IBM and the Data Centre

IBM is the largest occupier of data centre space in the world and currently owns or occupies approximately one million square metres globally.

IBM also builds more data centres than any other company and invests heavily in research and development to retain its position as a global leader in data centre research, design and implementation.

IBM has a dedicated business unit focused on data centre best practices and standards and has earmarked in excess of US$ 1 billion towards the Global Green Data Centre Initiative.

The new IBM Data Centre in Auckland incorporates the latest in IBM Green Data Centre design and will deliver a world class facility for New Zealand and enable IBM to position New Zealand as a viable offshore alternative for clients in the Asia Pacific region.

Scale

The 5,200m² facility will include 1500m² of net usable of column-free raised floor, with a repeatable modular design and expansion options allowing for further stages of the same scale to be developed to meet an estimated 15 years' demand i.e. each stage will provide 1500m² of net usable raised floor.

This will provide customers with greater long-term certainty in managing their future IT needs.

- 1500m² raised floor area has capacity for about 720 racks
- 26km of mains cables plus sub circuit
- 54 tonnes of switchboard requiring 100,000 man hours to produce
- 25 tonnes of copper in the switchboards
- 1.4km of air conditioning pipe work
- The 4 generators could provide enough power to supply 266 homes

Sustainability

Globally, IBM's data centres are characterised by energy efficiency, green technologies, scalability and the latest power and cooling technologies.

IBM's vision for its New Zealand data centre was to deliver a highly efficient facility while minimising its environmental impacts. To achieve these goals, IBM partnered with Schneider Electric, a world leader in energy management, to design and deliver a highly customised facility.

Specifically, the following standards apply to all 5,200m² of the Highbrook facility:

- Targeted Building green star rating of 4 stars
- Targeted Office green star rating of 5 stars
- Targeted Data Centre Green Grid Level 2
- Maximum annual average Power Usage Effectiveness (PUE) rating of 1.6

Resiliency

The Auckland IBM Data Centre is an IBM Reliability Level 3+ Data Centre, one of the highest levels of reliability available in data centres. The IBM rating system is a global recognised rating to worldwide standards for multi-tenanted data centres.

Located at Highbrook Business Park, the IBM Data Centre is situated on a low risk site 30+ metres above sea level, outside the Auckland Volcanic Field and in a low seismic risk area.

While offering dual site access for power and communications entry points, the IBM Data Centre avoids reliance upon Auckland's mains power supply through the use of a series of generators providing a reliable secondary power source. These generators are capable of providing power to supply 266 homes.

Key resiliency features are:

- Electrical - 2 levels of redundancy from mains power, 2 levels of redundancy from UPS power and multiple levels of redundancy from generator power
- Mechanical – central chilled water plant, advanced air conditioning, fire services
- Environmental – flood, fire and earthquake protection
- Security - dedicated staging room, CRAC units outside of the RFM.

Security

Situated on a secured site with just one boundary with an adjoining neighbour, the IBM Data Centre building is set back a minimum of 10 metres and incorporates controlled access points for visitors, IT support, facilities maintenance and deliveries.

There is a dedicated security control room within the building, resourced 24/7 and supporting IBM's CAS access and monitoring system, which includes:

- Three forms of access into RFM
- IP Based CCTV with storage for 90 days
- Intercom at entry points
- Master key system throughout
- Alarm monitoring
- Biometric screening
- Vehicle control points

Cloud Enablement

Built to IBM global cloud architecture specifications, the IBM Data Centre is enabled for virtualisation, auto provisioning, metering and billing and integrated service management.

- Two diverse communications lead in services
- Dedicated dual MDFs
- Provision for roof top communications systems
- Direct access to MDFs for Telco's outside of RFM

Energy Efficiency Design Components

Pre Cooling of Air Supply

As mains water is supplied to site via underground pipes its temperature is usually 16-17 degrees, the water is then pumped through cooling coils on the Air Handling Units (AHU's) that provide outside air to the utilities rooms and the data hall pressurisation system. The effect is 'free water side cooling' that reduces the load on the chilled water system in summer and tempered air heating in winter.

Centralised Dehumidification / Humidification

In traditional decentralised systems i.e. each Computer Room Air Conditioning (CRAC) unit undertakes its own humidification and dehumidification. This usually results in a significant amount of wasted energy as adjacent and opposite CRAC units fight each other. This is normally referred to as control hunting.

At the IBM Data Centre the humidification and dehumidification processes have been centralised into the data hall incoming fresh air system, leaving the CRAC units to undertake temperature control only. The central plant type air treatment process was able to incorporate two high efficiency ultrasonic humidifiers rather than twelve smaller decentralised units.

Elimination of non IT heat sources

The data hall has been constructed as a "box within a box" utilising metal encased fire rated insulation panels. These provide a high level of tightness, insulation and coupled with the extensive building vapour barrier results in a highly efficient building envelope that reduces the potential for energy loss and gains.

Computer Room Air Conditioners (CRACs)

Large capacity high efficiency CRAC units have been utilised to obtain optimum system efficiency. The CRAC unit fan boxes, incorporating EC variable speed fans, are located in the floor void beneath each CRAC unit. In conjunction with this, perforated plate barriers have been installed to eliminate potential velocity pressure issues at the data hall floor grilles. Computational Fluid Dynamic (CFD) modelling has been undertaken to achieve the optimum outcome.

All CRAC units in the data hall, including allowance for redundancy (N+20%), operate simultaneously with the load spread across all units to achieve the highest operating

efficiency. The CRAC unit fans will automatically speed up to compensate for loss of floor void pressure of if a CRAC unit stops operating due to a critical fault condition.

The air flow is managed via the perforated floor tiles which are also fitted with dampers to close off air supply to areas either not in use or not requiring cooling. The dampers also have the ability to reduce the volume of air flow to suit the rack cooling requirements and eliminated wastage of cool air.

Energy efficiency analysis did not just look at the power but also the latent heat a CRAC produces, the selection required CRAC manufacturers to provide coils that match our chilled water temperatures and provided the highest sensible to total cooling ratios in order to minimise the wasteful latent cooling load.

Battery Room Temperature Control

As battery rooms are required to be maintained at a consistent temperature all year round, the rooms are well insulated to reduce solar heat gains / losses and reduce energy costs. Hot air from the UPS room is used to provide free heating.

Data Hall Lighting

The data hall lighting system is fully automated to only turn on those rows where required. Rows or lights are switched on automatically and remain on while movement is detected but rather then turn on all lights only the row where activity is sensed plus one row either side is activated. Thus the data hall remains a lights out environment for the majority of the time reducing the area to being lit Thus saving energy and improving the life of fittings.

Data Hall Return Air

A common problem with most data halls is the return air path and the mixing of air to spread the load evenly over the CRACs. At the IBM Data Centre our return air is drawn back to the CRACs into mixing chambers on either side of the hall turning the air twice through 90 degrees before dumping the air into the Mechanical services passage way and back to the CRACs.

This removes the possibility of one or more CRACs receiving a disproportionate amount of the hot air from high heat sources. Thus CRACs working together share the load, rather than one unit running at 100% and other at 10% thus reducing any wasted energy from CRACs with none or little load.

Rain Water Harvesting

While not a new concept, rain water harvesting usually means installing tanks at high capital cost. However we have reduced the capital cost by over-sizing the underground pipework collection system, into which the roof rainwater down pipes discharge, and using this as the storage system in lieu of a tank.
The rainwater is used as a first priority water supply for the Cooling tower make-up.

Water Side Economiser

Water side economisers are normally found only in colder climate locations. At Auckland Data Centre we have engineered a water side economiser, based on higher chilled water flow and return temperatures that is able to leverage the wider range of temperatures experienced locally.

Monitoring the outside air conditions chilled water can be diverted through plate exchangers connected to each cooling tower to provide total free cooling for the entire site or partial free cooling in tandem with mechanical Chillers. This type of operation is known as 'extended mode' free cooling and is able to provide free cooling at higher outside air temperatures. This significantly increases the number of hours per year when free cooling can be utilised.

Variable Speed Drive units (VSDs)

All pumps and fans are controlled via VSDs to minimise the energy consumption during start up and at operating speeds. Operating speeds are regulated to ensure the output is always at the required power eliminating excess energy consumption.

Support and Office Areas

Not even the small load areas have escaped the energy revolution. A holistic view of the site support and office area energy efficiency ensured there are best of breed engineered solutions throughout from solar hot water to double glazed exteriors and wide over hanging awnings to prevent thermal gain from the sun. Office lights are automatically controlled in 100sqm zones (there are no light switches.)

Monitoring and Metering

To design energy efficient systems is only the first step. Monitoring, measuring and reporting their performance enables the FM team to maintain the design intent and the performance.

The IBM Data Centre's Building Monitoring and Control System (BMCS) is the most comprehensive, centralised data analyser in the NZ data centre industry.

The BMCS has been integrated into all services from measuring the power input at the supply authority to the consumption of power at the circuits supplying the racks; the water onto the site through to the discharge into the sewer; fuel delivered to site and used by the generators. All energy is measured and metered 24/7 in real time.

The BMCS trends the performance and history allowing the Facilities Manager to identify when a system is no longer performing correctly and or efficiently. The energy efficiency of a site is only as good as the team maintaining the design, monitoring the performance, making the adjustments and ensuring the plant is well maintained.