues to grow from US$40bn in 2022 to US$400bn by 2030 at a CAGR of 33%.

NVIDIA leads the GPU market

NVIDIA is currently the market leader in GPUs for AI workloads, with a more than 80% global market share. The company's long history in developing GPUs, alongside the discovery that GPUs were the most efficient chips to train neural networks, established a strong first-mover advantage. NVIDIA has been able to maintain its market leadership by investing the proceeds from its success in hardware innovation and creating software ecosystems like CUDA. However, some believe that its dominant market share has led to pricing premiums, opening opportunities for competitors.

Intel remains strong in data centre technology and CPUs, but lags in GPUs. Advanced Micro Devices is gaining CPU share but trails NVIDIA in software maturity for AI. However, both provide lower price points for their processors, improving competitive positioning.

Google, Amazon and others are developing custom AI chips (Tensor Processing Units), which may have the potential to train neural networks as efficiently as GPUs, but at a lower cost. However, most AI software is designed to run on GPUs, creating a re-engineering issue for these proprietary chips. Quantum computing presents a potential long-term competitive headwind but is still far away from practical applications.

The need for clean compute power

Data centres are among the highest consumers of energy, with the International Energy Agency estimating that they account for 1–1.5% of global energy use. Despite the rapid rise in digital technologies over the last 10 years, energy efficiency improvements and greater use of renewable energy sources have moderated the impact of data centres on greenhouse gas emissions. That said, data centres are still responsible for a substantial amount of the world's total emissions.

For many data centres, the need to generate compute power with low latency has created what Hewlett Packard calls the zombie server challenge, whereby on average 20% of data centre

equipment is powered up but not doing any work. However, growing regulatory pressures, energy costs and consumer demands are magnifying the need for data centres to be more efficient.

At a federal level, the US lags Europe in terms of regulation. The EU's Energy Efficiency Directive mandates public energy performance reporting for data centres with an installed IT power demand of at least 500kW, to help reach its aim of reducing energy use in Europe by 11.7% by 2030. Data that need to be reported include:

- annual incoming and outgoing traffic;
- amount of data stored and processed;
- temperature set points;
- power, water and carbon usage effectiveness;
- energy reuse factor;
- renewable energy use; and
- cooling effectiveness ratio.

With regulators and customers now in alignment, efficiency and disclosure is imperative for data centres. Leading operators, like Northern Data, are now using innovative techniques like direct-to-chip and other liquid cooling methods, as well as automated load optimisation, to reduce waste and maximise efficiency. As a fairly new entrant, Northern Data stands apart in its ability to provide innovative infrastructure at scale. Many larger legacy players require major investment to replace traditional, outdated infrastructure to meet these modern standards. This positions the company to meet rapidly growing demand from discerning customers who value both efficiency and scalability.

Market landscape: Cloud computing

Data centres serve several key functions, including providing compute power, data storage/privacy, infrastructure support, network connectivity and enabling cloud services. Leading operators in Europe include Equinix, Digital Realty and KDDI, but they all lack a specific focus on powering generative AI compared to Northern Data.

AI currently comprises c 5–10% of the c US$200bn global public cloud infrastructure spend according to a former Google executive. A key barrier for wider AI adoption has been data centre infrastructure constraints, requiring high-performance GPU servers like NVIDIA's to train neural networks efficiently.

Northern Data operates Europe's largest focused AI and cloud GPU cluster, which has substantially increased in size after its latest acquisitions. Heightened data sovereignty concerns, coupled with the need for low-latency solutions, may increase competition from major US hyperscalers like AWS, Google Cloud and Microsoft Azure. Meta's record €1.2bn EU privacy fine in 2023 for transferring user data to the US, surpassing Amazon's €746m fine in 2021 for the same reason, indicates the importance of having an established European presence.

Northern Data is well positioned to benefit from the EU's 2021 digital strategy, which commits €150bn in infrastructure investment by 2025 and aims to double the number of European tech start-ups valued at more than US$1bn to 100 by 2030. The 2023 EU AI Act, the world's first comprehensive AI law, focuses on data sovereignty and data scrutiny for model training, which could also discourage hyperscalers from expanding in Europe.

Additionally, management believes that the leading European data centres for colocation, like Interxion, Equinix and NTT, lack sufficient capacity and power for the next 30m NVIDIA GPUs coming to market over the coming 12 months, further enhancing Northern Data's market positioning.

Market landscape: Bitcoin mining

China's ban on cryptocurrency trading and mining in 2021 led to a substantial shift in power, allowing crypto miners in other regions to gain market share, particularly from the US. China resumed mining shortly after the ban and has recovered hash rate share since then, reducing the US lead to 38% versus China's 21% share, although the reason for China's reversal is uncertain.

Exhibit 9: Bitcoin mining market share by geography, measured by share of the hash rate
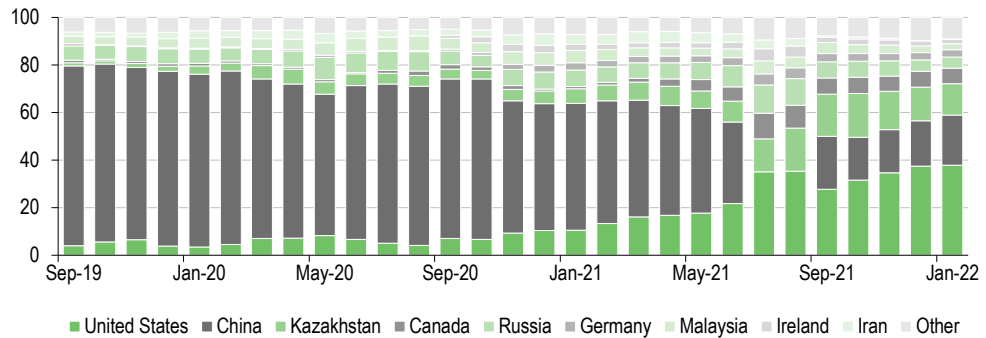
Source: Statista

Following the Chinese ban, major US miners like Riot Platforms and Marathon Digital rapidly expanded hash rate capacity driven by the migration of specialised mining rigs, like ASICs, out of China. For example, Riot grew its hash rate from 3.1EH/s in 2021 to 9.7EH/s in 2022. As highlighted by Exhibit 10, these market dynamics have driven a steady increase in the global bitcoin hash rate over the last three years.

Exhibit 11 highlights that bitcoin mining profitability has declined since 2021, remaining broadly flat throughout 2023 after hitting troughs towards the end of 2022. We measure profitability by looking at the mining revenue that can be generated per TH/s, which is driven by three main factors:

- mining difficulty (measured by hash rate);
- shrinking block rewards following consecutive halvings (most recent halving in May 2020); and
- the bitcoin price.

The above factors have contributed to the fall in revenue per TH/s. Thinner margins have squeezed out smaller competitors, enabling players like Northern Data to capture market share. Large miners can still achieve meaningful profits even with compressed revenue per TH/s, particularly those leveraging more cost-efficient mining hardware and innovative methods like liquid cooling. The hash rate's steady increase implies miners remain bullish, likely aiming to secure market share before the halving, which could buoy prices given reduced block subsidies.

Exhibit 10: Global hash rate and bitcoin price progression from 2021 to 18 December 2023
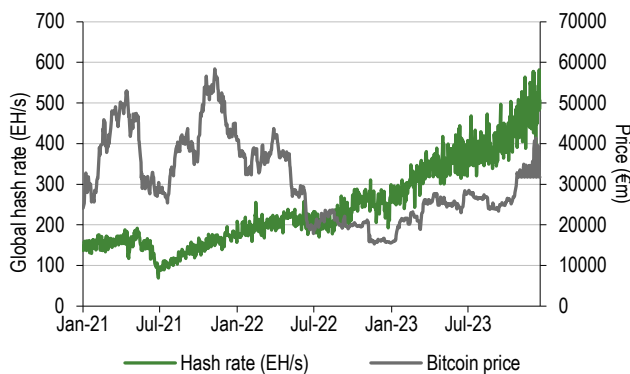
Source: CoinWarz, Refinitiv

Exhibit 11: Global bitcoin miner revenue per TH/s per day, January 2019 to December 2023

Source: Edison Investment Research compiled data from Statista and BitInfoCharts

While China's mining ban has created opportunities, execution risks remain around maintaining cost-efficient US mining operations given the challenges around sourcing cheap electricity at scale. President Joe Biden's proposed Digital Asset Mining Energy tax would also have led to considerable cost constraints if it had been passed, prompting a 30% tax on cryptocurrency miners. The aim of the tax was to limit the environmental and societal damage caused by mining operations, although it is unclear how much this would have affected Northern Data given its strong ESG credentials. Additionally, miners are expanding their use of renewable energy sources, especially in Texas, which has attracted a concentration of US mining activity thanks to its abundant wind and solar resources, deregulated energy market and affordable electricity rates.

In May 2023, US-based miner Applied Digital announced its pivot towards cloud computing, mirroring Northern Data's strategic shift. The move was well received by investors, with shares doubling within a week. We believe this re-rating reflects reduced revenue volatility due to recurring cloud revenues, offsetting lumpy mining proceeds, reduced sensitivity to crypto regulation and the strong market sentiment for AI.

We note that recently the bitcoin price rose significantly (c 53% in Q423 so far), fuelled by hopes that a spot bitcoin ETF could be approved by the US Securities and Exchange Commission (SEC) soon. A catalyst for this has been the recent court win of Grayscale, the largest digital asset manager globally, which filed an application to convert its Bitcoin Trust into a spot ETF. A judge in the US Court of Appeals for the District of Columbia Circuit ordered that the SEC's denial of Grayscale's application should be reviewed. We note that several high-profile asset managers also have spot Bitcoin ETF applications that are pending review, including BlackRock, Fidelity and WisdomTree, among others. The introduction of a spot bitcoin ETF could potentially spur significant inflows and assist price action.

Northern Data management

Northern Data has a two-tiered board structure, consisting of a management board and a supervisory board. The management board is led by Chief Executive Officer Aroosh Thillainathan, who founded Whinstone Group in 2014 prior to its acquisition in 2020. At group level, he is supported by Chief Operating Officer Rosanne Kincaid-Smith, who brings extensive experience in managing day-to-day operations and end-to-end business transformation.

Karl Havard is the managing director of Taiga Cloud, where he was previously head of Europe, Middle East and Africa go-to-market for Amazon Web Services and Accenture, before joining the group in March 2023. Corey Needles heads Ardent Data Centers and has more than 25 years' experience in data colocation, cloud services and cryptocurrency mining. Niek Beudeker is managing director of Peak Mining and was previously vice president of operations and business development at Bitfield, a bitcoin mining company that was acquired by Northern Data in September 2021.

The management team is supported by a three-person supervisory board, chaired by Dr Tom Oliver Schorling and supported by Bertram Pachaly and Dr Bernd Hartmann.

Scenario-based testing

We expect Northern Data's investment in new hardware across its divisions to lead to a significant uplift in revenue, although quantifying the exact uptick is challenging given multiple variables. Below, we illustrate the efficiency gains from Peak's new ASIC miners and Taiga's NVIDIA H100s, where costs are more visible and can be estimated more accurately.

Peak Mining

Every month, Northern Data provides a mining update, summarising the number of ASICs in deployment, mined bitcoin, bitcoin sold, hash rate, utilisation and revenue generated. In Exhibit 12, we provide a breakdown of the different components of a miner's revenue, providing an estimated illustration of how the company generated €5.0m from bitcoin mining in October (€48.7m ytd).

This figure was calculated by first estimating global mining revenue based on mined bitcoin quantities and average pricing, plus assumed transaction fees. Northern Data's share was derived from an implied market share, underpinned by its hash rate divided by the global rate.

Exhibit 12: Breakdown of Northern Data's October mining revenue, using our estimates

Global market	
Block rewards per month	26,100
Average bitcoin price (€)	28,564
Value of mined bitcoin (€m)	746
Transaction fees (€m)	51
Total global miner fees (€m)	797
Global average hash rate (October) (EH/s)	440.9
Northern Data	
Mining hash rate (EH/s)	2.7
Implied market share	0.6%
Implied revenue (€m)	5.0

Source: Northern Data, Edison Investment Research

As mentioned previously, Northern Data has acquired US$150m of the latest WhatsMiner mining rigs from MicroBT, which management expects to increase its hash rate to 7EH/s before the halving in Q124. As shown in the Peak Mining section, management believes it can reach 14EH/s by end-FY24, including a further 0.9EH/s by enhancing existing centres and 6.1EH/s by expanding to new ones. Exhibit 13 illustrates Peak's planned hash rate expansion to end-FY24 and resulting global market share, assuming the global hash rate grows at the same pace as Northern Data, or leading bitcoin miners, or stays flat.

Exhibit 13: Implied revenue scenarios under various global hash rate progressions

		Northern Data	Leading bitcoin miners*	No growth
	Planned growth prior to halving	**119%**	**60%**	**0%**
Northern Data's planned hash rate progression	**Implied global hash rate (EH/s)**	**1,022**	**747**	**467**
3.2	Market share (%)	0.3%	0.4%	0.7%
	Implied annual revenue (€m)**	38.0	52.0	83.2
7.0	Market share (%)	0.7%	0.9%	1.5%
	Implied annual revenue (€m)**	83.2	113.7	182.0
7.9	Market share (%)	0.8%	1.1%	1.7%
	Implied annual revenue (€m)**	93.9	128.3	205.4
14.0	Market share (%)	1.4%	1.9%	3.0%
	Implied annual revenue (€m)**	166.4	227.4	364.0

Source: Northern Data, Edison Investment Research. Note: *Includes Marathon Digital, Riot Platforms, and CleanSparK. **Assumes bitcoin price of €38,763 as at 18 December.

We note that the above is a simplified scenario, which may change considerably alongside the bitcoin price and growth in hash rate. Typically, the hash rate falls in the short-term after the halving as some miners may shut down operations due to reduced profitability from lower block rewards and then sees a rebound over the mid-to-long term (six to 18 months post halving) as the bitcoin price often rises, increasing profitability. Additionally, broker Bernstein stated that the leading 16 listed bitcoin mining companies globally are expected to increase their hash rate by 182% in the next two to three years, which could squeeze Northern Data's market share if it does not keep pace with this increase. However, the table does illustrate the potential for Peak to deliver strong revenue generation across a range of scenarios if it delivers on its planned expansion in hash rate for FY24.

Exhibit 14: Cost comparison from implementing new ASIC miners

	Current hardware	New hardware		
Mining hash rate (EH/s)	3.2	7.0	7.9	14.0
Average mining efficiency (W/THs)*	38	28	27	25
Power required (kWh)	121,600	195,635	216,068	354,559
COGs per hour (US$)**	4,864	7,825	8,643	14,182
COGs per year (US$m)	43.4	69.9	77.2	126.6
Global bitcoin mined per month	313,200	313,200	313,200	313,200
Implied ND market share (at October hash rate)	*0.7%*	*1.5%*	*1.7%*	*3.0%*
Implied number of ND bitcoin mined	2,146	4,695	5,298	9,389
COGS per bitcoin mined (US$)	20,235	14,882	14,564	13,486
Current bitcoin price (US$)***	41,410	41,410	41,410	41,410
% of current bitcoin price	*49%*	*36%*	*35%*	*33%*

Source: Northern Data, Edison Investment Research. Note: *Watts per terahash. **Assuming 4c per kWh. ***Priced at 18 December.

Exhibit 14 contrasts the considerable incremental efficiencies attained by deploying this new MicroBT hardware with the current infrastructure over time, highlighted by the decline in COGs per bitcoin mined. Management has stated that maximum electricity costs will be 4c/kWh, which we assume above in our scenario table, but this is conservatively high given rates can be as low as 2c. Other overheads are minimal versus energy costs, so the below table highlights the potential for margin expansion alongside the planned growth in hash rate.

Taiga Cloud

Exhibit 15 compares prospective energy outlays for Taiga's current NVIDIA fleet (A100s and A6000s: 6,400) against incoming H100s (18,200), presuming a 24,600-unit total inventory. We have assumed total opex of 40–50c/kWh, including electricity, colocation fees and cost of sales.

Exhibit 15: Energy cost forecasting for existing and new GPU servers

	A100s/A6000s	H100s
Max power consumption per GPU (W)	350	700
Number of GPUs	6,400	18,200
Total power consumption per hour (kWh)	2,240	12,740
Cost per hour (US$)*	1,008	5,733
Cost per year (US$m)	8.7	49.5

Source: Northern Data, NVIDIA, Edison Investment Research. Note: *Assumes midpoint of running costs.

Although the costs of running the NVIDIA H100s are higher than its current A100/A6000 hardware, Northern Data believes that they have a much higher price point given their limited supply. For reference, Taiga expects to generate run-rate revenue of c €30m from its current infrastructure. Assuming a modest €2 per GPU hour, full utilisation of its 18,200 H100s would generate annual revenue of more than €315m – approximately 60% of the midpoint of its FY25 group revenue guidance. That said, both scenarios indicate significant margin potential.

Scenarios provide sense check against guidance

Executing on milestones, such as deployment schedules, will be key to management reaching its FY24 financial guidance (see Exhibit 16), while the FY25 targets show the potential for the business once all its new hardware is deployed. If Peak delivers its target of 14EH/s by end-FY24, at the mid-point of our assumed growth in the global hash rate, this implies revenue of €227m at the current bitcoin price. In addition to the €345m revenue from Taiga Cloud (H100s: €315m, current run-rate: €30m), this would imply possible revenue of €572m – at the top-end of FY25 revenue guidance.

We note several variables could affect this, such as software upsells in Taiga, external sales in Ardent or volatility in the bitcoin price or hash rate. Of these, bitcoin price shifts and changes in the global hash rate following the next halving event may prove most impactful. Significant movements up or down in either factor could greatly swing Peak's revenue. In contrast, the potentially greater revenue from Taiga should prove more stable. We do not present scenarios for total operating

costs given the number of variables but believe the deployment of more efficient hardware could allow management to reach margin targets.

Exhibit 16: Northern Data's financial guidance

Source: Northern Data
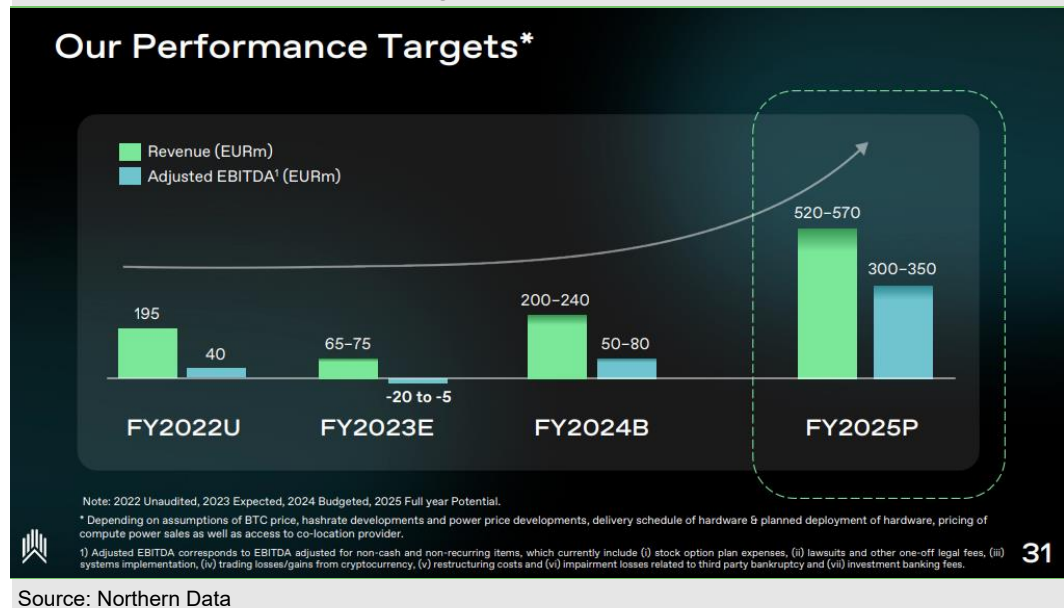
Sensitivities

Below we detail several sensitivities that investors should be aware of:

- **Regulation:** emerging regulations for crypto mining and data centres present both risks and opportunities. In the US, potential mining restrictions create uncertainty, while EU regulation may have a mixed impact on the group given its strong ESG credentials and European presence.

- **Bitcoin price volatility:** despite Northern Data's diversification away from crypto, it is still exposed to bitcoin prices in Peak. For example, the bitcoin price fell by 77% over 12 months to US$15.8k in November 2022, after peaking at US$76.6k in 2021, and now stands at US$41.4k. Sustained volatility may affect overall group liquidity.

- **Early stage for generative AI:** Northern Data has invested substantially in Taiga to drive its generative AI strategy, but its limited track record of performance creates uncertainty until initial contracts materialise.

- **Limited visibility from bespoke contracts:** Taiga Cloud's use of bespoke contracts to acquire new customers diminishes the group's ability to generate recurring revenue, reducing visibility. Standardised offerings may support higher-quality recurring sales, albeit potentially at the expense of customer wins.

- **Reliance on key suppliers:** the group's data centres are equipped with the latest technology from a small group of suppliers, especially in Europe. Technological breakthroughs could make Northern Data's current infrastructure obsolete and may require substantial investment to maintain market leadership.

- **Historical controversy:** allegations of inaccurate reporting and a lawsuit from Riot Blockchain following a failure to disclose important information from the Whinstone sale create uncertainty. The company has always received unqualified audits by KPMG but the recent significant evolution of the business has created challenges. Now established, Northern Data is striving for transparency for FY23 and beyond, where we believe audited reporting could boost investor confidence.

EDISON