



**Norman
Disney &
Young**

A TETRA TECH COMPANY



TETRA TECH

High Performance
Buildings Group

Mission Critical

Capability Statement

Asia Pacific Region

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**NDY by
numbers
Global**

 established
1959

 **600+**
people

 **9**
key markets

12 
offices

 **5**
countries



Our mission critical capabilities

From site selection and masterplanning, detailed design documentation, through to developing sequence of procedures (SOPs) and detailed commissioning documentation, we help address your needs in the Mission Critical space.

Mission critical facilities are vital for large scale businesses and government organisations and with NDY's detailed knowledge of TIA-942 and Uptime Institute requirements, coupled with our significant on-site experience of delivering major upgrades in live environments, we are uniquely positioned to provide design engineering services in the Australian, Mission Critical market sector.

NDY has a proven track record in delivering mission critical projects across Australia, both in terms of new facilities and upgrades in existing, live facilities. With a Mission Critical team presence in all Australian states, we are also well positioned to provide construction services for you, without the need for interstate travel.

NDY understands the importance of environmental sustainability and will always work closely with you to minimize a facility's Power Usage Effectiveness (PUE) and obtain LEED / NABERS certification where required.

We look forward to discussing how we can add value to your mission critical project needs.

Green Building Rating Certification within Data Centres

We are extremely proud to have successfully assisted data centre providers within Australia achieve LEED Gold Certification and NABERS 4.5 Star Certification for their facilities.

Uptime Institute Tier Certification

We are extremely experienced in the Uptime Institute Tier Certification process and have provided design engineering services for seven no. Tier III (concurrently maintainable) design certified facilities and one no. Tier IV (fault tolerant) design certified facility in Australia.

Better together

Powered by innovation

Norman Disney & Young (NDY) and Engineering Commissioning Services (ECS) form part of Tetra Tech's High Performance Building Group, a global collective of engineers, commissioning agents and sustainability practitioners with a significant footprint throughout the Asia Pacific region.

The High Performance Buildings Group serves blue-chip clients across every sector with a core offering of mechanical, electrical, hydraulic, fire protection, sustainability and commissioning management services. Our team is bolstered by expertise in the specialist disciplines of energy analysis, lighting design, vertical transportation, low and high voltage, information technologies, security, fire engineering, structural and acoustics.

The High Performance Building Group's Asia Pacific team are supported by over 20,000 specialists who are well positioned to collaborate and share expertise with colleagues around the world, providing a truly global reach.

NDY ASIA PACIFIC REGION BY NUMBERS

established
1959

380+
people

9 key
markets

10 offices

3 countries
Australia
Hong Kong
New Zealand



TETRA TECH

High Performance
Buildings Group

Our value add

Agile approach

-

Customer centric

-

Technical excellence

-

APAC design hub with
global connections



In addition to our core MEP services, NDY offers these in house design services as a value add to our clients.

Commissionability

Reviews during the Design Stages.

ECS provide support to NDY during the design stages on Mission Critical projects so that key commissioning activities are considered as early on as possible during the design process, in order to minimise disruption to the construction and commissioning activities on site.



"Whilst we provide this assistance as a value add to our sister company, we are still fiercely independent when it comes to commissioning and pride ourselves on being best in class, which is evident in the clients we work with in the Mission Critical space." **Martin McGrath | ECS's National Mission Critical Manager**

"NDY are privileged to have ECS under the same Tetra Tech banner as ourselves. With their technical assistance during our design stages on Mission Critical projects, we feel we have a distinct advantage over our competitors in giving our clients a design that gives contractors and their trades, the best opportunity for success." **Ian Lewis | NDY's Mission Critical Sector Director for Australia**

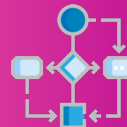
The following are a few examples of how ECS assist NDY:



A review of **design specifications** to expand on key commissioning activities such as detailing specific test equipment, Functional Performance Tests and Integrated System Tests to avoid cost and program issues later in the construction



A holistic review of the **environmental conditions** that have been considered as part of the design and compare them to those that are commonplace in the market so environment sustainability can be at the forefront of any design



A review of **low load conditions** and anticipated buildout of the facility, as this can impact the operation of mechanical and generator systems and may need the capacity of some equipment to be redesigned to cater for these conditions



Understanding **site phasing** over time and its impact on commissionability, especially where centralised, capacity components are being phased in. Recommissioning systems is often overlooked as they are adjusted, which in turn can lead to issues in understanding how the systems are operating unless metering / measurement points are considered as part of the initial design



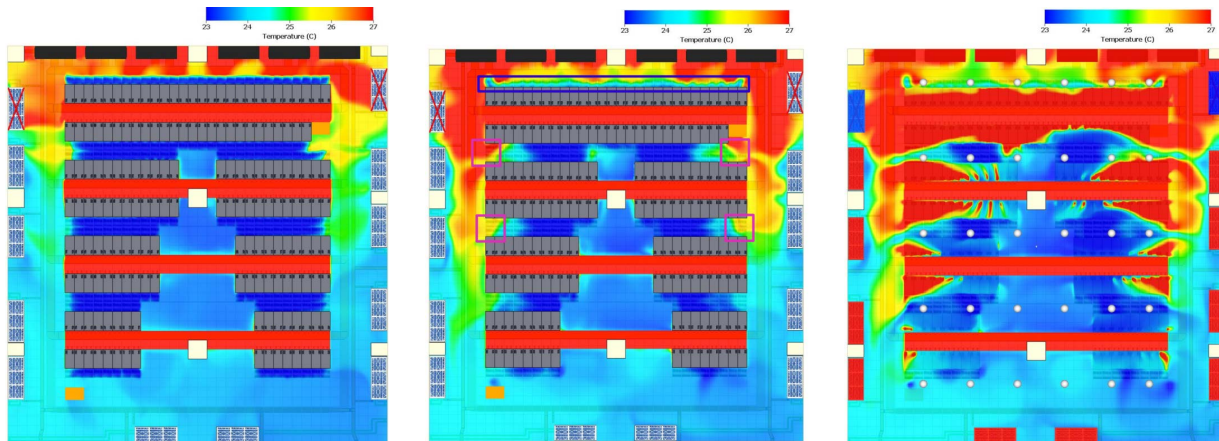
Often when **testing existing systems** in live environments, there is little consideration to how testing can be completed without unduly affecting those live systems around them. Understanding what types of temporary isolation arrangements are possible and are likely to be agreed to by the operations team when working in a live environment is critical to this being a success

Computational Fluid Dynamics (CFD)

NDY use computational fluid dynamics (CFD) for many purposes within the Mission Critical sector.

This includes comparison of air flow and temperature distributions for different supply air strategies in new data halls, troubleshooting and retrofitting of existing data halls as well as assessment of heat recirculation around external plant enclosures which can have a significant impact on mechanical cooling efficiency, and the overall efficiency of the facility.

Further, we are able to simulate what may happen during cooling failure mode, and assess what additional measures will assist in maintaining optimum internal conditions before facilities are constructed, providing additional resilience within our building services designs.



CONFIDENTIAL CLIENT

During operation, two UPS rooms within one of our client's facilities were observed to reach unacceptable temperatures within the spaces, even with an N+1 CRAC arrangement. Whilst it was evident that the existing layout would likely result in poor performance, CFD simulation was used to replicate this issue and understand the root cause of the problem. Further, our mechanical team worked with our CFD engineer to design a bespoke ducting system to directly extract hot air leaving the back of the UPS units and returning it to the CRAC unit. CFD analysis was again used to prove that this solution would result in acceptable conditions with limited recirculation.

CHINA MOBILE INTERNATIONAL PHASE II

NDY undertook CFD analysis to support the proposed mechanical design for China Mobile's new facility by replicating conditions not only within the data hall itself, but in the underfloor plenum. Both normal and two different failure modes were assessed, with the results of the analysis used to refine the floor void performance. Baffles were incorporated between the CRAC outlets and the floor grilles that transferred the cool air in to the data hall, with significant improvements in the uniformity of air flow through these grilles observed.

CONFIDENTIAL CLIENT

One existing data hall within the facility was observed to not be meeting internal temperature conditions. Upon further investigation, it was found the existing cooling units installed were producing significantly less than their rated capacity. As a short term solution, additional in row coolers were proposed to be implemented. Our CFD analysis ran a number of scenarios including the cooling units running at full rated capacity as well as at their current de-rated performance, with and without the presence of in row cooling units to assess the likely temperature profiles that could be expected. Another was the number of existing units failing completely to understand the effectiveness of the proposed solution, which resulted in the location of a number of the in row coolers being changed within the design proposal.

BIM & Digital Engineering for Data Centres

Quite simply, the true value of Building Information Modelling (BIM) & Digital Engineering (DE) is the ability to collect, share and leverage project related information from various project stakeholders. This translates into greater speed, accuracy and efficiency at every stage of project delivery through design, construction and into operations.

Why NDY Digital BIM & Data Services

NDY provides specialist Building Information Modelling (BIM) and Digital Engineering (DE) services for Virtual Design and Construction (VDC) project, delivered by an experienced team of professionals with extensive experience in the digital delivery of Data Centres through design, construction and operations handover.

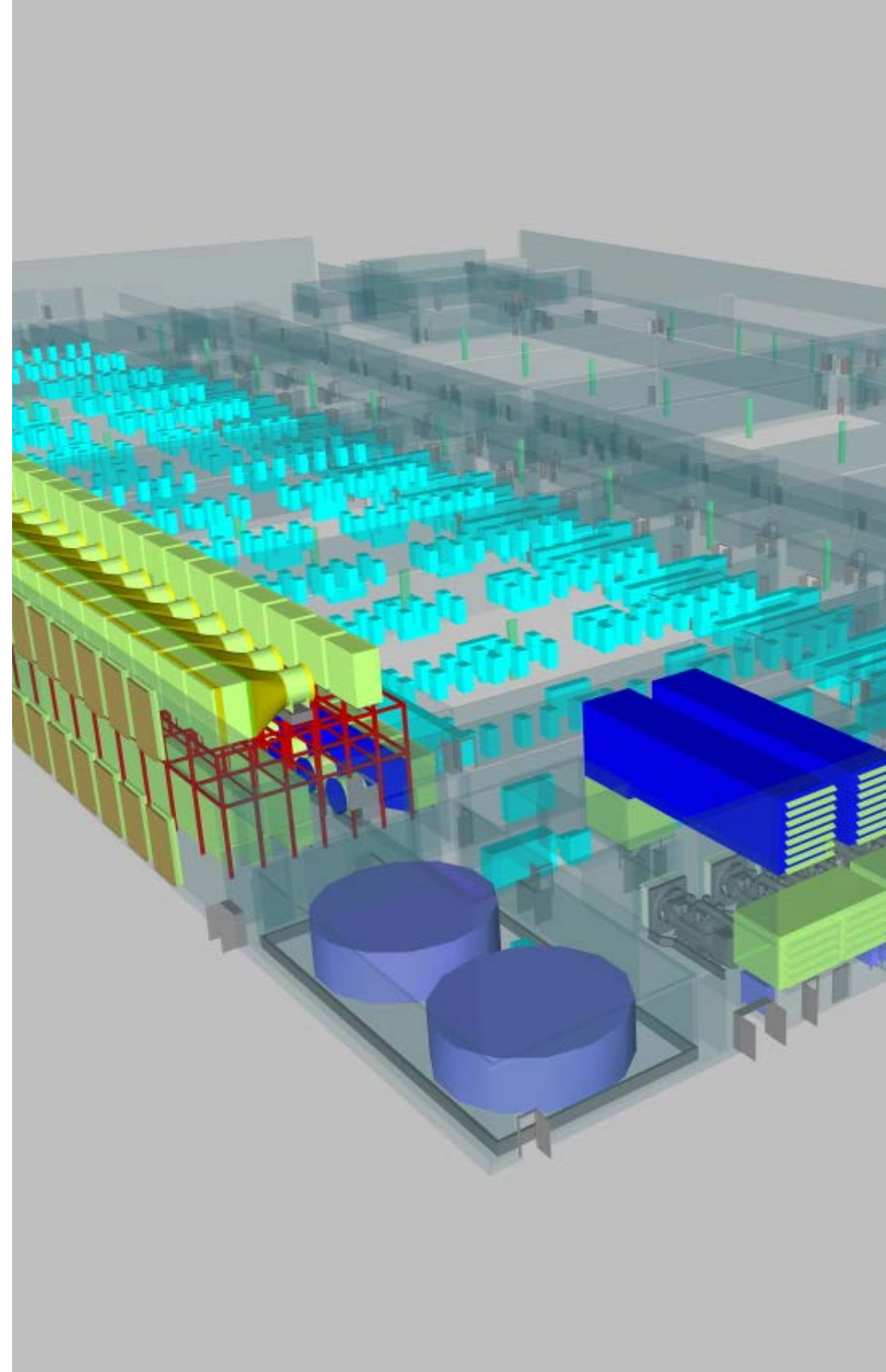
Data Centre Digital Project Management

We believe, that for complex projects, such as data centres, a dedicated presence is beneficial in order to increase communication and maximise efficiencies gained from implementing the latest developments in BIM technology and delivery methodologies.

Coordination meetings represent an integral part of the process, allowing teams to collaboratively review and resolve issues before they get to site, effective meetings set the scene for effective communication and collaboration throughout the project, with the potential to save significant costs, providing increased efficiencies and profitability for all stakeholders.

We conduct meetings in person or they can be effectively conducted remotely, using cloud-based model collaboration tools, such as BIM360 and Revizto.

We also provide training, support and ongoing guidance to all project stakeholders and other team leaders in the effective oversight of Coordination meetings; and in the effective use of the latest cloud-based collaboration platforms.



Cloud-Based Collaboration & Model/Data Hosting

We provide the advantages of recent technology advancements and have standardised the way we bring project teams together to collaborate, by utilising industry leading cloud-based solutions.

Our focus is to ensure we use the best tools for the job. Technology is continuously changing, therefore we challenge ourselves to continuously keep up with these technology trends and improvements, to help us deliver the best outcomes for our clients.

Adopting powerful cloud-based collaboration platforms on all our BIM and Digital Engineering projects improves coordination workflows and allows project members to communicate accountability and address challenges in real-time through the whole project lifecycle.

Other advantages of cloud-based collaboration over static model sharing are huge boosts in project efficiencies. Our real-time issue tracking platform allows us to focus on collaboration and BIM-DE coordination, making the model immediately accessible and actionable for the entire project team, managing model-based issues in the 3D space and on 2D sheets. Cloud-based collaboration resolves challenges with interoperability, providing access to all model data on any device and in Virtual Reality (VR).

We specialise in the implementation of cloud-based model collaboration tools, such as BIM360 and Revizto.

Construction / Installation Coordination & Prefabrication

Prefabrication is having a significant effect on the construction process, providing efficiencies gained in off-site fabrication, safety in reduced site-based work, as well as cost.

Prefabrication of many of the building systems and components, from the enclosure to the mechanical and electrical systems. BIM-DE/VDC is vital for designing and testing prefabrication concepts with respect to material handling, path of travel, and installation sequence.

We utilise Autodesk Navisworks and Bentley Synchro for 4D Virtual construction, planning and model-based workflows.

Managing Project Phasing

Data centre projects are typically phased to avoid building out expensive capacity that may not be required from the outset.

Utilising phasing in the BIM model(s), allows the team to analyse the cost, schedule, as well as energy consumption at various phases.

On completion of the construction and subsequent handover, the completed, as-built verified BIM supports future development with an accurate record of the installed conditions, enabling the team to confidently plan future requirements.

Integrated Raised-Floor Services Reticulation

Coordination of the BIM model for the flooring enables the installation teams to understand where the MEP systems are located in relationship to the pedestal support systems.

Integrating the coordination of the raised-flooring into the modelling process, the flooring installers can see where they need to modify support framing early in the process and fabricate the necessary bridging and support components to span across the MEP systems where necessary.

Enabling Commissioning

Data centres require a robust commissioning process to ensure performance and reliability. Commissioning information tags for each piece of equipment and associated reticulation can be added to the BIM model to provide an active/live database of commissioning process status.

When this information is inserted into the BIM database, the information can be retained and viewed for each piece of equipment, rather than in separate volumes, providing a single-point-of-truth for all information.

Analysing Airflow

By incorporating computational fluid dynamic (CFD) simulations into the BIM model, engineers can evaluate and fine tune server layouts based on the thermal modelling.

On-site Support/BIM Modelling Support

NDY provide support on projects for the implemented BIM-DE collaboration platforms that form the projects Common Data Environment (CDE). Our team will ensure that all project stakeholders are engaged with the cloud-based model collaboration environment, maximising the efficient communication across the whole project team

NDY's BIM-DE Manager will become a vital element within your team, and a significant contributor to project success.

Our project experience

Data Centres Hong Kong

Tseung Kwan O Industrial Estate: GSHK Hong Kong Data Centre. Hong Kong

Services:

- › Communications
- › Electrical
- › Fire Protection
- › Mechanical
- › Plumbing & Drainage
- › Security & Control

NDY is providing Client-side MEP Oversight and Peer Review Services for Electrical, Mechanical, Fire, Plumbing, Drainage and ELV (Security & Control) services for Global Switch Hong Kong 'GSHK' Data Centre located in Tseung Kwan O Industrial Estate.

NDY has provided support from the initial project development / inception stage in 2015 and throughout construction.

Leveraging on prior experience gained during commissioning of the initial project phase, NDY was able to draw upon a deep understanding of the original services concept and client drivers, gaining valuable insights including a strong appreciation of restrictions the site presents, in order to effectively manage technical complex issues with respect to implementation of key infrastructure.

Key responsibilities include peer review of design documentation, review of contractor commissioning plans and testing methodologies, undertaking site inspections as well as providing technical support for on-going day to day operational issues. Completion of this scope of works for this client builds on earlier, successfully delivered project commissions including delivery of more than 30MW of IT power in a concurrently maintainable configuration in the first stages of the project.

The facility has an ultimate power capacity over 64MW for IT load supported by a dedicated on-site generation plant and a 100MW redundant utility power supply in a N+1 configuration (150MW installed).

The cooling system is based on a water-cooled chiller system with elevated temperature to decrease energy consumption by improving the

chiller efficiency, targeting one of the lowest PUE (<1.4) around the sub-tropical region characterised for its high temperatures and high relative humidity across all the year.

NDY has delivered fast turn-around peer review and assurance services for Global Switch.

NDY has been able to be responsive on site and work proactively with the Main contractor and Project Manager to test alternative engineering design options, interrogate commissioning issues, scale up resourcing support to suit the colocation customer demands; this project continues and NDY is proud of its track record to date, successfully resolving all technical considerations to the satisfaction of Global Switch.

The GSHK Data Centre has achieved practical completion in December 2020. NDY continues to assist Global Switch during the post handover phase.



Selection of recent experience

1. Confidential Data Centre, NSW, Australia

NDY were engaged to provide detailed design documentation associated with the upgrade of a number of data halls and their associated electrical infrastructure with approximately 4MW of IT load, upgrade to economy cycle cooling for the facility, upgrading the 11kV diesel generator capacity to 5.7MW and upgrading the HV supply from 11kV to 33kV to future proof the facility.

Across these various upgrade projects, NDY was typically engaged as lead consultant and engaged the architect, civil and structural engineers as sub-consultants, where required.

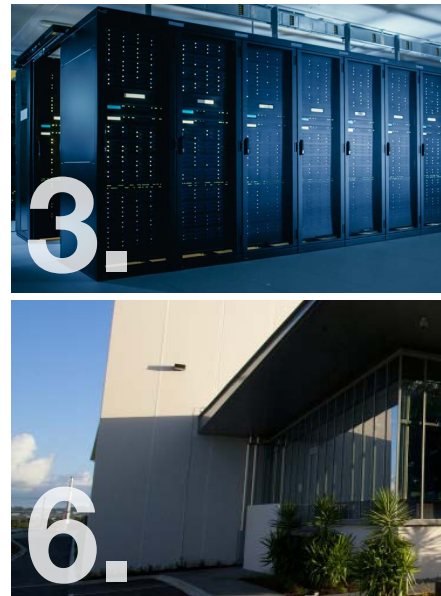
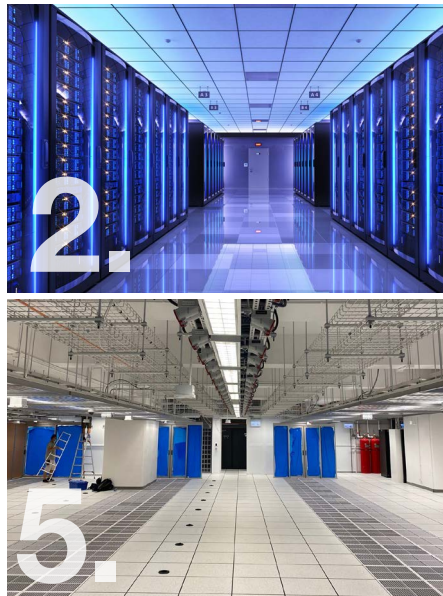


2. Examples of upgrades in Australian live facilities

NSW - UPS Upgrade projects: Upgrading a total of 2.6MW of existing UPS systems within a live facility.

VIC - Energy Centre project: Upgrading of MEP services associated with a live data hall with 2MW IT load, including upgrading the incoming utility supplies from LV to HV.

NSW - Upgrade of 11kV systems: Including new 11kV switchboards, 11kV DRUPS and interconnection between existing and new 11kV systems.



3. Confidential Data Centre - NSW, Australia

NDY were engaged to provide detailed design documentation for the expansion of an existing facility, across two data halls with a total of 6MW IT load. The Mechanical and Electrical infrastructure were designed to be concurrently maintainable, in accordance with Uptime Institute Tier III requirements. As part of the works, the HV network was expanded, including four new 3150kVA package Substations and four 2250kW Diesel Rotary Uninterruptible Power Supply (DRUPS) units.

NDY also provided detail design of the Data Hall 2 & 3 fit-out works, including coordination with the tenant rack layouts, CFD, power assessment and cable containment systems.



4. Confidential Data Centre - WA, Australia

NDY were engaged to provide detailed design activities associated with the update to an existing data centre, to achieve Uptime Institute Tier IV Fault Tolerant Design Certification. Our role included but was not limited to: Site audit of existing facility, Tier IV gap analysis, Master-planning and assistance with budgets, Detailed engineering documentation suitable for formal Uptime Institute Tier IV submission, Formal submission of UI certification documents, Uptime Institute reviews, liaison and coordination

5. Confidential Hong Kong Island 1MW Data Hall Fit-Out

NDY provided client-side assurance advisory, design peer review and commissioning site testing witnessing for a 1MW Data Hall Fit-Out. The on-site generation system and continuous cooling to the critical load was specifically tested against Mains/Utility supply failures and single equipment failures. Client "Special thanks to our consultant team for all the comment and recommendation, raise the bar and bring a successful project."

Project Successes: The comprehensive testing regime implemented, was able to identify key issues of the infrastructure. NDY worked together with the contractors and equipment vendors, providing recommendations and input to resolve and improve systems operations. This project was completed in December 2020.

6. IBM Highbrook Business Park Auckland, New Zealand

NDY were engaged for detailed concept design, design review, and performance acceptance testing on behalf of IBM. After handover of the design concept for D&C developer tender and award, this included review of the D&C Developer's detailed design for compliance with the concept design, development of the performance acceptance testing plan, on-site commissioning management and witnessing of performance acceptance tests. NDY was involved over a 4-week intensive period representing IBM in witnessing the outcomes of tests, and any re-testing required. In delivering this project, our team were able to demonstrate our detailed understanding of all aspects of the construction and operation of a mission critical data centre.

7. Confidential Hong Kong – 10MW Data Hall Fit-Out

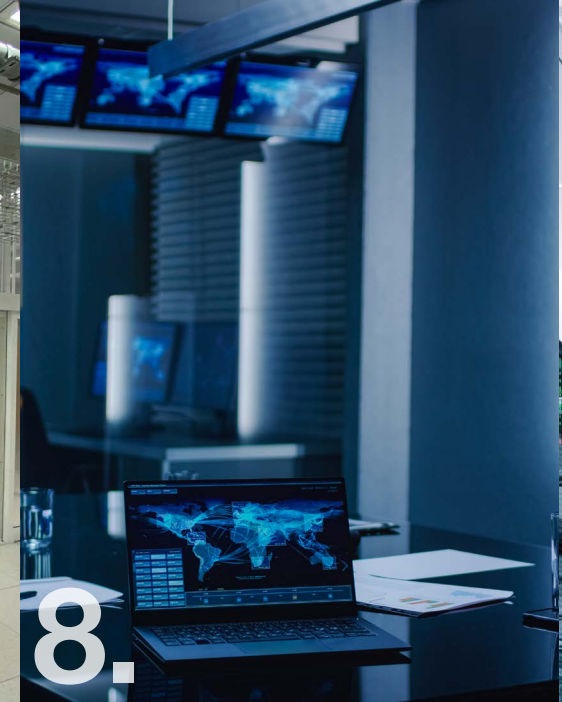
Services: Mechanical, Electrical, Communications, Fire Protection.

NDY provided concept schematic design, construction and commissioning oversight for 7 x 1383kW data halls fit-out including a Computational Fluid Dynamics (CFD) base model with failure modes scenarios. The project included the provision of a 2N temporary supply arrangement and future planning for the IT power changeover to the permanent supply.

Main Physical Infrastructure per data hall:

- Twelve (12) + CRAH perimetral room units, 131kW capacity each, in N+2 configuration
- Six (6) 800A Power Distribution Units (PDU), in N+N configuration.
- Cold Air containment system with Hot Air return plenum
- 2 x 500 sqm Data Halls

The deep knowledge and understanding of the base building system and tenant requirements enabled NDY to successfully integrate IT high density racks of up to 20kW whilst maintaining the ASHRAE recommended air supply temperatures in normal and failure modes scenarios. The adjustment and design of the return air plenum grilles were a key factor to improve air flow and efficiency.



8. Confidential Data Centre, NSW, Australia

NDY were engaged to provide detailed design documentation associated with the upgrade of a number of data halls and their associated electrical infrastructure with approximately 4MW of IT load, upgrade to economy cycle cooling for the facility, upgrading the 11kV diesel generator capacity to 5.7MW and upgrading the HV supply from 11kV to 33kV to future proof the facility.

Across these various upgrade projects, NDY was typically engaged as lead consultant and engaged the architect, civil and structural engineers as sub-consultants, where required.

9. Confidential Hong Kong – 1.5 MW Data Hall Fit-Out

Services: Mechanical, Electrical, Communications, Fire Protection, Security & Control.

NDY provided detail design, construction and commissioning oversight for a 1.5MW data hall fit-out including a Computational Fluid Dynamics (CFD) base model with failure modes scenarios.

The project included a base building upgrade to increase the data hall capacity IT load by 20%. Specification of additional IT power distribution units (PDUs) and CRAHs to support the tenant critical load whilst maintaining the site concurrently maintainable infrastructure.

The project was delivered fast tracking design and procurements activities to achieve the tenant aggressive deployment dates.

NDY worked hand by hand with the client and the equipment vendors to specify long lead items prior to completion of the schematic-detail design.

Project Successes: The deep knowledge and understanding of the base building system and tenant requirements enabled NDY to successfully overlap the stages of design and procurement to deliver this important project on time. NDY was able to reduce the client's fit-out cost by altering the electrical topology without compromising on system resiliency and capacity.



Contact

Team Leads



Donna Paredes

APAC - Mission Critical
Market Sector Director

E: d.paredes@ndy.com



Steve Marotta

Australian - Mission
Critical Market Key
Client Leader

E: s.marotta@ndy.com



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