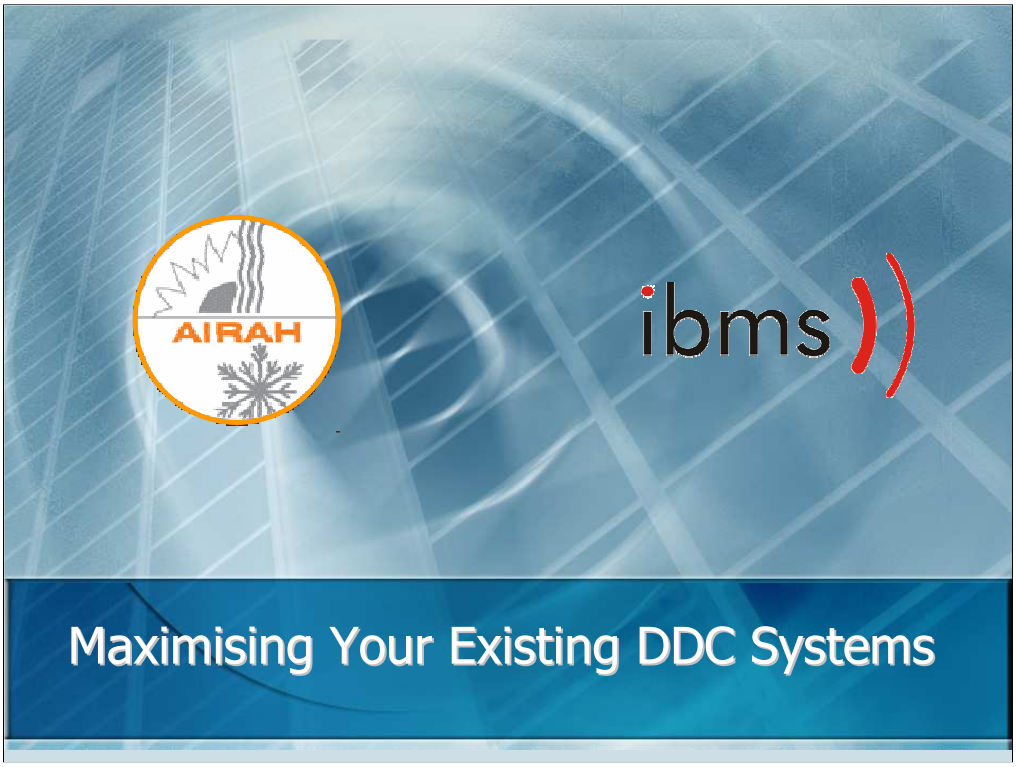

Maximising Your Existing DDC Systems

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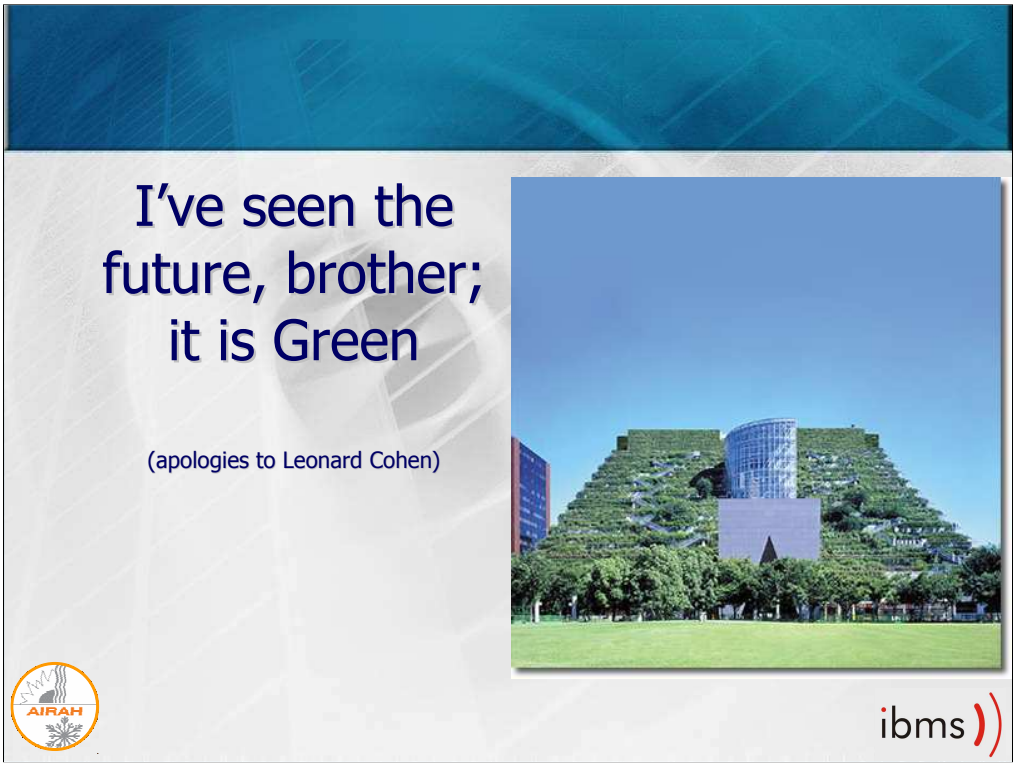
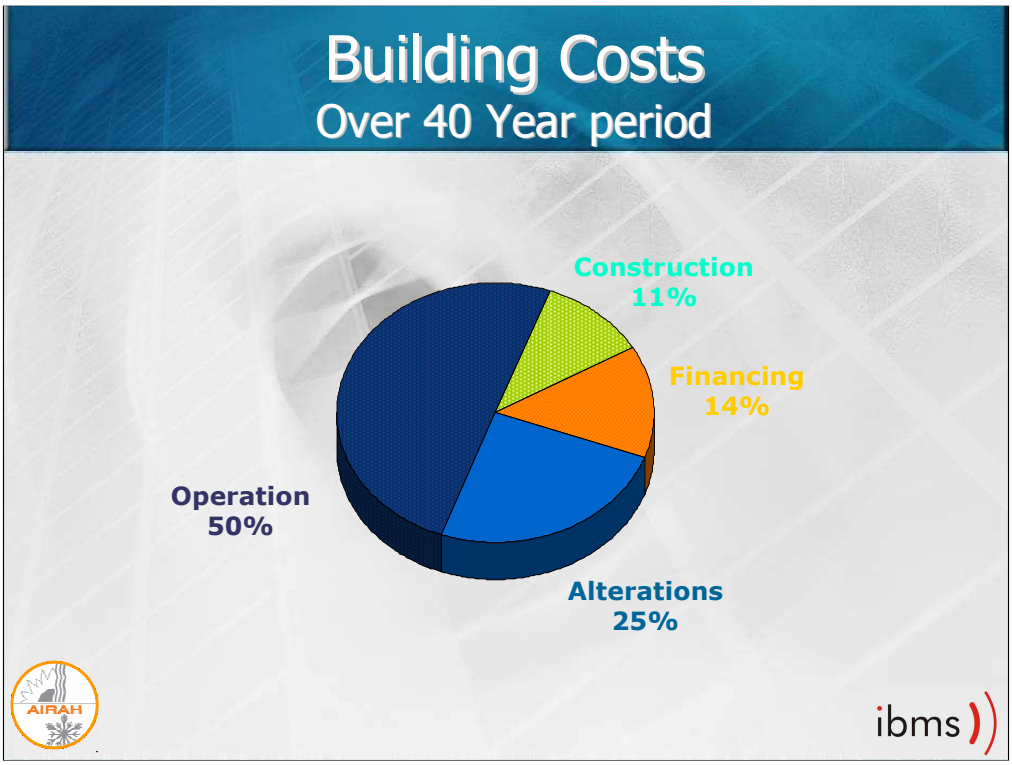


So why should we worry about existing DDC systems in current buildings? Aren't they running OK?
If they aren't broken don't touch them – it will only cause more problems.
And with commercial vacancy rates running at 1% the tenants will just have to put up with what they've got right.
Well the competition is coming out of the ground fast.

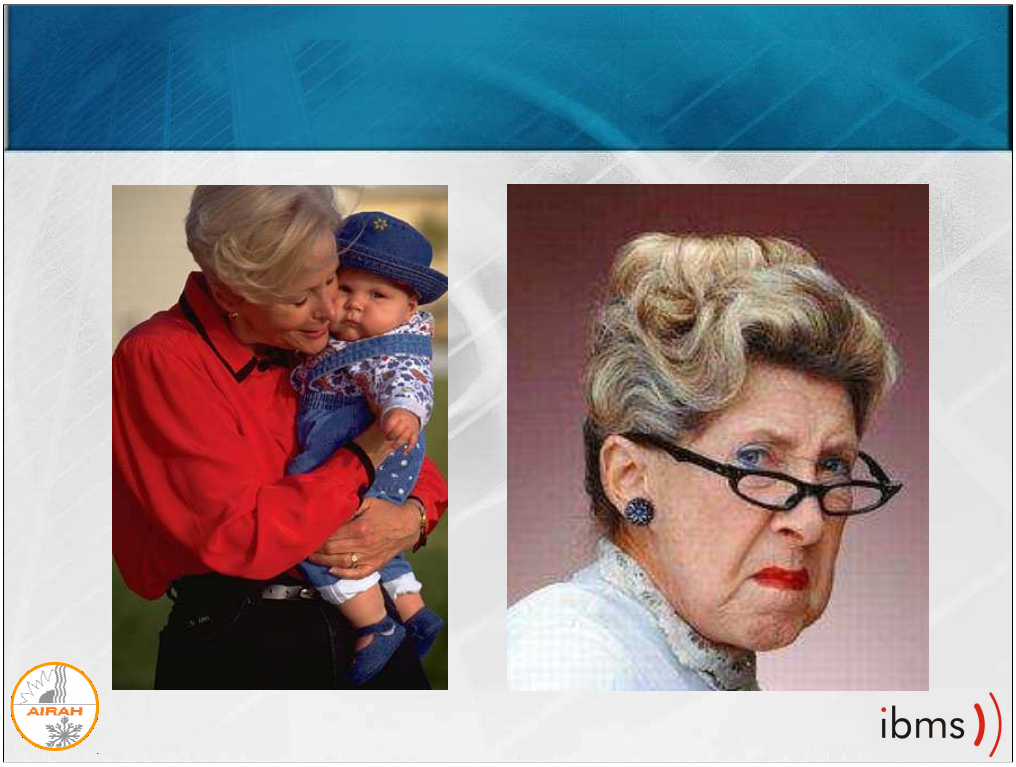
Quotes from the recent Green Cities conference held in Sydney in February this year organised by Green Building Council.

Over 800 attendees from the property and construction industry.



Whilst DDC systems only makes up a small proportion of the total construction costs, they can have a disproportionately large impact on the efficiency and operating costs of any facility.

And it is in operations where the big costs of running a building are.



Control systems are analogous to the human body in the way they work.

•They have eyes and ears to measure the environment (sensors)

•They have arms and legs to carry out actions (actuators and motors)

•They have a brain to figure out what to do based on what they sense (microprocessors and control strategies)

Electronics changes rapidly - the age of electronics should be measured in dog years. So if your DDC system is 10 years old its really 70 years old

So you should think of the DDC system in an existing building like your grandmother

•Not a nice grandmother that fed you lollies and bought you great presents

•More like the nasty grandmother – cantankerous, stuck in her ways and not very co-operative but still sharp as a tack.

But like many old people, her eyesight and her hearing are failing so she misunderstands a lot of what is going on.

In looking around existing buildings – sensors are the items that fail often and these can have a big impact on the performance of the DDC system. Some exam

•Older humidity sensors were unreliable – so many people stopped using them in economy cycles. Newer sensors with capacitive sensing and replaceable heads are more reliable and can be easily serviced

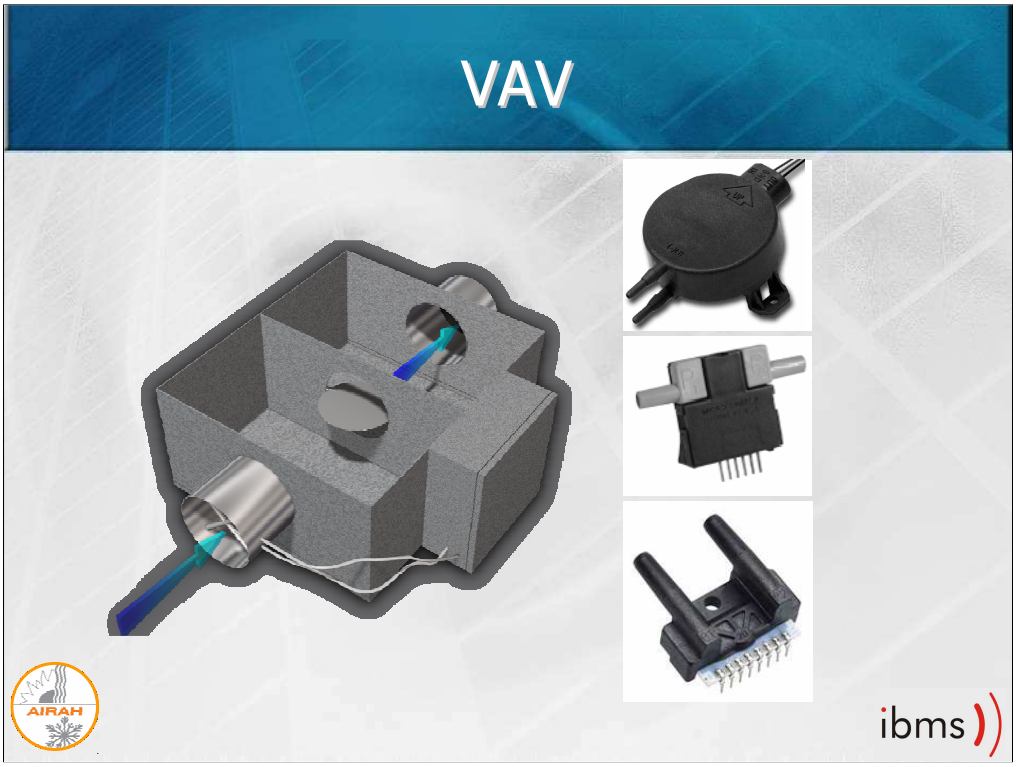
•A faulty paddle wheel flow sensor was used to stage chillers even though the return sensor was reading more than the supply sensor. (The building was making its own chilled water somewhere!)

•CO Sensors based on electrochemical technologies that can be poisoned by other chemicals and deliver false readings forcing exhaust fans to run continuously.

Often faulty sensors are just taken out of the control loop and the point placed in test. Then you have a complete control sequence that is not operating correctly. Result – no energy efficiency and additional running costs.

Modern sensing technology has advanced greatly in the last ten years. Higher quality sensors, improved technologies and lower prices. These can be easily added to existing DDC systems.

Also look at implementing diagnostic checks and redundancy routines for critical loops.



The airflow sensor is the most critical part of a pressure independent VAV controller. This little $10 sensor can affect the operation of the whole air-conditioning system in a building.

We have surveyed a number of existing DDC control systems in buildings across Australia in the last 2 years and everyone with VAVs has some problem with the VAV operation. In many cases more than 50% of the VAVs are reading incorrectly through sensor degradation or incorrect calibration parameters being entered into the controller.

The result is typically increased airflow, calling for higher fan speeds and increased cooling requirements. This also leads to problems and complaints on the floor including drafts, noise and loss of conditions.

What can be done.

•Check the airflow being delivered by the AHU against the original commissioning figures

•Check the airflows that individual VAVs are delivering with a comparison with a micromanometer in parallel with the airflow probe.

•Use the DDC system to monitor the IGV position or VSD speeds over time, if there is an increasing trend you have a problem.

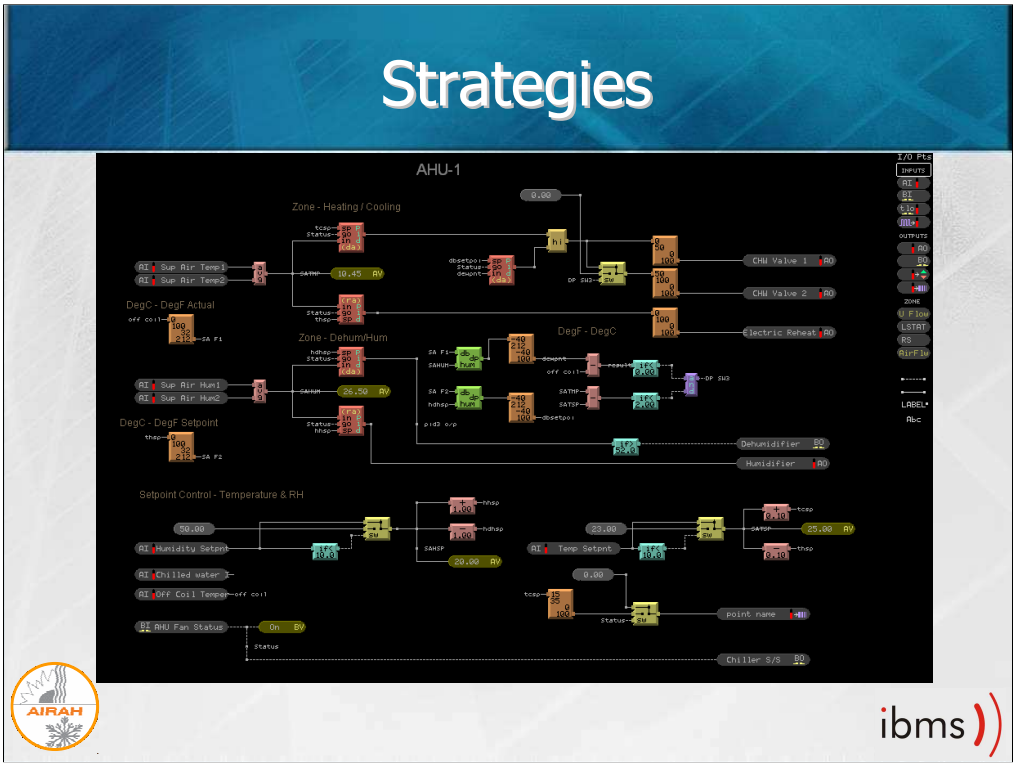
Corrective Actions

•Talk to the service provider about the ability to recalibrate the airflow sensor and/or replace the sensor

•Have a plan to keep spare stock of refurbished units.

•Confirm with the supplier how long they will support the current models (many are already obsolete). Over 15 years of product development I was personally involved with the release of 7 different models of VAVs for a major controls company. That's how quick the technology evolves. Many older VAVs are no longer supported by the original manufacturer.

•If your VAVs are 10 years old or more need to plan to upgrade the system to an open technology based system (LON or BACnet)



Grandma might have a few antiquated ideas. Ten years ago the main focus of the control strategies was to provide comfort conditions with energy efficiency a secondary issue. Methods of control have moved from focussing on comfort to providing more energy efficient operations

There are many opportunities to improve the energy efficiency and reduce costs in your building by addressing the control strategies in your DDC system.

A good place to start in your review is to

•Before making major changes, you need to understand the design intent and think about the impact that a change might have. Don't forget that there have been changes to various codes (e.g. AS1668 regarding fresh air quantities). In some cases, the physical arrangement of the plant will affect the types of control strategies you can apply

•Review and understand all of the major control loops in the building.

•Check for sensors that have failed or may have been disconnected. It is likely that the associated control strategy is being held in a fixed position because a value is in test/manual.

In some cases the control strategy may not have been completely implemented.

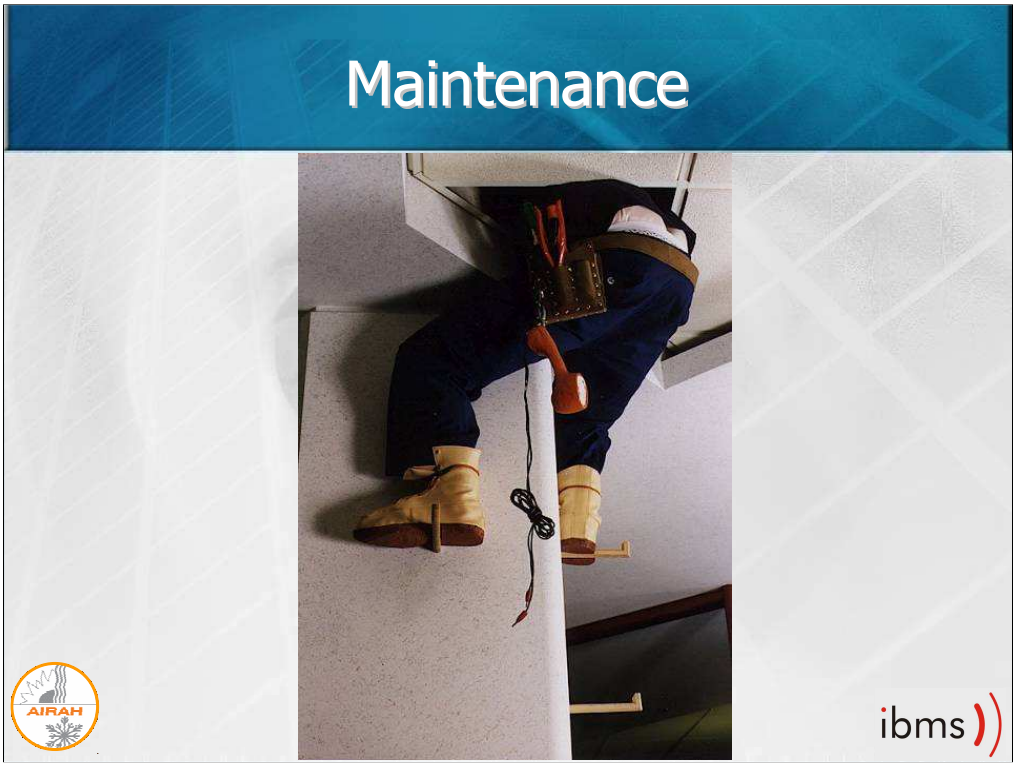
As an example, a 4000sq.m building in Perth had air conditioning costs of $66/sq.m vs $18-$22/sq.m for similar buildings. In this case the VAV control strategy was not linked to the AHU control strategy. The AHU was left to run on a fixed supply air setpoint so the CHW valve was at 100%. Similarly there was no connection from the AHU strategy to the chiller plant strategy so the chillers would start on a time schedule. Once the lead chiller achieved status, the lag chiller started. The result – over $100,000 p.a in electrical demand charges alone.

Another issue to consider is metering. It is important to measure the performance of your building to check the effectiveness of changes you are making.

Ensure you are correctly measuring all utility consumption (electricity, gas, water and diesel consumption). This is particularly important if your using your DDC system to do this. Be wary of pulse inputs to DDC systems that can have a number of issues.

Many electrical meters can now be directly networked to DDC head-ends and reporting packages without the need to use pulse inputs.

When considering the placement of meters it is worth following the guidelines set down in ABGR and Green Star. This will ensure that you are collecting the right data for ABGR audits in the future. Green Star gives a good guideline for the quantity of meters needed in a typical building.



Engage your maintenance providers. You don't want this to be the only view of your maintenance provider all the time!

Typical maintenance contracts we see are based on pneumatic systems and involve lots of calibrating temperature sensors in the space and maybe involve cleaning the screen and keyboard.

Prices have been squeezed down as well so less work is being carried out. This has been partly in response to the perceived reliability of electronic systems but it neglects many of the hidden issues.

Need to move the service away form calibrating temperature sensors and checking actuators. The checking and calibration of temperature sensors should be limited to those associated with critical control loops. The remaining checking of temperature sensors and actuators could be carried out by the regular mechanical maintenance provider.

Instead use the controls maintenance budgets to engage skilled people who can help set up the DDC to provide better reporting and diagnosis. Ensure that critical loops are being trended and review tuning issues. Set up alarms for deviations from typical control conditions (e.g. increasing speed on a VSD output to maintain static pressure or increasing energy consumption for similar degree day conditions)

Case Studies



A few examples of the results that can be achieved by applying improved energy efficient strategies to buildings with existing DDC systems.

•Woodside Plaza – air conditioning costs reduced from $28/sq.m to the average figure for premium commercial buildings.

•Southgate Melbourne - reduced energy consumption costs for the two towers by $250,000 or more than 10% in 10 months.

•Westralia Square – already quite an efficient building but still able to achieve a reduction in air-conditioning consumption of 10% in 12 months.

Some of the actions taken

-Lowered Static Pressure Setpoints to suit operation of VAVs

-Reimplemented Economy Cycles including humidity control

-Varied supply air temperature based on seasons

-Used a floating chilled water setpoint based on ambient temperature

-Removed IGVs that had remained in-situ after VSDs were installed.

-Standardised supply air and VAV master setpoints across the buildings. (A large variation had occurred over time)

-Applied seasonal lockouts on electric duct heaters and boilers

-Rationalised plant operation times so that central plant was not running excessively.

-Winter lockout of chillers