FACILITIES MANAGEMENT

BEST PRACTICE AND COMPLIANCE FOR FACILITIES PROFESSIONALS

The mother of reinvention

Jackie Le Poidevin looks at how intelligent building controls are being introduced in Dubai to cut energy consumption, improve public safety and enhance the usability of the city's landmark structures.

If anywhere can reinvent itself, Dubai can. Where once was desert, the world's tallest building is taking shape. Where once was sea, the first of three palm-shaped islands extends, its fronds laden with luxury villas. Where once was dry land, canals now wind, complete with mock-Venetian bridges and electric-powered gondolas.

But Dubai's latest ambition – to build sustainably – seems to require a stretch of the imagination too far. This is a city where the hotels, offices and malls not only have fierce air conditioning but there are an indoor ice rink and a real-snow ski slope to keep frozen when it is over 40°C outside. A city where the existing airport, with its new, 26-gate third terminal, will seem provincial in scale compared with the seven-runway, nine-terminal new airport – the world's biggest – being planned on the other side of the emirate. As for getting between these monumental buildings, this is a city addicted to cheap petrol and free valet parking, where even widening the main Sheikh Zayed Road to six lanes in each direction has failed to prevent traffic jams for much of the day.

However, with neighbouring Abu Dhabi planning to build a zero-carbon city, Masdar, the pressure is on energy-guzzling Dubai to clean up its act. A metro system is in progress, air-conditioned bus shelters are being built, and a green building-rating system has been introduced, modelled on the US Green Building Council's Leadership in Energy and Environmental Design (LEED) programme.

TOMORROW'S TECHNOLOGY
For a glimpse of how Dubai could be transformed into a sustainable city, you need to visit its Techno Park. This is an area which is relatively undeveloped at the moment, but where one end of an 80km manmade canal is now being dug and where the Palm Jebel Ali, the second of Dubai's artificial islands, accommodating more than 500,000 people, will take root. Compared with Dubai's landmark towers, the five-storey building you find here may look unremarkable, but in terms of energy efficiency, it breaks new ground in the region. The Pacific Control Systems' head office is the first building in the Middle East – and only the 16th in the world – to receive a platinum rating under LEED after notching up 55 points. Even before its inauguration in October 2007, the 200,000 sq ft headquarters

had won three awards, including the world's "best intelligent building" at a US building and facilities management event.

The building incorporates an energy-efficient 100-ton air-conditioning system, using a solar-powered vapour-absorption chiller and low-energy screw chillers. Acting in conjunction with the thermally efficient building shell, this system has led to an estimated reduction in the building's fuel consumption of 40–50%.

In addition, roof-mounted photovoltaic solar panels connected to six intelligent inverters convert sunlight into sufficient electricity to power the lighting system. The system's energy efficiency is enhanced by the extensive use of passive infra-red detectors on every floor, which activate the lighting only when it is needed.

All the building's waste water is collected and stored in an underground tank, before being treated and used to irrigate the palms and other native plants surrounding the site. Other environmental features include: the application of measures to reduce soil erosion; the use of materials with a high recycled content; variable-speed drives for fans and pumps; low volatile organic compounds in carpets, adhesives, sealants and paints; and the use of eco-friendly housekeeping chemicals.

The building cost was up to 30% more than that of a traditional design but the cost of maintaining it over a 20-year period is expected to be 50% less. According to Nigel McKenzie, Pacific Controls' chief technology officer, the payback period for the solar panels was predicted to be 25 years, but with electricity prices rising, the company now expects to achieve a quicker return on investment.

What really sets this building apart, though, is its IP (internet protocol) enabled automation system, which allows all the building equipment and systems, including air conditioning, access controls, CCTV, fire alarms, audio-visual equipment, chillers and lighting, to be integrated and controlled from one central point. The system, powered by Tridium's Niagara Framework, allows energy consumption to be monitored and tracked in real time, enabling energy use to be optimised, targeted consumption levels and maintenance costs to be achieved and system reliability to be maximised.

Terry Casey, Tridium's president, explains that: "You can start sharing information on screen on all these systems, and different people can get this data served up in the form that is most appropriate for their needs."

As well as using this system to track and reduce its own carbon emissions, Pacific Control Systems has two command and control rooms in the building which

allow it to monitor the assets of clients who share the same technology around the clock. Both rooms have an entire wall of screens, one showing energy-management data from clients' buildings around the world; the other reserved for the Dubai Civil Defence, a government department responsible for protecting the emirate's inhabitants and buildings. Although the rooms look identical and the technology is the same, the applications are quite different and serve to show the breadth of what can be achieved when diverse devices within a building, regardless of manufacturer or communication protocol, can all be controlled using the same software.

ENERGY MONITORING
In the global energy-services centre, the operators can manipulate and present the data gathered in a wide variety of ways. Using Pacific Control Systems' own building as an example, they can:

- compare real-time and historical data and look at deviations in energy consumption compared with previous months;
- check whether the solar panels are operating at their full capacity and what proportion of the building's energy they are generating;
- gather data on the efficiency of the wind turbine being tested on-site;
- see how much energy is being used in different areas of the building;
- monitor varying consumption levels throughout the day;
- extract the data most relevant to the facilities manager, chief financial officer or other personnel;
- compare actual carbon emissions against target levels;
- monitor standards of indoor air quality – including humidity and carbon-dioxide concentrations – and ventilate each area in line with changing occupancy levels; and
- benchmark the building against other buildings.

Casey explains: "You can look at occupancy rates, climates around the building, meteorological data – and you can pump that data out of the building into a sophisticated energy-analysis package so you can understand how the building is behaving over time and how that building is behaving compared to its peer group."

Another application is providing accurate information for planned maintenance. "Computerised planned maintenance is a fairly common idea, but it's seldom linked to real things going on in the building," Casey argues. "It's rare for that to be fed with real data, so you don't know whether your pump has pumped for 2,000 hours; you tend to maintain it because it's 3 March."

The system can also generate reports that go out to customers on a daily or monthly basis. Pacific Control Systems can export graphs and charts, draw up energy-

management recommendations, and summarise the cost and potential savings if the customer implements those recommendations. For example, the system showed that the four chiller units on one client's building were not running equally, which would create life-cycle issues in the future – a problem that has now been rectified.

"You can work out if the chillers are running at the right levels, work out if they're overdoing it. If you can run that chiller just strongly enough so it's meeting the main demand, you're going to get a lot more efficient plant," Casey says. "These systems allow you to run a building as well as it was designed to be run."

CIVIL DEFENCE
Within the next five years, every building in Dubai used by the public will be required to have an alarm system installed that will be connected to a central command and control centre via the Pacific Control Systems and Tridium e-monitoring technology. A thousand buildings a month are being retrofitted with the technology or, in the case of new builds, having

SCREEN SHOTS OF SAMPLE ALARM AND ENGINEERING DASHBOARDS
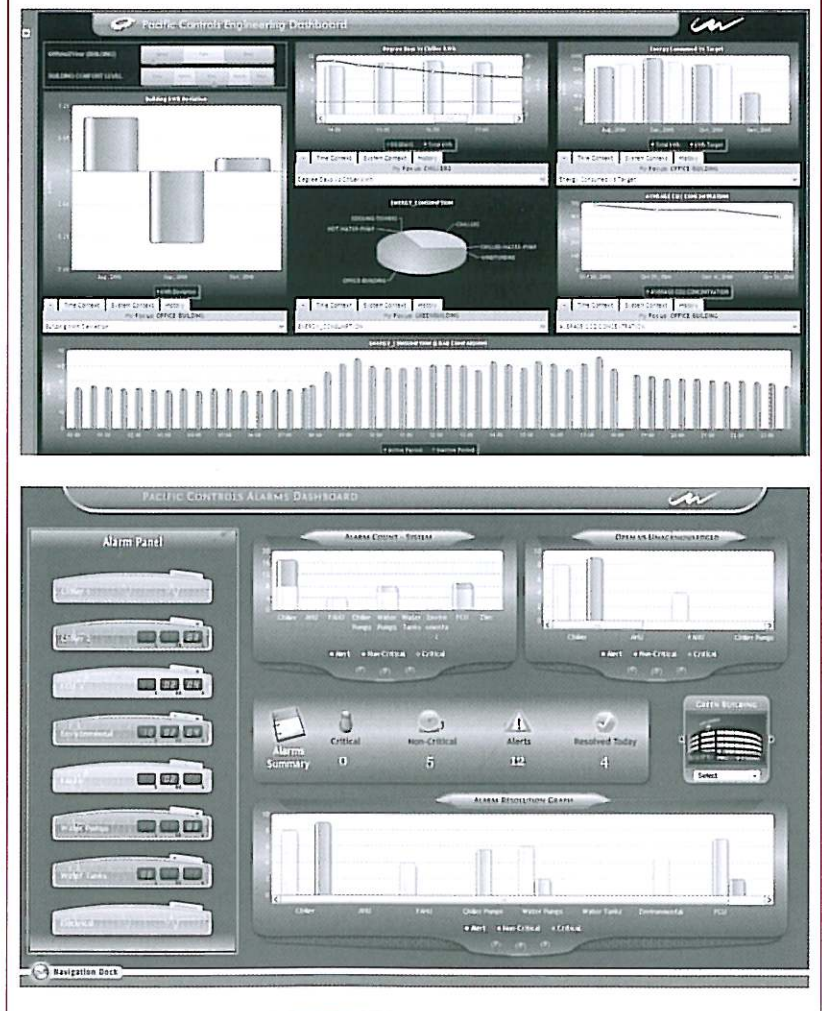
it installed before they can be occupied. The second command and control centre at the Pacific Control Systems headquarters is being used to monitor the buildings that are already online. However, 60,000 buildings will be included in the project overall, and a new "crisis and disaster centre" is therefore being constructed next to Dubai Civil Defence, which the government will own but where Pacific Control Systems will continue to host the service. In addition, the city will be divided into four zones, each with its own small command centre. "If there is a problem at the main centre, one of the others can take over," explains Major General Rashid Thani Al Matroushi, director of Dubai Civil Defence.

The system allows fire and elevator alarms, pumps and other equipment to be monitored 24/7 in real time via the internet. The screens in the control room can show:

- maps displaying the location of any alarm and allowing the location and speed of emergency vehicles to be tracked;
- details of the building that is the source of the alarm, such as entrances and exits or the nearest water-supply points;
- which operator will deal with the next alarm that comes in;
- historical data such as how many alarms there have been over a given period; and
- analyses of performance in responding to alarms against targets.

To verify whether an alarm is genuine, the control-room operators will first try to call the site manager, but they can also see which zone of the building the alarm is in and then access images from that zone's CCTV cameras. The system can also send a map to the civil defence vehicle attending the emergency, and automatically schedule testing of firefighting equipment.

MEYDAN: A "SMART" CITY
One of the largest-scale installations of this smart technology will be in Meydan, a development in Dubai consisting of four areas – a racing district, business park, Meydan City and Meydan Godolphin River City. The only part under construction at the moment is the grandstand – although this is a vast development in itself, capable of seating 60,000 people – with its associated buildings and grounds, including a hotel, 10 restaurants, a racing museum and parking for 10,000 cars, which will be shaded by a roof covered with solar panels. The hotel will be ready for opening by early 2009, while the rest of the racecourse development has to be completed by March 2010 in time for the Dubai World Cup, described as the world's richest horse race.

Other landmark buildings will be a 1.4km-long mall stretching along a canal running from Dubai Creek; and the Godolphin Gateway Tower, a 40-storey building with a cutaway section in the shape of a horse's head through which the canal will flow. There will be around 150 high-rise towers on the development, a similar number to Dubai's existing marina, but according to Terry Casey, "the difference is the desire to run Meydan as a single entity". To this end, Wassim Hamwi, Meydan LLC's chief information officer, is working with Pacific Control Systems to create a converged infrastructure for building services in the racing district, using Tridium's technology, with the ambition to extend this infrastructure throughout the entire development as the project progresses.

"I'm learning how to build a new green, intelligent and energy-aware city, where technology is used to reduce the impact of our projects on the environment, ease the usability of services, and enhance the lifestyle of the people who will live, work and entertain at Meydan," says Hamwi. "The objective for us is to unlock the potential of different technology products and make them work together to create a unique ecosystem."

Nigel McKenzie identifies three benefits from having an integrated system for operating Meydan's buildings:

- lifestyle – instead of having different controls with different finishes throughout the building, the occupier uses a multi-function device to control the lights, thermostat, alarms, entry phone and so on;
- sustainability – metering systems enable occupiers to measure their energy consumption and carbon footprint, and gain an insight into their usage patterns; and
- facilities management provision – information can be presented and served up for viewing, access and use over the internet, enabling an external facilities management provider to analyse energy use, plan maintenance schedules, check utility bills, optimise chiller operation and comply with legislation such as *legionella* regulations.

"Developers are reluctant to invest in something just as a lifestyle feature", McKenzie explains, "but they like the whole package." One particular benefit is that when the building is all controlled on one system, sophisticated rules can be developed to run the premises. For example, in the event of a fire, actions can be automatically triggered in the ventilation system, emergency lighting and signage, lifts and CCTV.

Hamwi suggests that developers are usually only "interested in getting the building up and looking good but they won't look at the service of the building going forward, they will not spend time saying, 'how can we reduce the cost of operations for the client?' So the client is stuck with something complex, expensive to run and very difficult to maintain – a lot of hands need to be there get the job done." However, now that the market in Dubai is becoming more competitive, he claims developers "have learnt they cannot just build a building" and then expect occupiers to pay high service charges. "We will be able to reduce that service charge by reducing the manpower, by improving the collection of data, having things linked together, so you don't have to have so many people watching so many different systems in silos to make sure they are operating well."

Hamwi describes how he has gone about putting the business case for Meydan's converged building infrastructure to clients: "We said, 'Do you want to have a better, more efficient, cheaper building to run? Yes, we may increase the capex [capital expenditure] upfront but we can guarantee that for the next 30 years, your opex [operating expenditure] will be less.' So instead of having a building management system in every one of those 150 towers, we will have one centralised location to monitor all those buildings."

His aim, Hamwi says, is to "future proof" Meydan, although "we are just providing the technology; businesses will have to decide how to use it." So, for example, if the whole development is on a single IP telephony network, you could ring up and order a pizza and the company would be able to see your identity and location without having to ask. "It's easy to do if you have the right infrastructure in place," he explains.

McKenzie concurs. "You can't define a need and then meet it; you need systems that adapt to future need."

Other planned features include district cooling and what Hamwi claims will be a "green data centre" to avoid companies having to waste valuable space on a server room in their own building. Recycled grey water will be used to water the grass on the racetrack and golf course; and for the water supply to the buildings, a test is being carried out in the desert to drill down for salt water for desalination, using solar-powered pumps to bring it to the surface.

INSTALLATIONS BIG AND SMALL
Dilip Rahulan, Pacific Control Systems' chairman and chief executive, can list a huge range of projects in Dubai that his company is involved in. The new airport terminal – which, unlike Heathrow's Terminal 5, opened without a hitch – also uses Tridium's technology, so that one framework controls everything from the security systems to managing the terminal to ensure it operates as energy efficiently as intended, and to passenger processing and aircraft handling. Crucially, the software allows the airport operators to manage and maintain systems such as the aircraft docking system, gate management, check-in desk allocation and flight-information displays using one overarching platform, enabling them to respond rapidly to glitches before they have a knock-on effect on airport operations. A fault on a passenger-loading bridge, a boarding gate that refuses to open,
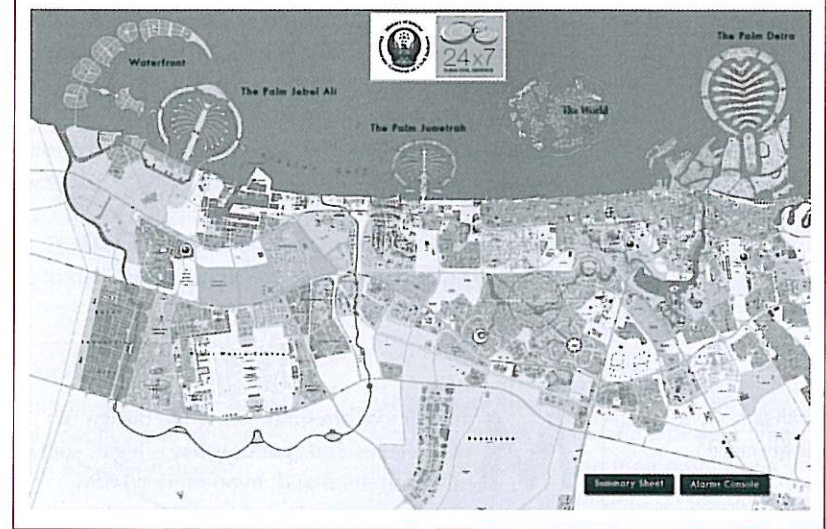
a conveyor belt getting stuck on a baggage-handling carousel, an elevator or escalator getting stuck or an automated sliding door not opening – these are all problems that the operators can be notified of quickly to avoid delays and an adverse impact on the airport's reputation.

At the other end of the scale, the technology is also being installed in many of Dubai's luxury villas. Previously, residents tended never to switch off the chiller units for the air conditioning, even if they left the city in the summer to avoid the worst of the heat. Now, Pacific Control Systems' home automation system mean residents "can control all the building systems from one box", Rahulan says, creating energy savings of 20–30%.

LESSONS FOR THE UK
According to Terry Casey, the problem of poorly managed building services is not confined to Dubai. "Facilities managers in the UK are not very good at operating plant correctly [either]," he contends. "They often only try to reduce the complaint level, not operate the building at its optimum level."

"We need to get buildings to operate closer to their actual operability", he goes on. "I've never come across a building that was operating as it's supposed to."

UK organisations may never be able to take advantage of solar power to the extent that Dubai can, but they can certainly ensure that they monitor and control their premises' energy use more closely. We may wonder whether Dubai can really pull off the sustainable-building trick, but if the UK, with all its red tape and ponderous processes, is to meet the government's target of an 80% cut in carbon emissions by 2050, it will have to reinvent itself as rapidly as Dubai has done. Now that really is a challenge.   **FM**