

11.2 MW, Indirect Air Economizer, 10875m²

Design Overview

Data Centre IT Capacity

11.2 MW
Adaptable from 2.8 MW to 11.2 MW

Redundancy Levels

Power: 2N at the MV level, tri-redundant UPS, N+2 generators

Cooling: N+2 indirect air economizer sections

Data Centre Overall Space

10875m²

Regional Voltage and Frequency

MV: 11kV, 50Hz
LV: 400V, 50Hz

About this Design

- IT space and power distribution designed to accommodate standard and Open Compute Equipment
- Indirect air economizers provide energy savings
- Tri-redundant UPS configuration allows for cost savings while maintaining 2N reliability
- Hot aisle containment saves energy and supports a mixture of rack power densities

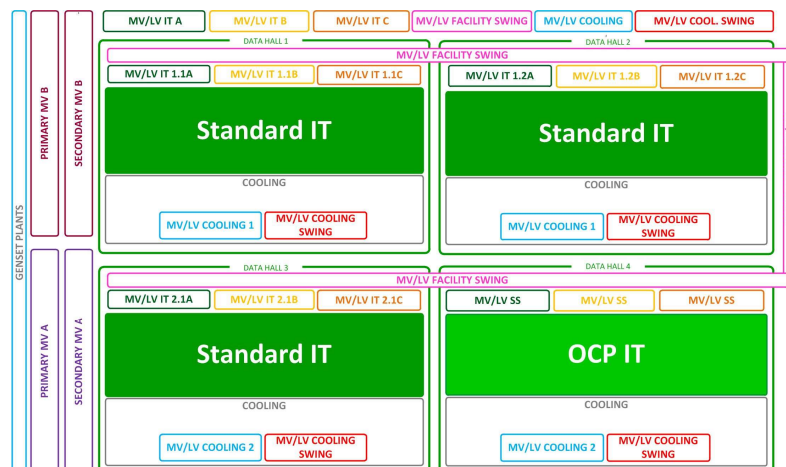
Introduction

This reference design is optimized for large colocation companies planning large data centres with an emphasis on total cost of ownership (TCO), redundancy, and time to market (TTM). The total size of the data centre is 11.2 MW IT and should fit with colocation business that offers regional / edge cloud services and multi-tenant IT outsourcing services.

This data centre includes four data halls, each with 2.8 MW of IT with an air-to-air cooling system serving each IT room. Design is made to be very flexible with respect to evolution of IT racks; it allows for various average densities either with standard racks and centralized UPS or OCP racks (or equivalent) with distributed UPS / energy storage. Electrical distribution and cooling architectures are optimized to meet these two different technical requirements. Data halls can be built one-by-one for scalability purposes, so together these rooms and systems constitute the building blocks for the data centre. Each data centre expansion, therefore, can occur in increments of 2.8 MW of IT load.

Reference Design 107 includes information for three areas: facility power, IT space, and facility cooling. Combined, they comprise the integrated power, cooling and structural systems required to meet the design's specifications in this overview document.

Disclaimer: Products contained in this Reference Design may be discontinued. Please consult your SE representative to find appropriate replacement for them.



Design Options

This reference design can be modified as follows, without a significant effect on the design’s performance attributes:

- Add/remove generator redundancy
- Change MV generator to LV generator with step-up transformers

Power

Primary Medium Voltage (MV) Distribution

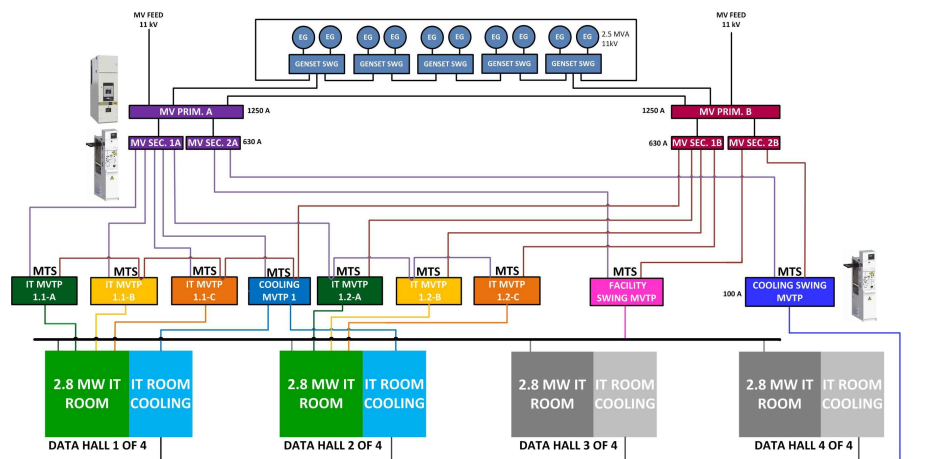
The data centre is designed for a maximum demand of 15 MVA, which means that the facility can connect directly to the utility’s medium voltage (MV) distribution. The point of connection of this data centre can be at different levels of medium voltage or high voltage, this design is optimized to allow 11 kV MV connection. The facility power system supplies energy to the critical and non-critical components within the data centre, with high reliability levels. Two *MCset* switchgear – each rated at 11 kV, 1250 A, and 25 kA – make up the initial MV distribution, provide A and B side power downstream to A and B *Premset* switchgear, and integrate backup power, provided by ten 2.5MVA diesel MV generators in an N+2 redundant, ring arrangement.

MV Back-up Generation

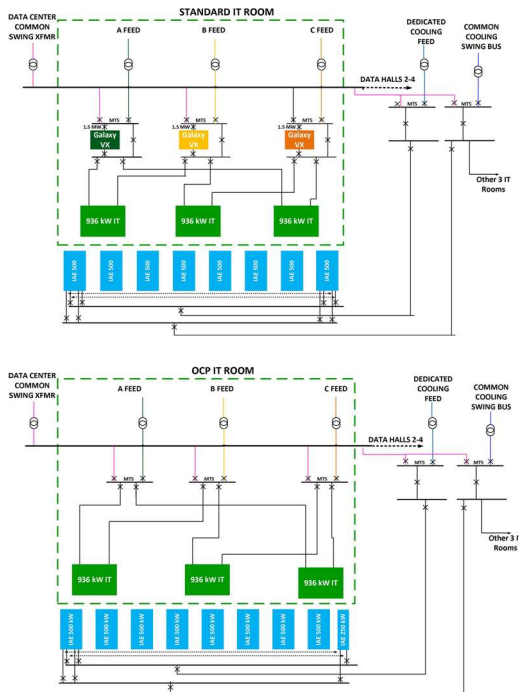
Back-up generation is centralized at MV level with 2N connection to the duplicated MV primary switchboards. Back-up generators are in N+2 redundant, ring arrangement to drastically reduce the Capex. Each pair of generators is paired with a *MCset* switchboard rated at 11 kV, 1000 A, and 25 kA. The generator plant is shared across the facility, allowing capital costs savings from avoiding the need for additional switchboard and over-sizing. The ring topology with multiple MV switchboards, completed by appropriate protection and control scheme, is a fault tolerant architecture to ensure high availability and thus the full continuity or service.

Secondary MV Distribution

Downstream of the A and B *MCset* switchgear are two pairs of A and B *Premset* switchboards – each rated at 11 kV, 630 A and 25 kA (3s) – making up the secondary MV distribution. There are 16 Medium Voltage Transfer Panel (MVTP): A, B, and C-side distribution for each IT room; two cooling MVTP (one for each pair of IT rooms); and two swing MV/LV line-ups (one for facility and one for cooling). Each MVTP are fed by a pair of A and B MV secondary switchboards, with one pair feeding the MVTPs for a pair of data halls. The swing MVTPs are to provide redundancy when performing maintenance on one of the MVTP and are both powered by the second pair of the A and B *Premset* switchboard. Each of the MVTP consists of a *Premset* switchboard rated at 11 kV, 100A. and 25 kA and a MV/LV transformer (1600 kVA for the IT MVTP and 1250 kVA for the cooling MVTP)



Facility LV Power Block Diagram



Design Options

This reference design can be modified as follows, without a significant effect on the design's performance attributes:

- Add UPS to power path of cooling systems
- Add/remove redundancy at UPS module level
- Change UPS batteries (type, location)

Power

Low Voltage (LV) Distribution

Downstream from the MV distribution, the IT room has a tri-redundant LV architecture with a common swing feed for maintenance bypass, while cooling, and auxiliaries has a N+1 redundant LV architecture using a common swing feed. The common swing feeds will keep the same level of redundancy in case of maintenance of one of the MVTP. The LV IT distribution for each IT room is made up of three *Trihal* 1600 kVA transformers (6% impedance), each coupled with an *Okken* LV switchboard, rated at 400 V, 42 kA with a 2500 A bus, providing power to the main and alternate power paths. These line-ups are designed to be skid-optimized, to improve modularity and scalability. Line-ups is also optimized to meet the maximum capacity of each component, thus optimizing on cost and footprint.

For the standard IT rooms, these *Okken* lineups feed a 1500 kVA *Galaxy VX* UPS on each A, B, and C-feed to guarantee tri-redundant LV distribution with UPS backup. Downstream of the UPS, these lineups feed busways that feed the racks with 2N redundancy. While, for the OCP IT rooms, these *Okken* lineups feed straight to busways that feed the OCP power supply units with battery back-up units in each rack for 2N LV distribution; this simplifies the electrical design. For both types of IT rooms, each LV switchboard is also powered by a common swing bus that serves as a maintenance bypass for a dedicated transformer feed.

The LV distribution for the cooling systems and auxiliary loads for two IT rooms is made up of one *Trihal* 1250 kVA transformers, paired with *Okken* switchboards, rated at 400 V, 42 kA, with a 2000 A bus. Furthermore, there's a cooling swing bus shared by each data hall's cooling system to provide maintenance bypass for one data hall at a time. The facility common swing feed also provides maintenance bypass to cooling transformers. For cool climates like Dublin, Ireland, it is not needed to place the indirect air economizer units on UPS to prevent temperature to raise above ASHRAE's allowable temperature limit (32°C) after a primary power failure. Please refer to the [Data Centre Temperature Rise Calculator](#) to help determine if cooling units need to be on UPS for other locations and design.

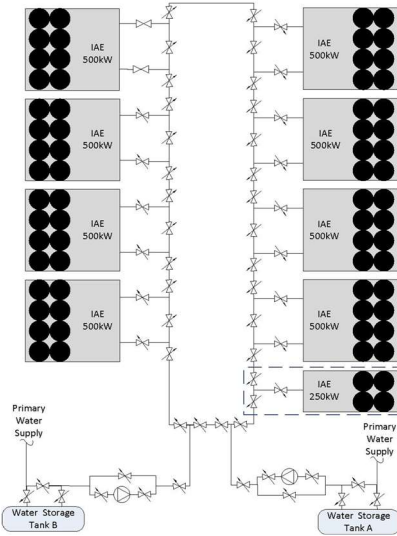
The facility power system is designed to also support integrated peripheral devices like fire panels, access control systems, and environmental monitoring and control devices. Power meters in the electrical path monitor power quality and allow for predictive maintenance & diagnostics of the system. These meters also integrate with *EcoStruxure Power*.

Every component in this Reference Design is built and tested to the applicable IEC standards. Further design details and schematics are available in the engineering package available upon request.

MV Power Distribution Attributes	Value
Quantity of primary MV switchboards	2
Primary MV switchboard bus amps	1250 A
Primary MV switchboard bus voltage	11 kV
Primary MV switchboard kAIC	25 kA
Quantity of secondary MV switchboards	4
Secondary MV switchboard bus amps	630 A
Secondary MV switchboard bus voltage	11 kV
Secondary MV switchboard kAIC	25 kA
MV generator capacity (N)	16 MW
MV generator redundancy	N+2
Number of medium voltage transfer panels (MVTP)	16
MVTP bus amps	100 A
MVTP bus voltage	11 kV
MVTP kAIC	25 kA
LV Power Distribution Attributes	Value
Total bus amps (main LV bus)	2500 A
Input voltage (main LV bus)	400 V
LV switchboard kAIC	42 kA
Power path	Dual
IT space UPS capacity	3000 kW
IT space UPS redundancy	Tri-redundant
IT space UPS runtime @ rated load	5 mins
Facility cooling UPS capacity	N/A
Facility cooling UPS redundancy	N/A
Facility cooling UPS runtime @ rated load	N/A

Facility Cooling Block Diagram

Facility Piping Diagram (Shown 1 of 4)



Indirect Air Economizer (IAE) Unit



Design Options

This reference design can be modified as follows without a significant effect on the design's performance attributes:

- Reduce redundancy to the module, not frame, level
- Eliminate secondary water supply tank, or change its size
- Turn on water-saver mode to reduce water consumption and rely less on evaporative cooling
- Change to roof-top or straight-thru units

Cooling

The facility cooling design is comprised of four identical stand-alone cooling systems with a total of 33 perimeter indirect air economizers (IAE) that deliver clean and conditioned supply air to the data centre. For the standard IT rooms, eight 500 kW IAE units with N+2 (by module) redundancy are mounted along a common supply plenum that runs along the side wall of the IT room. The design assumes that each 500 kW unit consist of two 250 kW modules, each with their own direct expansion (DX) trim cooling, piping connections, and dual power supply. For the OCP room, eight 500 kW IAE units and one 250 kW IAE unit serve the room with N+2 redundancy at the module level. Note: capacities mentioned in this paragraph refer to cooling capacities of the IAE units and not its electrical power consumption.

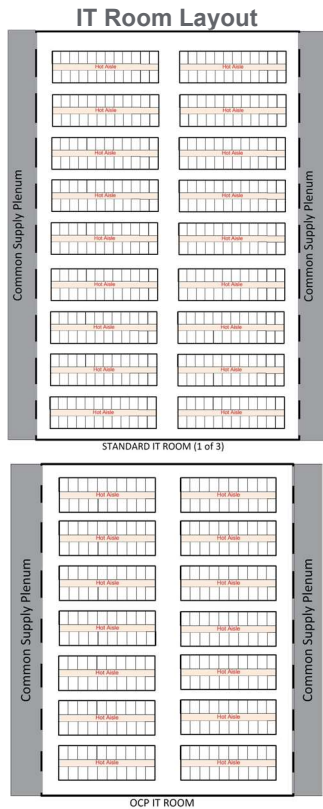
Warm return air from the IT equipment is ducted to a common ceiling plenum, which each IAE unit draws air from, using air-to-air heat exchange when ambient temperatures are favorable to supply the IT room with a flood of cooled air through the common supply plenum, and diffuser grilles at the perimeter of the IT room. When ambient temperatures are less favorable, IAE units supplement the free cooling with indirect evaporative cooling, which removes heat from the IT air by evaporating water on the outside of the heat exchanger channels. In circumstances of extreme ambient temperatures, the refrigerant loop in each IAE module activates, using DX cooling to maintain the desired IT space temperature. Regardless of which cooling mode is being used- air-to-air free cooling, indirect evaporative, or direct expansion- the units always prevent the outside air from mixing with the data centre air.

In the case of a primary water supply failure, a shared 106 m3 water storage tank can supply water for 12 hours of evaporative cooling to all the IAE units on the site. Pumps are needed to pump water from the water storage tank and are redundant to ensure concurrent maintainability.

Air in all electrical rooms is conditioned by N+1 *Uniflair* perimeter DX cooling units.

This design is instrumented to work with *EcoStruxure IT Expert* for monitoring and control, and *EcoStruxure IT Advisor* for operations. Further design details such as dimensions, equipment placement, temperature set points, pipe sizing, flow rates, and pressure drops are available in the engineering package.

Facility cooling attributes	Value
Total cooling capacity (N)	12,000 kW
Input voltage	400 V
Heat rejection medium	Air, water, and/or R-410a (depends on conditions)
Supply air temperature	24°C
Return air temperature	36°C
Mechanical redundancy per IT room	N+2 at module level
Outdoor heat exchange	Indirect evaporative cooling
Storage tank size	106 m ³
Ride through time	12 hours
Economizer type	Air-to-air and indirect evaporative



IT Space

Four IT rooms make up the entire IT space of this design, there are three standard IT rooms and one Open Compute Project (OCP) or equivalent IT room, laid out horizontally. Each standard IT room consists of 18 pods housing 24 *NetShelter* racks, for a total of 432 racks per room. Each rack is capable of 6.5 kW for a total of 2808 kW of IT capacity per room, with 8424 kW worth of non-OCP IT capacity in aggregate. An OCP IT room consists of 14 pods housing 20 OCP V2 racks or equivalent racks with distributed UPS per rack combined with power supply unit (PSU) of the IT equipment. Each rack is capable of 10 kW for a total of 2800 kW of IT capacity. Combining all the OCP and standard IT rooms yield 11.2 MW worth of IT capacity in aggregate.

The IT rooms are designed to allow for pod-by-pod deployment since the supporting system and hot aisle containment is provisioned for each pod by the *HyperPod* containment system, allowing racks to be fully populated and rolled into place. Deploying *HyperPod* increases the cooling efficiency of the N+2 indirect air economizer units and provides a robust structural system to support busway distribution and network cabling, among other advantages. *HyperPod* extends the scalability of the total solution to meet, as close as possible, the variable business demand and occupation inside the IT space.

For both types of IT room, each rack is powered by having taps off (2N) redundant 400 A *Canalis KS* busway providing A and B-side power to each rack. Every standard IT rack is configured with two metered rack-mount power distribution unit (rPDU) to enable remote monitoring of the units for efficiency and capacity management, while OCP racks contain one OCP V2 rack PDUs for each power feed.

The security of the room is maintained at multiple points. At the rack level, access is controlled by a door lock and sensor. At the room level, security cameras are utilized for monitoring.

HyperPod Containment System



Design Options

This reference design can be modified as follows without a significant effect on the design's performance attributes:

- Change IT composition (OCP vs. Standard)
- Add environmental and security management
- Change rack options (tall, wide, deep)
- Change rack power distribution options
- Add *EcoStruxure IT Expert*

IT space attributes	Value
IT load (total – per room)	11.2 MW – 2.8 MW
Input voltage	400 V
Supply voltage to IT	230 V
Average density of traditional IT racks	6.5 kW/rack
Number of traditional IT racks	1296 racks
Traditional IT floor space (total – per room)	2468.1 m ² – 822.7 m ²
Average density of OCP IT racks	10 kW/rack
Number of OCP IT racks	280 racks
OCP IT floor space (total – per room)	646 m ²
Single or dual cord	Dual
CRAC/CRAH type	N/A
CRAC/CRAH redundancy	N/A
Containment type	Hot aisle

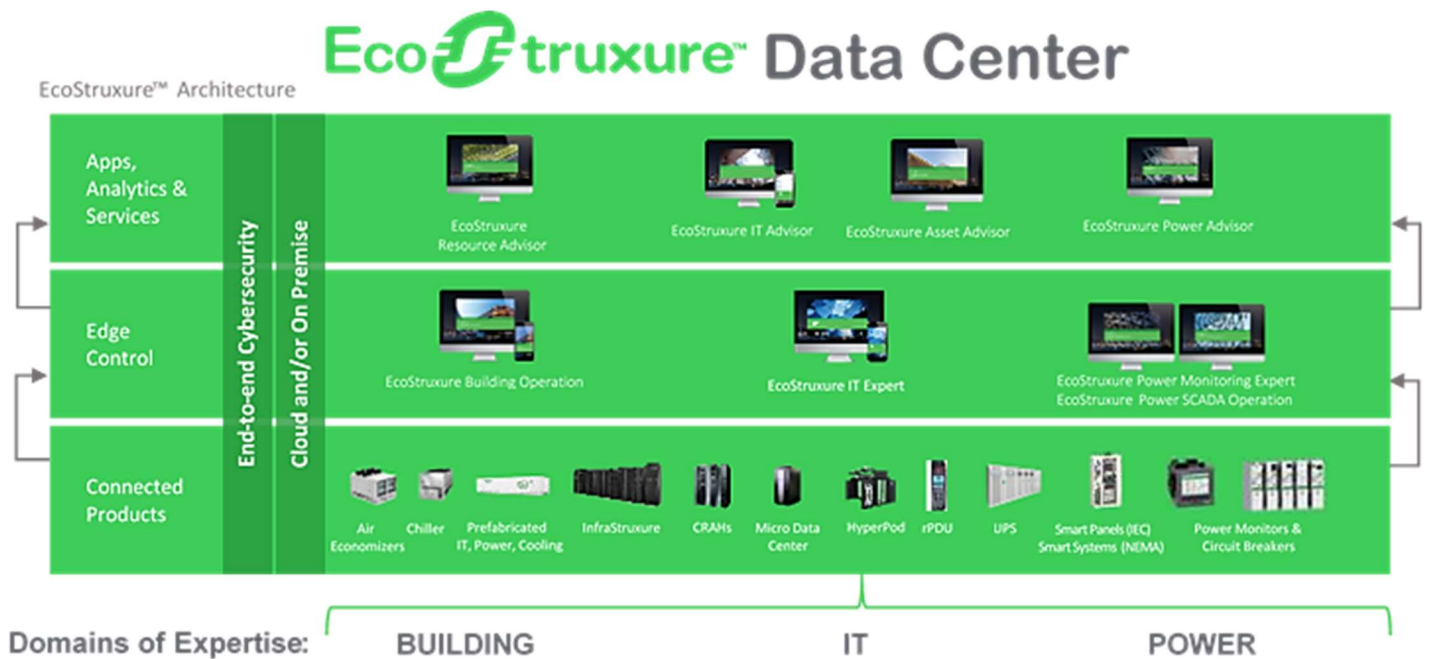
EcoStruxure Data Center

EcoStruxure™ is Schneider Electric's open, interoperable, integrated Internet of Things (IOT)-enabled system architecture and platform. *EcoStruxure* delivers enhanced value around safety, reliability, efficiency, sustainability, and connectivity for our customers. *EcoStruxure* leverages advancements in IoT, mobility, sensing, cloud, analytics, and cybersecurity to deliver Innovation at Every Level. It consists of three layers: connected products, edge control, and applications, analytics, and services. This includes Connected Products, Edge Control, and Apps, Analytics & Services. *EcoStruxure* has been deployed in 480,000+ sites, with the support of 20,000+ system integrators and developers, connecting over 1.6 million assets under management through 40+ digital services.

The connected products layer communicates with the edge control layer, which allows users to remotely monitor and control the connected products in real time. The edge control layer communicates with the application, analytics, and services, which will translate data into actionable intelligence and better business decisions. All three layers are secured with end-to-end cybersecurity. *EcoStruxure* can either be located on-premise (this will only consist of the connected products and edge control layers) or the cloud.

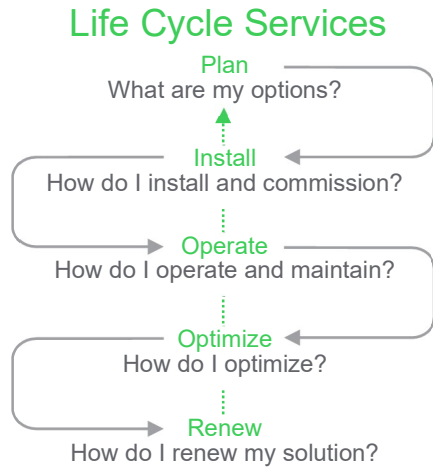
EcoStruxure Data Center is a combination of three domains of *EcoStruxure*: Power, Building, and IT. Each domain is focused on a subsystem of the data center: power, cooling, and IT. These three domains combined will reduce risks, increase efficiencies, and speed operations across the entire facility.

- *EcoStruxure Power* monitors power quality, generates alerts, while protecting and controlling the electrical distribution the electrical distribution system of the data center from the MV level to the LV level. It uses any device for monitoring and alerting, uses predictive analytics for increased safety, availability, and efficiency, while lowering maintenance costs.
- *EcoStruxure Building* controls cooling effectively while driving reliability, efficiency, and safety of building management, security, and fire systems. It performs data analytics on assets, energy use, and operational performance.
- *EcoStruxure IT* makes IT infrastructure more reliable and efficient while simplifying management by offering complete visibility, alerting and modelling tools. It receives data, generates alerts, predictive analytics, and system advice on any device to optimize availability and efficiency in the IT space.



Visit [EcoStruxure for Data Centers](#) for more details

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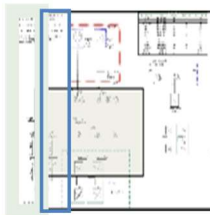
Get more information for this design:



Floor layouts



Bill of materials



One-line schematics

Engineering Package

Every reference design is built with technical documentation for engineers and project managers. This includes engineering schematics (CAD, PDF), floor layouts, and equipment lists containing all the components used in the design.

Documentation is available in multiple formats to suit the needs of both engineers and managers working on data centre projects.

Email referencedesigns@se.com to receive the Engineering Package for this design.

Design Attributes

Overview	Value	Unit
Annualized PUE at 100% Load	1.16	
Data centre overall space	10,875	m ²
Facility Power		
Total bus amps (Primary MV bus)	1250	A
Input voltage (MV bus)	11	kV
MV switchboard short-circuit interrupting rating	25	kA
MV generator capacity (N)	16	MW
MV generator redundancy	N+2	
Total amps (main LV bus)	2500	A
Input voltage (main LV bus)	400	V
LV switchboard short-circuit interrupting rating	42	kA
Power path	Dual	
IT space UPS capacity – standard IT (N)	3000	kW
IT space UPS redundancy – standard IT	Tri-redundant	
IT space UPS runtime at rated load – standard IT	5	minutes
Facility cooling UPS capacity	N/A	kW
Facility cooling UPS redundancy	N/A	
Facility cooling UPS runtime at rated load	N/A	minutes
Facility Cooling		
Total cooling capacity (N)	12,000	kW
Input voltage	400	V
Heat rejection medium	Air, water, and/or R-410a depending on conditions	
Supply air temperature	24	°C
Return air temperature	36	°C
Mechanical redundancy per IT room	N+2 at section level	
Outdoor heat exchange	Indirect evaporative cooling	
Storage tank size	106	m ³
Ride through time	12	hours
Economizer type	Air-to-air and indirect evaporative	

IT Space		
IT load (total – per room)	11.2 – 2.8	MW
Input voltage	400	V
Supply voltage to IT	230	V
Average density of standard IT racks	6.5	kW/rack
Number of standard IT racks	1296	Racks
Average density of OCP IT racks	10	kW/rack
Number of OCP IT racks	280	racks
IT floor space	3114	m ²
Single or dual cord	Dual	
Heat rejection medium	Indirect evaporative	
CRAC/CRAH type	None	
CRAC/CRAH redundancy	None	
Containment type	Hot aisle	