Submission 90:
Attachment A

Network Demand Management Case Study- James Cook University Douglas Campus, Townsville

April 2011

Toward Q2 Tomorrow's Queensland

Queensland Government

James Cook University Australia

Ergon Energy

Network Demand Management Case Study - James Cook University Douglas Campus, Townsville

Key challenge
James Cook University Douglas Campus Townsville formulated plans to grow its building footprint from 70,000 to approximately 140,000 square metres of air-conditioned space. This would have resulted in an increase in maximum site demand to 15MW post 2015, well above the current network agreement of 9MW and necessitating additional substation capacity and expensive high-voltage upgrades to both the Ergon Energy network and university electrical infrastructure.

JCU also recognised the increased operating cost implications of a rising electricity market and the capital cost of network upgrades to meet this increased demand.

Electricity represented a large proportion of the ongoing operating costs of the university, with air-conditioning accounting for roughly 50-60 per cent of total electricity consumed. The university's electrical demand was forecast to exceed the site's high-voltage maximum feeder capacity by approximately 9MW.

To facilitate the university's expansion program and reduce ongoing operating costs, JCU Douglas Campus actually needed to reduce peak daily electrical consumption.

As well, the university wanted to progress its Strategic Intent to become a leader in environmental sustainability in the Tropics.

** Electricity for large users, such as JCU, is charged in two ways - one for consumption (split into 16 hours at peak tariff and 8 hours at off-peak tariff) and the other for highest peak of daily power used each month (the "demand" charge).*

Bonus outcome
James Cook University Douglas Campus Infrastructure Master Plan includes a central spine of underground service trenches throughout the campus, which streamlines existing services and allows for future development.

JCU Townsville has built the largest Central District Cooling system in the Southern Hemisphere, incorporating high-efficiency chillers, sophisticated controls and large-scale thermal energy water storage for cooling 30 buildings on campus with the capacity to connect future buildings as they are constructed.

ABOVE: The thermal energy storage tank under construction.

The system has resulted in reduced electrical demand and, thus, operating costs; reduced greenhouse gas emissions; reduced maintenance and transport costs and a new refrigeration plant with a projected economic life of 30 years. The electrical operating cost savings stood at approximate $2 million per annum in 2011 and will increase over time as the campus grows.

Measurement and Verification (M&V) Results Table					
	Business as usual (2010)	District Cooling Plant (2010)	Business as usual (2015)	TES + Post EMC implementation (2015)	Savings / annum (%)
Energy consumption (kWh)	43,137,718	32,748,468	49,731,034	36,418,174	27 %
Demand (KVA)	12,909	7490	15,040	7972	47 %
Greenhouse gas emissions (tonnes)	44,000	33,400	50,726	37,147	27 %
Operating & maintenance costs (% of total costs)	$ 6,067,468	30%	$ 7,012,286	$ 4,243,747	40 %
Capital cost ($ or %)	$34 M	$21 M	Not determined	Not determined	
Payback period (years)	Immediate payback with avoided capital cost of HV upgrade in 2009.				

Energy Management Plan overview
In addition to the Central District Cooling system project, Ergon Energy assisted the university to formulate an Energy Management Plan to allow JCU Townsville to meet its commitments to reduce electrical demand by 4.5MVA.

Background
James Cook University Douglas Campus was developed from the late 1960s on the prevailing convention that every major building needed to incorporate a stand-alone air-conditioning plant to supply that building's cooling requirements.

Between 2006 and 2009, 'district cooling' with thermal energy storage (TES) was retro-fitted to significantly reduce baseline operating and maintenance costs.

At the time, Douglas Campus was burdened by multiple constraints, including:

- a large capital building program in progress
- high energy costs

- limit of high-voltage (HV) supply being approached, and
- aged air-conditioning plant requiring significant refurbishment or replacement.

One of the four cooling towers at the university.

Business-as-usual scenario

Douglas Campus had a number of older inefficient chiller plants running, in many cases well beyond their design life. The replacement cost of existing chillers over the next five years was estimated at $9 million.

Utility operating costs were forecast to increase due to the demand component and escalating energy usage during daytime peak periods, resulting in a 2009 electricity bill in the order of $2 million.

By 2010, BAU demand was forecast to escalate to 9.8MVA, breaching the maximum network agreement of 9MVA, requiring a major upgrade of network.

By 2015, demand was forecast to grow to 15MVA.

Demand management solution

A central chiller plant would replace individual chiller plants and medium-sized cooling units in all major campus buildings, with an underground pipeline supplying chilled water from the new central facility.

Running the campus chiller plant during the night to charge the thermal energy storage tank with chilled water would allow the plant to be switched off and go into circulation mode during the daytime peak periods, removing the chiller load and providing headroom for normal lighting and power consumption and producing a very flat power demand line.

Capital savings would continue to be made into the future as remaining buildings with chilling plant due for major maintenance or replacement could be connected to the central chiller plant.

Additional capital savings would accrue to new buildings in the future, as these would not require capital outlay for stand-alone water chilling plant.

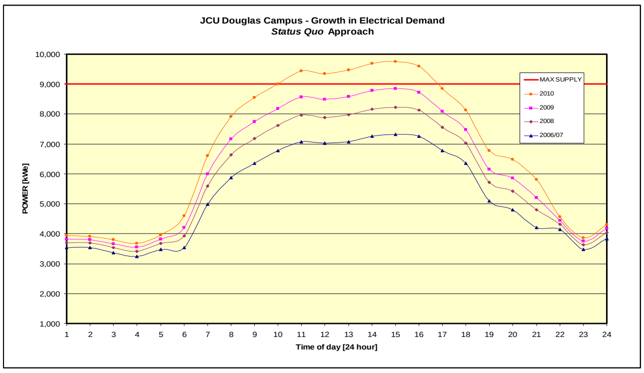


Fig 1: Business as usual growth in Daily Electrical Demand 2007-2010

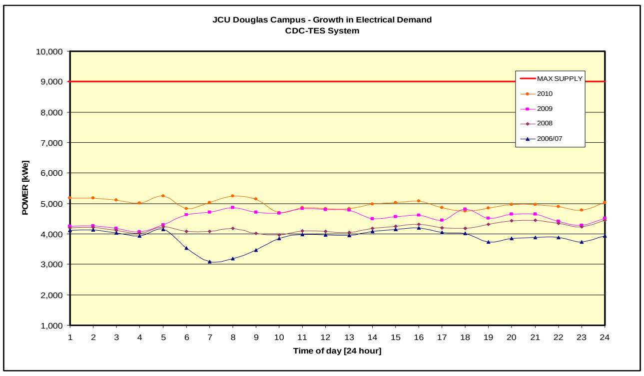


Fig 2: Central District Chiller growth in Daily Electrical Demand 2007-2010

The Central District Cooling system had the expansion capacity to service more than twice the present built floor area of Douglas Campus. By 2015, it was forecast that electrical demand would be 8MVA for a total air-conditioned space of 138,000 square metres.

Cost:
The capital cost of installing the Central District Cooling system was $21 million.

Ergon Energy contracted to pay JCU $1 million over five years for its commitment to reduce demand by 4.5MVA. It exceeded that commitment, reducing demand by 5.71MVA.

Partners:
Principal Design, Mechanical and Electrical Design Consultant: MGF Consultants (NQ) P/L and MGF Consultants P/L.
Principal Design Engineer: Craig McClintock
JCU Facilities Management: Dennis Frost

Future initiatives:
James Cook University is continuing its work towards optimal demand management through:

- site-wide high-efficiency lighting program
- new 11kV high-efficiency fourth chiller
- additional power factor correction
- additional building connections to the Central District Cooling system, and
- smarter use and upgrade of building air-side air-conditioning plant.

Awards:

- Engineers Australia Queensland Division 2008 Excellence Award, Reports, Procedures and Systems category

Innovations & improvements:

- an 11kV motor and high-voltage soft-starter kit that enables the site high-voltage reticulation to be directly coupled to the chillers without the need to reduce the 11kV to 415V power supply (industry standard). This reduces transformer losses, transformer capital cost, switchgear and switchboard capital cost, building floor area needed to house additional indoor transformers and long-term maintenance costs. Estimated capital cost saving $800,000.

- an innovative chilled water pipe manifold arrangement that allows five headers to be stacked above each other on support frames, with their weight being carried directly by the floor slab and not the steel roof framing. Capital cost saving for smaller steel roof members $40,000.

- Medium Density Polyethylene (MDPE) piping to reticulate the chilled water throughout the campus avoids the need for pipe insulation and allows the use of greater 12m pipe lengths, reducing the number of joints and promoting flexibility in the installation and flexibility for future branch take-offs. The wall thickness of the 500mm diameter MDPE is 29.6mm, which is directly buried in a compact sand fill, offering high thermal performance and inherent vapour barrier and mechanical protection.

- a 9° water temperature differential (6°C outgoing, 15°C incoming), allowing a 25% lower flow rate thus requiring less pumping energy and smaller pipes, 160mm to 560mm diameter. This, however, requires the air-handing units within the building to be calibrated for these less common parameters and the chillers to work harder to restore the 6°C water during the night-time cooling cycle.

- a master plan of the electrical and mechanical services for the site enables future designers and building expansions to utilise the parameters set for consistency and simplicity across the site

- Engineers Australia 2008 Australia Excellence Awards finalist
- Townsville City Council 2008 Excellence in Sustainability and Innovation Business Award.

Above: Piping between the plant room and cooling towers.

Above: Switchboard and power factor equipment in the control room.

Benefits:

- space recovery from removal of individual chiller units and plant rooms
- noise and vibration reduction from air-conditioning plant rooms and external cooling towers
- lower transmission line losses as high-voltage power is transmitted at night
- variable-speed-drive pumps allow flexibility as well as electrical efficiency
- lower energy consumption due to more efficient central chiller plant
- lower energy costs due to the production of chilled water at off-peak rates
- lower maintenance costs due to running new plant at optimal levels in cooler night conditions and uniform technologies
- reduced overall maintenance costs due to the decommissioning of numerous smaller, older items of plant, fewer breakdown and maintenance costs and fewer after hours callouts
- capital savings as smaller chillers will not have to be replaced in the future
- capital savings on chillers in new buildings as these buildings will be serviced by the CDC at minimal capital cost
- longer economic service life
- improved health and safety.

![powersavvy]

commercial case study

Islander Board of Industry and Service

Douglas Street Store, Thursday Island

Company profile

The Islanders Board of Industry and Service, known as IBIS, operates community supermarkets throughout the Torres Strait Islands and at Bamaga in the Northern Peninsula Area.

The IBIS store in Douglas St, Thursday Island, is the primary grocery outlet for a large community. The shop is approximately 1600 m^2, with 950 m^2 of air conditioned space, operating seven days a week.

IBIS agreed to participate in ***powersavvy*** to reduce energy consumption in both of its Thursday Island stores. The graph below shows the store's expected annual electricity costs if no changes had been made (top blue line) compared with the actual and forecast power costs after the ***powersavvy*** measures were introduced.

Energy survey results

An energy audit on the Douglas St store found many opportunities to improve energy efficiency, particularly in refrigeration which is IBIS' main energy consumer. This also happens to be an important part of the business—ensuring customers have access to fresh, refrigerated produce in the tropics.

Case study snapshot

Client: Islander Board of Industry and Service (IBIS)

Premises: Supermarket.

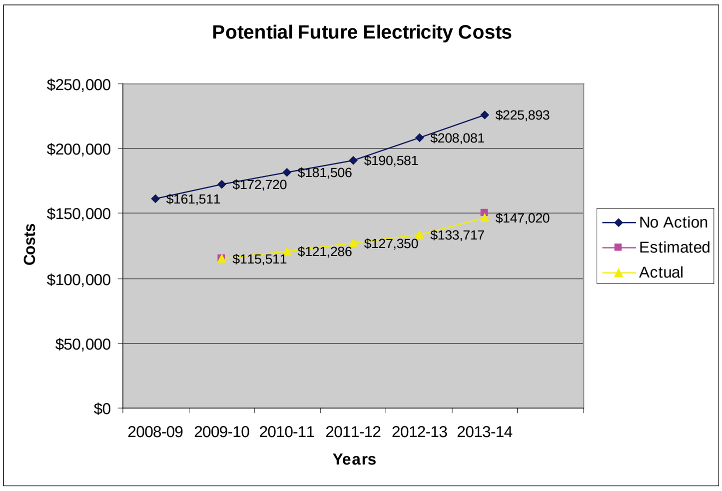
Douglas St, Thursday Island

Energy improvement implementation period: April 2010 to November 2010

Estimated savings for one year:

- 234,248 kWh (26 per cent)
- $46,000
- 58.5 tonnes CO2

The store's baseline electricity consumption was 885,044 kWh per annum—equivalent to the combined use of about 100 average Queensland households. Refrigeration accounted for 57 per cent of consumption, air conditioning 25 per cent, appliances 12 per cent and lighting 5 per cent.



powersavvy recommendations

Refrigeration

An extensive upgrade of the refrigeration systems reduced the store's current electricity use by an estimated 15 per cent. The work included: recommissioning the existing main refrigeration plant, reconfiguring the main control plant and time control, along with resealing and installing new seals on all doors and curtains.

Air conditioning

Reconfiguring the air conditioning system reduced its energy consumption by an estimated 55 per cent. This was achieved by implementing a building zone control strategy along with resetting the controls to ensure appropriate temperatures for operational hours and introducing time controls.

Lighting

The power used to light the store was reduced by about half. This was achieved by introducing lighting zones and light time controls along with passive infra red sensors.

Halogen light fittings were replaced with LEDs and compact fluorescent lamps.

Hot water

The energy used for water heating was reduced by 66 per cent by replacing the existing 3.6 kW hot water system with a 1.2 kW heat pump system.

Photovoltaic power system

A 10 kW solar photovoltaic system was installed on the building's roof. This will generate around 15,330 kWh per year, saving IBIS about 1.7 per cent of its electricity costs each year.

Tariff change

On the advice of ***powersavvy***, IBIS reviewed its tariff rate and found that a general demand tariff (Tariff 41) was the most economical for IBIS. The new tariff is based on a constant load profile—with little peak loading—and delivers the best value for money for IBIS.

Cost of the work

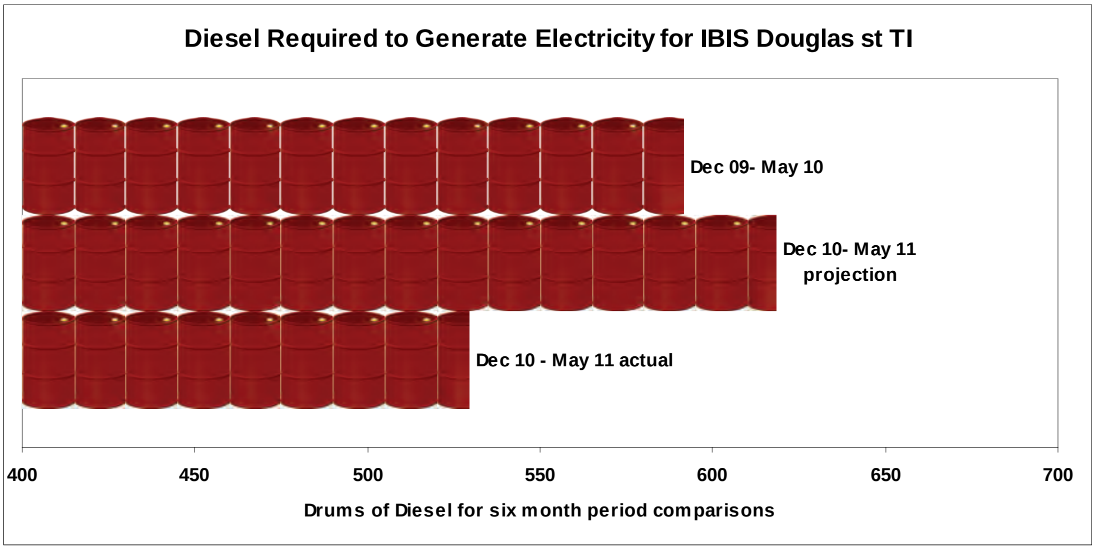
All the recommended energy saving measures were estimated to cost a total of $73,100. ***powersavvy*** offered a $27,100 incentive to help fund the work, leaving IBIS to fund the remaining $46,000.

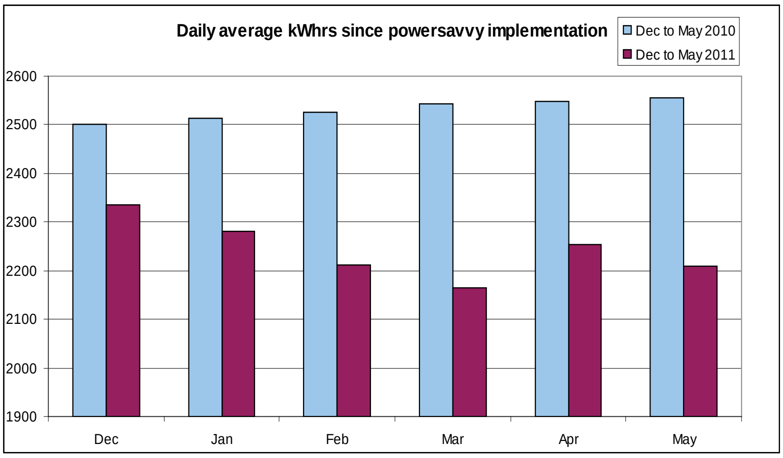
powersavvy's financial contribution is expected to be recouped through reduced power station fuel usage within about six months.

Summary and estimated savings

IBIS' power bills for the Douglas St store after the work was completed showed an estimated annual reduction of 234,248 kWh (26 per cent), a saving of $46,000 and 58.5 tonnes of greenhouse gases. This is equivalent to saving the power consumption for 29 Queensland households and is a tremendous positive outcome for both IBIS and ***powersavvy***.

The large savings in electricity use has lead to significant savings in the amount of diesel required to generate the electricity to run the IBIS Douglas Street supermarket. Almost 6 barrels—1200 litres of diesel—has been saved for a period of 6 months. The funding provided by Ergon Energy through ***powersavvy*** is a significant investment that has realised widespread innovative benefits for all the project stakeholders.





Estimated cost and fuel savings for IBIS store Douglas St, Thursday Island

powersavvy

commercial case study

Star of the Sea Home for the Aged Thursday Island

"We are already reaping the benefits of this work. Over the last two months our energy consumption has been the lowest in almost five years."

Dion Vermey, Maintenance Manager Star of the Seas, April 2011

Customer profile

Star of the Sea Home for the Aged on Thursday Island provides full-time hostel accommodation and acute care services for 40 residents. The home has 14 buildings totalling about 1200m2 with a mix of concrete block and fibre cement construction. It has:

- bed-sitter units (25) spread across three wings
- acute care wards (7) with 15 beds
- townhouse-style two-bedroom apartments for staff (8)
- a shared accommodation building with six bedrooms.

Energy survey results

An energy audit of Star of the Sea found that energy efficiency improvements could be made, particularly in air conditioning and refrigeration. Air conditioning is important to ensure residents and staff are comfortable in their indoor environment.

The home's baseline electricity consumption was 380,916 kWh per annum, equivalent to the power used by 47 average Queensland households. Air conditioning accounted for just over half the total yearly consumption, refrigeration accounted for 12 per cent, hot water 11 per cent, and lighting seven per cent.

Case study snapshot

Client: Star of the Sea, Home for the Aged Thursday Island Torres Strait

Energy improvement implementation period: April 2010 to December 2010

After one year's operation, annual savings are expected to be:

- 102,000 kWh. (27 per cent)
- $15,300
- 73 tonnes CO2

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powersavvy recommendations

powersavvy recommended a variety of measures to help the home cuts its power bills, and these were adopted in full.

Hot water

The electricity used to heat the home's hot water was reduced by 70 per cent by replacing existing electric hot water cylinders with heat pumps. As well as being highly efficient they use waste heat from a refrigeration system to heat the water.. Low flow shower heads were also installed and reduced the home's water consumption by 22 per cent.

Heat pumps reduced the energy used to heat water by 70 per cent.

Refrigeration

An inefficient glass display fridge and an old fridge were replaced with new energy efficient models, resulting in a 20 per cent reduction in refrigeration energy use.

Lighting

The electricity used to light the home was reduced by about 39 per cent by replacing incandescent light bulbs with compact fluorescent lights and dual fluorescent tube fixtures with single tubes with no lowering of lighting levels.

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Air conditioning

Changes to the operation and maintenance of the air conditioning system contributed to a reduction of about 25 per cent in the cost of running the system. A new control system was installed in all buildings which included an automatic switch to turn off the air conditioning after a window or door was left open for a set time. Time control for the whole home was also introduced. The home lacked a maintenance regime so a maintenance plan was prepared to ensure consistent long term maintenance for the system.

Installing an air conditioning control system featuring Allen Bradley hardware resulted in a 25 per cent running cost reduction. It can shut down the air conditioning when a window or door is opened for any length of time.

The new user interface, hardwired back to the control box above, allows staff to easily determine status of each unit's air conditioning and control how the air conditioner will operate.

Tariff change

The home reviewed its tariff rate and switched to Tariff 41 which delivered a better price per kWh and provided significant savings.

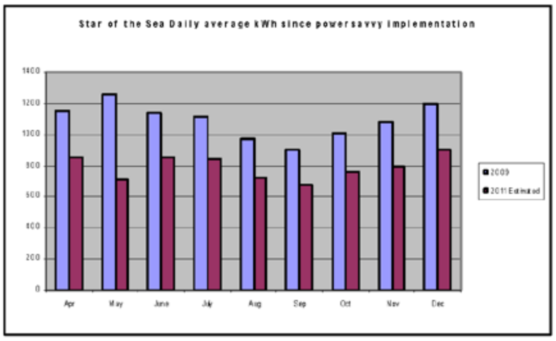
Cost of the work

The recommended work was estimated to cost $51,748. ***powersavvy*** offered an incentive of $17,000 leaving $34,748 for Star of the Sea to fund. ***powersavvy***'s financial contribution is expected to be recouped through reduced power station fuel usage within about nine months. The payback period for Star of the Sea's contribution is under two years.

Summary and estimated savings

Since implementing the recommended measures, Star of the Sea has reduced its annual electricity consumption by around 102,000 kWh—about 27 per cent. It will save the home around $15,300 a year and reduce annual greenhouse gas emissions by 73 tonnes.

The savings are equivalent to saving the power consumption for 13 Queensland households. The graph below shows the home's expected annual electricity costs if no changes had been made (top blue line) compared with the estimated and actual power costs after the ***powersavvy*** measures were introduced.



powersavvy's work with Star of the Sea demonstrated the importance of the human element in implementing energy efficiency measures. The home's maintenance manager was initially doubtful about the program, but became an enthusiastic supporter after he experienced the benefits in reduced power bills. He went on to implement energy saving measures over and above those initially recommended by ***powersavvy***, as well as site-wide staff training and signage to reinforce energy efficiency awareness.

More than just saving power

The funding provided by Ergon Energy through ***powersavvy*** is a significant investment that has realised widespread innovative benefits for all the project stakeholders.

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DLGP and SunWater

Northern Peninsula Area water supply, Bamaga

Case study snapshot

Customers: Department of Local Government & Planning *and* SunWater

Sites: Bamaga Water Treatment Plant and Jardine River pumping station

Northern Peninsula Area

Project implementation period: 2011

Estimated savings for one year:

- 105,000 kWh (11 per cent)
- $24,350
- 73 tonnes CO^2

Customer profiles

The Department of Local Government and Planning (DLGP) works closely with local governments and leads a coordinated Queensland Government approach to growth management, planning and development across the state, including delivering infrastructure.

SunWater is a Government Owned Corporation which manages a regional network of bulk water supply infrastructure to support around 5,000 customers across Queensland's mining, power generation, industrial, local government and irrigated agriculture sectors.

Under contract to DLGP, SunWater maintains and operates the Northern Peninsula Area (NPA) water supply system—including the Bamaga water treatment plant and the Jardine River intake and pumping station—to provide a reliable, secure potable water supply to the communities in the NPA.

The sites

The treatment plant and the pumping station were identified as major users of power in the NPA.

The 55 kW pumps at the Jardine River intake are each capable of pumping nearly five megalitres a day through 16 kms of pipeline to the treatment plant at Bamaga.

In 2008–09 the pumps used 330 MWhs of electricity, and the treatment plant used 614 MWhs to treat and pump the water to the five communities in the NPA.

Energy survey results

A detailed energy audit of both sites found power consumption was unnecessarily high as a result of:

- pumps for both sites operating on a constant run-as-required basis
- limited controls on the Jardine River pumps with no control feedback to the treatment plant at Bamaga and no remote sensing of operational issues such as blocked river strainers or damaged pumps
- using an outdated control method on the water treatment plant feed pumps, which only operated at full speed.

These conditions were exacerbated by the fact that a significant proportion of electricity use occurred at peak times, rather than configuring operations to take advantage of off-peak times and tariffs.

powersavvy recommendations

The following key energy efficiency measures were undertaken as recommended by the ***powersavvy*** audit.

Air conditioning

A new energy efficient inverter split system air conditioner was installed to replace an old unit in the Jardine River pumping station control building.

Controls

One of the ***powersavvy*** audit's major recommendations was to upgrade the pumping control systems for both sites. This was achieved by:

- installing Variable Speed Drive pump controllers for each pump at both sites, linked to a master control system, to optimise pump speeds
- installing equipment to monitor the electrical load and water delivery through the 16km pipeline
- re-configuring the control strategy for the water filtration feed pumps.

These changes gave the operators full control over the efficiency of their system by monitoring kW per kL production and enabling them to set up maintenance triggers.

DLGP via its contractor Sunwater also undertook a major upgrade of its master SCADA control system, in conjunction with measures recommended by ***powersavvy,*** further increasing the plant's operational efficiency***.***

Switchboard

The switchboard at the Jardine River pump station was upgraded to the latest technology.

New switchboard with variable speed pump drives

Lighting

An energy saver timer was specified on the high bay lights at the Bamaga treatment plant.

Cost of the work

All the recommended energy saving measures were estimated to cost a total of $99,633—$39,123 at the Bamaga water treatment plant and $60,410 at the Jardine River pumping station.

powersavvy offered a substantial financial incentive to help fund the work through an Energy Conservation Agreement with DLGP.

powersavvy's contribution is expected to be recouped through reduced power station fuel usage within about two years.

Summary and estimated savings

The adoption of the energy efficiency measures will provide both financial and operational benefits for the NPA water supply system.

The work across both the Bamaga and Jardine River sites is expected to reduce power consumption by more than 100,000 kWh per year—a saving for SunWater of up to $24,350 and reducing the production of greenhouse gases by up to 73 tonnes.

This will mainly be achieved through improved control systems that optimise pump operations to their most efficient level and better match water production—and therefore electricity use—to the community's water demand.

More than just saving power

Other benefits include:

- reduced plant wear—and therefore increased the working life of the equipment
- automation of the plant to allow easier management of off peak times—thus reducing cost
- system control feedback points to indicate issues such as blocked strainers or general drop in pump efficiency
- increased protection for expensive motors
- accurate monitoring of pump run hours to enable maintenance planning
- increased lifespan of all equipment including the switchboards
- remote access to the pump station control system via internet link. This enables detailed remote assessment of its performance and reduces the need for expensive in-person checks at the facility
- a cut in fuel use at the Bamaga power station, saving 27000 litres of diesel per year.

The funding provided by Ergon Energy through ***powersavvy*** is a significant investment that has realised widespread innovative benefits for all the project stakeholders.

The project also created a new partnership between Ergon Energy's ***powersavvy*** team, the Department of Local Government and Planning (project owner), SunWater Limited (facility managers), Austek (facility contractor) and the community.

powersavvy's *Des Jackson (left) with SunWater's Peter Barnes, John Conroy of DLGP and Dano Myrteza of DLGP.*

powersavvy

commercial case study

Islander Board of Industry and Service

Dauan Island Store

powersavvy and the Islander Board of Industry and Service (IBIS) worked together to achieve significant electricity savings at the IBIS Dauan Island Store through a combination of technical and behavioural solutions.

Customer profile

The Islanders Board of Industry and Service, known as IBIS, operate community supermarkets throughout the Torres Strait Islands and at Bamaga in the Northern Peninsula Area. The IBIS store on Dauan Island is the primary grocery outlet for the community.

IBIS is continuing their commitment to energy efficiency with an agreement with ***powersavvy*** to include many energy efficient features in their new stores roll-out. Dauan Island Store is the most recent of these, to be completed in May 2012. IBIS is incorporating variable capacity refrigeration technology as a key energy saving initiative across the new stores.

Ongoing engagement with *powersavvy*

A detailed energy audit of the previously finished new store at Mabuyag Island enabled analysis of the new store design under operating conditions — in terms of energy use and opportunities for the "typical new store design". Many of the ***powersavvy*** recommendations have been considered in the build stage making the job of finding new savings a little challenging.

Case study snapshot

Customer: Islander Board of Industry and Service

Site: Dauan Island Store (greenfields site)

Project implementation period: This new store was built between Jan 2012 and June 2012, with an operational opening date of 2 July 2012

Estimated savings for one year:

- Up to 42,000 kWh/annum
- Up to $8,300 in the utilities budget
- Over 30 tons of CO_2

Key technologies

Variable capacity refrigeration condenser units were a key energy efficiency measure included in the New Stores Energy Savings Proposal to IBIS. It is now anticipated that IBIS will include this technology in the remaining new works at Saibai and Murray Islands, then continuing to update all other stores in due course.

Variable capacity refrigeration condenser units

Installation of these latest Bitzer units are set to provide several advantages to IBIS over the next few years on top of the energy saving ability to vary the compressor speed and capacity:

- IBIS are required to install 'soft start' electrical current limiting devices in remote generation areas as per the Ergon Energy guidelines. Utilisation of this technology with integral soft start has meant that those costs are not required.
- Due to the cyclical nature of the deliveries into the store, a high refrigeration heat load exists only periodically when stock arrives, the remainder of the time this technology will give significant savings by closely matching the refrigeration capacity with the low heat load. Previously the unit had to be overdesigned meeting the maximum load requirement that exist for very short periods whilst stock is coming down to temperature.
- Structurally strong and durable composite materials are an important feature for the Torres Strait where corrosion is usually the biggest enemy of refrigeration equipment

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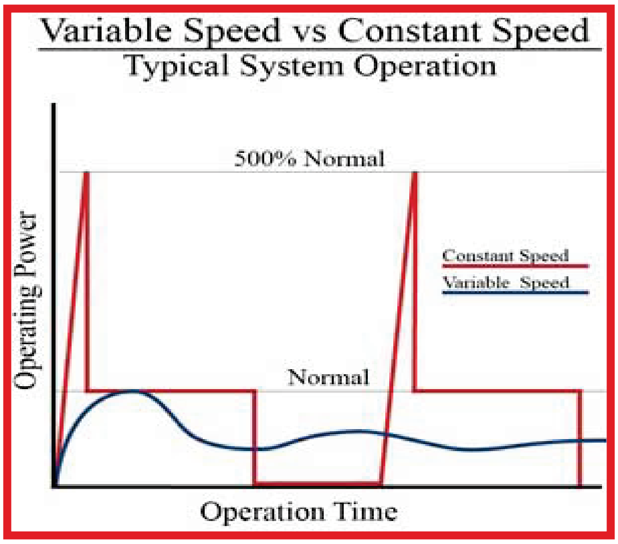
- The micro channel condenser is mono material construction again significantly increasing equipment life.

Installation observation

Ben Wone, Jackson and Jackson Refrigeration Branch Manager

Once commissioned, the units were tested and found that during normal low load situation were drawing 2.5 amps total, instead of the 15 amps that would normally be drawn by a similar sized unit. The units are ramping down to maintain load for the majority of the time causing a reduction in stop/start of 75 per cent and of those stop/starts, the units will slowly ramp, causing no sudden spike in consumption.



Response

powersavvy worked closely with IBIS, Bitzer Australia and their specialist refrigeration contractor Jackson and Jackson Refrigeration Pty Ltd to ensure the suitability of this new technology.

- The condenser units were custom assembled for the purpose as these are relatively small cold store requirements; Bitzer Australia imported the compressors specifically to tailor the condenser units to the application.
- Whilst this technology is very well documented and tested internationally it is sometimes not embraced in Australia due to the premium price for the higher quality product. ***powersavvy*** is proud to be able to assist introduce this technology to an area that it can do the most good. These are the first small scale variable capacity refrigeration units in the Torres Strait and to date experienced in any of the remote generation areas where there attributes are very valuable.

powersavvy funding

powersavvy offered IBIS $15,519 in funding for a number of efficiency actions, including these refrigeration units, with the expectation that IBIS and the Queensland government will benefit from annual savings for years to come. Below are some of the suggested actions:

- Review business case for upright display freezers.
- Replace freezer room and cool room condenser units with inverter models.
- Fit door closer to office door and rear door accessing service area near office, limiting Air Conditioner infiltration into service area.
- Fit GPO timeclock to front door air curtain.
- Fit vinyl swing doors to rear service entrance to store area, in place of the existing air curtain.
- Install movement detector in central location to limit operation of energy recovery ventilator.
- Replace light switchplates in rear service area and toilet with Clipsal 319 Series Pneumatic Timer switches.
- Configure main store lighting circuits to enable four strategic security luminaries switched manually, and time clock control remaining to operating hours only.

Future savings

Whilst it is early days and no site data is available for this store yet, potential savings have been calculated at 42,000 kWh/year. With the expected long life of these products, these annual savings are anticipated for at least five years and potentially the next ten.

More than just saving power

The funding provided by Ergon Energy through ***powersavvy*** is a significant investment that has realised widespread innovative benefits for all the project stakeholders. It helps to reinforce IBIS's status as a responsible local corporate citizen and provides positive media coverage through the ***powersavvy*** partnership, a sustainable energy conservation program rolled out throughout the organisation and a shift in the organisational culture.

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Network Demand Management Case Study-QHealth North Queensland Distribution Centre, Bohle

June 2011

Toward Q2 Tomorrow's Queensland

Queensland Government

ERGON ENERGY

Network Demand Management Case Study - QHealth North Queensland Distribution Centre

Key challenge
Queensland Health wanted to air-condition its distribution centre at Bohle 24/7 to help protect and increase the shelf life of the medical goods stored there prior to dispatch to hospitals and medical centres throughout the state.

However, the centre was located in Bohle Industrial Estate, a constrained part of the Ergon Energy network, and increasing supply availability was a costly option. Rather, Ergon Energy wanted customers in the area to reduce demand, particularly peak demand.

Bonus outcome
QHealth North Queensland Distribution Centre is now a high-quality facility, with vastly improved air quality for the storage of medical supplies and employee working conditions.

The air-conditioning system is believed to be one of the smallest chilled water thermal energy storage air-conditioning systems in Australia. Its design responds to Townsville climatic data, dehumidifies the outdoor air and provides a positive building pressure preventing dust and odours from entering the building maintaining a clean medical storage and working environment.

The improved working environment has enabled QHealth to proceed with its plan to implement a second work shift.

Above: QHealth North Queensland Distribution Centre Townsville

Above: Cooled air is circulated via a fabric duct hung from below the ceiling.

Above: The hi-bay lighting automatically switches off when there is adequate natural light penetration through the warehouse skylights.

Measurement and Verification (M&V) Results Table			
	Business as usual Commercial air-con	Post EMC implementation TES air-con	**Savings / annum**
Energy consumption (kWh)	598,158	412,494	**185,664**
Daytime demand (kVA)	138	23	**83.3%**
Nighttime demand (kVA)	138	106	**23.2%**
Greenhouse gas emissions (tonnes)	610	420	**190**
Operating & maintenance costs	$144,000	$98,000	**$46,000**
Capital cost	$450,000	$600,000	
Payback period	3.3 years		

Energy Management Plan overview
Ergon Energy entered into an Energy Management Plan with QHealth to reduce electrical demand, particularly peak demand, through installing a high-efficiency air-conditioning and LED lighting solution. QHealth committed to potentially reduce demand by 118kVA.

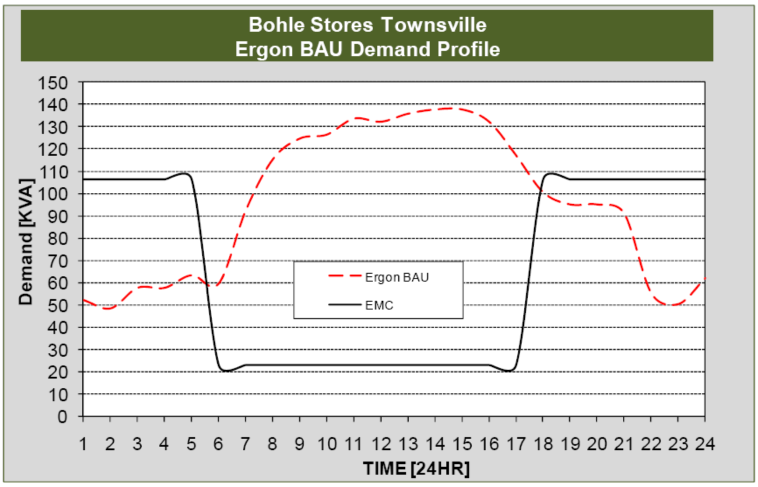
Background
QHealth North Queensland Distribution Centre is a bulk storage warehouse and office of 4400 square metres in tropical North Queensland, with half that space air-conditioned. It is used primarily to store medical supplies, some of which are sensitive to temperature and need to be stored below 25°C. It also is the main picking and packaging area occupied by Queensland Health warehouse staff. The warehouse has delivery and dispatch bays with large doorways to accommodate loading and unloading vehicles.

Business-as-usual scenario:
The office area of the warehouse comprised fluorescent lighting and a stand-alone 30kW air-conditioner and normal kitchen appliances and was used for up to 11 hours a weekday. The warehouse comprised 32 400-watt mercury vapour hi-bay light fittings and three ‘big arse’ 0.75kW ceiling fans and was used for up to nine hours a weekday.

At the time, there were plans to introduce a second work shift at the distribution centre, doubling operation hours.

The business-as-usual scenario for a traditional design and construct to air-condition the warehouse 24/7 would require an additional two 125kW air-conditioning package plant with a projected daytime operating maximum demand of 140kVA at a power factor of 0.85 (typical industry assumption).

Demand management solution:
An energy audit of the office and warehouse was undertaken to find the most energy-efficient air-conditioning solution.



The above energy profile shows a significant reduction in daytime demand.

The energy management considerations adopted were:-

- new main switchboard, with the ability to have a standby generator connected in the event of mains power disruption
- upgrade of earthing systems
- sophisticated metering of the main switchboard and air-conditioning plant
- a small-scale air-cooled chilled water thermal energy storage system to air-condition the warehouse
- skylights to increase warehouse lighting levels, and
- retrofit of existing hi-bay lights with LED hi-bay fittings.

The central chiller plant operates overnight from 6pm to 6am to lower the reticulated water temperature to typically 6°C for storage in four 28KL tanks. The cooled water is then passed through the building's air-handling unit cooling coil.

The thermal energy storage tanks effectively operate as a battery in the system, allowing the building cooling system to be decoupled from the process plant.

The flow of water is regulated via modulating valves to maintain precise control over the cooling coil and therefore air-stream temperature, circulated within the fabric duct hung below the existing roof structure. Water leaving the cooling coil absorbs the heat energy from the air-stream and is returned to the holding tanks.

The tanks effectively operate as a battery in the system and allow the building cooling demand to be decoupled from the process plant. This allows the power demand profiles to the site to be manipulated.

The air within the building is circulated by three 5.5m fans, offsetting any need for the elaborate ducting needed for a traditional air-conditioning design.

The system operates 24/7 with local control stations for temperature adjustment and ceiling fan speed.

The large doors to the despatch bay are sealed with an electric shutter that prevents conditioned air loss to the atmosphere.

The LED hi-bay lights automatically switch off when a sensor detects adequate natural light penetration via the skylights.

Central chiller results:
Demand savings from both initiatives were measured and verified by an independent auditor at 115kVA during the day and 32kVA at night, compared to business-as-usual.

Cost:
The cost to design and construct all Energy Management Concepts was approximately $150,000 more than a traditional air-conditioning design and construct solution.

The payback period for this energy-efficiency investment was 3.3 years.

Also, the whole-of-life cycle has been significantly extended through the energy-efficiency solution.

Ergon Energy paid QHealth $26,450 for delivering a 115kVA reduction in demand.

Partners:
Energy auditors/Project Management/Implementation: Eco Efficiency Experts
Air-Con Concept design: MGF Consultants
Air-Con Design engineer: Craig McClintock (formally with MGF Consultants)
M&V: Kevin Burns Consulting

Customer testimonial:
"The air-conditioning installation has provided an energy efficient solution that has enabled both a clean room environment for the storage of clinical inventory and a more pleasant work place for the staff employed at the facility," said Supply Manager North Queensland Hub Supply Services Wayne Nuske.

Air-conditioning innovations & improvements

- minimal capital cost
- lightweight fabric duct able to be hung below the ceiling
- evenly spaced ceiling fans to circulate air, and
- local temperature adjustment control stations and local ceiling fan speed control stations.

Benefits
LED lighting has:
- instant re-strike in the event of power failures
- no on/off warming up times
- uses 30% less electricity than standard lighting
- creates less heat
- utilises environmentally friendly materials during construction, and
- significantly longer lifecycle.

Chilled water storage is:
- able to take advantage of lower priced controlled tariffs
- lower maintenance costs
- even air distribution in warehouse, therefore less running time
- reduced greenhouse gas emissions, and
- longer lifecycle of 20 years.

Future energy-efficiency works under consideration:
The roof of the Distribution Centre is optimal for the installation of a large solar PV array.

Network Demand Management Case Study- QHealth North Queensland Distribution Centre, Bohle

June 2011

Toward Q2
Tomorrow's Queensland

Queensland Government

ERGON ENERGY

Network Demand Management Case Study - QHealth North Queensland Distribution Centre

Key challenge
Queensland Health wanted to air-condition its distribution centre at Bohle 24/7 to help protect and increase the shelf life of the medical goods stored there prior to dispatch to hospitals and medical centres throughout the state.

However, the centre was located in Bohle Industrial Estate, a constrained part of the Ergon Energy network, and increasing supply availability was a costly option. Rather, Ergon Energy wanted customers in the area to reduce demand, particularly peak demand.

Bonus outcome
QHealth North Queensland Distribution Centre is now a high-quality facility, with vastly improved air quality for the storage of medical supplies and employee working conditions.

The air-conditioning system is believed to be one of the smallest chilled water thermal energy storage air-conditioning systems in Australia. Its design responds to Townsville climatic data, dehumidifies the outdoor air and provides a positive building pressure preventing dust and odours from entering the building maintaining a clean medical storage and working environment.

The improved working environment has enabled QHealth to proceed with its plan to implement a second work shift.

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Demand management solution:
An energy audit of the office and warehouse was undertaken to find the most energy-efficient air-conditioning solution.

The energy management considerations adopted were:-

- new main switchboard, with the ability to have a standby generator connected in the event of mains power disruption
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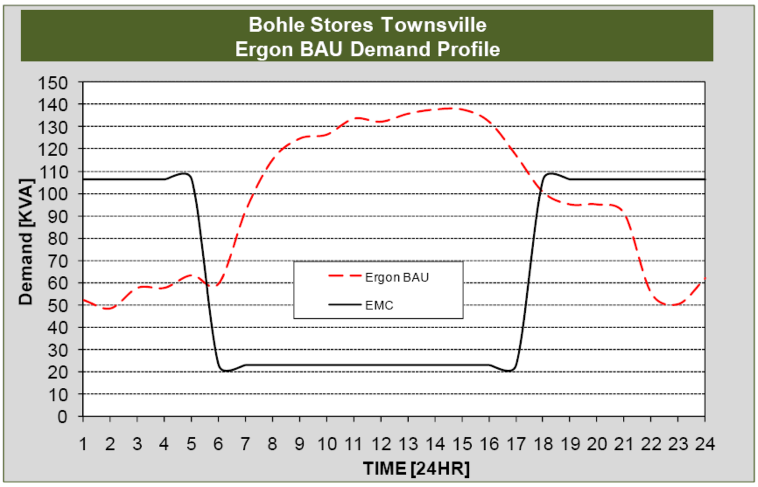

The above energy profile shows a significant reduction in daytime demand.

The thermal energy storage tanks effectively operate as a battery in the system, allowing the building cooling system to be decoupled from the process plant.

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The large doors to the despatch bay are sealed with an electric shutter that prevents conditioned air loss to the atmosphere.

The LED hi-bay lights automatically switch off when a sensor detects adequate natural light penetration via the skylights.

Central chiller results:
Demand savings from both initiatives were measured and verified by an independent auditor at 115kVA during the day and 32kVA at night, compared to business-as-usual.

Cost:
The cost to design and construct all Energy Management Concepts was approximately $150,000 more than a traditional air-conditioning design and construct solution.

The payback period for this energy-efficiency investment was 3.3 years.

Also, the whole-of-life cycle has been significantly extended through the energy-efficiency solution.

Ergon Energy paid QHealth $26,450 for delivering a 115kVA reduction in demand.

Partners:
Energy auditors/Project Management/Implementation: Eco Efficiency Experts
Air-Con Concept design: MGF Consultants
Air-Con Design engineer: Craig McClintock (formally with MGF Consultants)
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- even air distribution in warehouse, therefore less running time
- reduced greenhouse gas emissions, and
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Future energy-efficiency works under consideration:
The roof of the Distribution Centre is optimal for the installation of a large solar PV array.

Network Demand Management Case Study – Kirwan Community Health Centre, Townsville

September 2011

Network Demand Management Case Study - Kirwan Community Health Centre, Townsville

Key challenge
It is a requirement that all facilities within the Townsville Health Service District comply with the Queensland Government's Strategic Energy Efficiency Policy targeting a reduction in energy consumption in all government buildings of five per cent by 2010 and 20 per cent by 2015.

All facilities are also required to support the Government's commitment to meet its national greenhouse gas emissions reduction target of 60 per cent by 2050.

Kirwan Community Health Centre.

Energy Management Plan overview
An independent energy audit undertaken by Kirwan Community Health Centre identified a number of opportunities to reduce electrical demand.

Ergon Energy agreed to assist Queensland Health to implement these initiatives by paying up to $50,000 on the delivery of its commitment to reduce demand by up to 217KVa.

Background
Kirwan Community Health Centre is a single-storey building of 7308 square metres floor space, comprising four separate precincts, namely:

- administration
- mental health, long-term stay
- aged care, high care, and
- small clinic treatment centre.

The centre is part of the Townsville Health Service District and its Strategic Energy Management Plan supports the Government's Strategic Energy Efficiency Policy by endeavouring to:

- minimise energy consumption, its carbon footprint and demand; and
- achieve enduring cultural change in carbon reduction management across the entire organisation.

Energy conservation principles are incorporated in the centre's refurbishment plans.

Business-as-usual scenario

Air-conditioning accounted for 50-60 per cent of the total energy consumption at Kirwan Community Health Centre.

Two air-cooled chillers provided chilled water to a distributed air-handling system throughout the building. Each chiller had two condensers and two compressors and operated on either full or partial load between 5.30am and 7pm weekdays and some times on Saturdays.

The Health Centre's 1435 light fittings were a mixture of T8 tri-phosphor, compact fluorescent and halide street lamps of varying wattage. Some of the T8 lamps were recessed and side by side with no air gap, thus increasing heat gain and reducing the life of the tubes. About half the T8 lamps were expected to fail prematurely.

After-hours switches were installed in some parts of the building to conserve energy.

The switch to high efficiency LED lighting gave an immediate impression of freshly painted interiors throughout Kirwan Community Health Centre.

Office spaces were immediately brighter.

Demand Management Solution

The Energy Conservation Measures (ECMs) implemented included:

- upgrading to LED lighting for improved lighting efficiency and service life
- installing a Refrigerant Management System to increase the efficiency of the air-conditioner chiller condensers
- installing an Energy Management System to optimise air-conditioning unit compressor operation, and
- Power factor correction adjustment (from 0.80 to 0.98 as validated by installation of a Crompton Integra Power Monitor during the performance period).

Results

Measurement and Verification (M&V) Results Table			
	Business as usual	Post-ECM implementation	Savings / annum
Demand (kVA)	785	634	19%

The demand savings were measured and verified by an independent certifier after making a baseline adjustment for additional air-conditioning units installed after installation of the above ECMs.

The M&V audit confirmed that Queensland Health reduced demand by 152kVA.

Assumed benefits of LED lighting

- 10-year life cycle guaranteed
- 3 per cent depreciation over life cycle
- high energy efficiency
- easy and inexpensive retro-fit
- significantly reduced heat output
- nil maintenance in most cases
- environmentally responsible – no toxins to be disposed of
- NATA accreditation
- instant re-strike with no warm-up period
- dimmable.

Cost
Queensland Health invested $260,000 in the energy efficiency initiatives.

Ergon Energy contributed $34,960 on delivery of a demand reduction of 152kVA.

Bonus outcome
The amenity of areas retro-fitted with energy-efficient lighting improved immediately to the degree that staff 'thought' the areas had been freshly painted.

Increased electrical efficiency is critical to the health campus's future sustainability. The initiatives have demonstrated their ability to deliver both demand reduction and energy savings, adding confidence that demand stability can be achieved.

Partners
Opportunity Evaluation: Eco Efficiency Experts Australasia Pty Ltd
M&V: Energy Decisions

Customer testimonial
'The energy management initiatives installed during this project have improved the operational environment of this facility for the benefit of the staff, patients and visitors whilst also producing significant improvements in the building's operational efficiency in an environmentally sensible manner," said Michael Ward, Engineer, Building Engineering and Maintenance Services, at Townsville Hospital.

Future initiatives
Queensland Health is considering replacing existing stand-alone DX plant and air-cooled chillers with chilled water units at their end of life and replacing aged cooking equipment with high-efficiency LPG equipment.

Network Demand Management Case Study – North Ward Health Campus, Townsville

September 2011

Network Demand Management Case Study – North Ward Health Campus, Townsville

Key challenge
It is a requirement that all facilities within the Townsville Health Service District comply with the Queensland Government's Strategic Energy Efficiency Policy targeting a reduction in energy consumption in all government buildings of five per cent by 2010 and 20 per cent by 2015.

All facilities are also required to support the Government's commitment to meet its national greenhouse gas emissions reduction target of 60 per cent by 2050.

North Ward Health Campus, Townsville.

Energy Management Plan overview
An independent energy audit undertaken by North Ward Health Campus identified a number of opportunities to reduce energy demand.

Ergon Energy agreed to assist Queensland Health to implement these initiatives by paying up to $10,000 on the delivery of its commitment to reduce demand by potentially 43kVA.

Background
The Townsville District Health Service's North Ward Health Campus is a two-storey building near Townsville CBD containing offices and medical treatment rooms. As well, there is an external car park.

Medical services administered at North Ward include:

- Medical Aids Subsidy Scheme (MASS)
- health promotion
- renal health
- child youth and family health
- pathology services
- oral health
- sexual health
- alcohol, tobacco and other drug services, and
- community mental health.

North Ward Health Campus is part of the Townsville Health Service District and its Strategic Energy Management Plan supports the Government's Strategic Energy Efficiency Policy by endeavouring to:

- minimise energy consumption, its carbon footprint and demand; and
- achieve enduring cultural change in carbon reduction management across the entire organisation.

Business-as-usual scenario

Air-conditioning accounted for 60 per cent of the total energy consumption at North Ward Health Campus. The single air-cooled chiller in operation was in good condition and still had many years' life left in it. Its condenser and compressor could operate on either full or partial load.

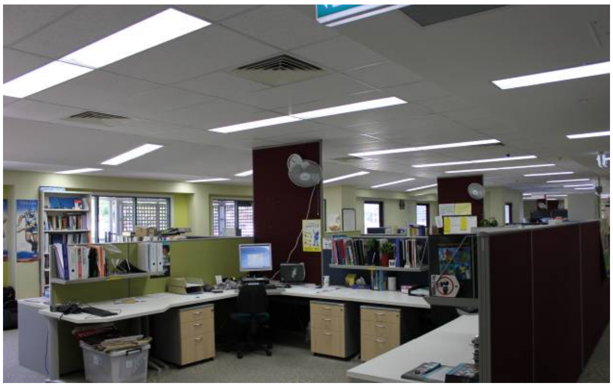
The Health Campus's 546 light fittings were a mixture of T8 tri-phosphor and compact fluorescents of varying wattage. Some of the T8 lamps were recessed and side by side, with no air gap, thus increasing heat gain and reducing the life of the tube. About half the T8 lamps were expected to fail prematurely.

After-hours switches had been installed in some parts of the building to conserve energy.

Demand management solution

The energy audit identified a number of Energy Conservation Measures (ECMs) including:

- installation of an Energy Management System to optimise air-conditioning unit compressor operation
- installation of a Refrigerant Management System to increase the efficiency of the air-conditioner chiller condensers
- installation of vents in the plant room to aid ventilation and removal of the attenuators from the chiller
- retro-fitting high-energy efficient 15 and 8-watt LED lighting to replace the bulk of the 36 and 18-watt tri-phosphor fluorescent tubes and 50-watt dichroic downlights
- replacing two 36-watt recessed T8 tubes in hallway lights with one 36-watt recessed LED tube, and
- kVA adjustment (from 0.80 to 0.918 as measured by Queensland Health and validated by McClintock Engineering Group).



Energy-efficient lighting has brightened office areas and hallways.

Results

Measurement and Verification (M&V) Results Table			
	Business as usual	Post-ECM implementation	Savings / annum
Demand (kVA)	259	191	26%

The demand savings were measured and verified by an independent certifier after making a baseline adjustment for additional renal units and air-conditioning units installed after installation of the above ECMs.

The M&V report confirmed that Queensland Health reduced demand by 69kVA, well above the expected demand reduction of 43kVA.

Assumed benefits of LED lighting

- high lumens per watt i.e. 90
- long lifecycle i.e. 10 years guaranteed
- significant range of colour temperatures
- 3% depreciation over life cycle
- ability to retro-fit existing fittings
- only slight reduction in lumen output over conventional T8 tubes
- significant energy reduction
- good air-conditioning reductions due to reduced heat load
- nil maintenance in most cases
- environmentally responsible, i.e., no toxic materials to be disposed of
- proven technology with NATA accreditation
- ease of installation
- easily dimmable (same as conventional lighting)
- instant re-strike
- first-class uniformity
- high power factor of 0.95

Cost

Queensland Health invested $104,000 on the energy efficiency measures.

Ergon Energy paid a capped incentive payment of $10,000 on the delivery of demand savings of 69kVA.

Bonus outcome

The amenity of North Ward Health Campus areas retro-fitted with energy-efficient lighting improved immediately to the degree that staff 'thought' the areas had been freshly painted.

Increased electrical efficiency is critical to the health campus's future sustainability. The initiatives have demonstrated their ability to deliver both demand reduction and energy savings, adding confidence that demand stability can be achieved.

Partners

Opportunity Evaluation: Eco Efficiency Experts Australasia Pty Ltd
M&V: Energy Decisions
kVA Adjustment Validation: McClintock Engineering Group

Customer testimonial

'The energy management initiatives installed during this project have improved the operational environment of this facility for the benefit of the staff, patients and visitors whilst also producing significant improvements in the buildings operational efficiency in an environmentally sensible manner,' said Michael Ward, Engineer, Building Engineering and Maintenance Services, at Townsville Hospital.

Future initiatives

Upgrade to building management system controls to improve air-conditioning system efficiency and replacement of electric hot water system with solar (now complete).

Network Demand Management Case Study– Royal Flying Doctor Service Townsville Base

June 2011

Toward Q2 Tomorrow's Queensland | Queensland Government | Royal Flying Doctor Service Queensland Section | Ergon Energy

Royal Flying Doctor Service QUEENSLAND SECTION

ERGON ENERGY

Network demand Management Case Study - Royal Flying Doctor Service Townsville Base

Key Challenge:
The Royal Flying Doctor Service (RFDS) Townsville Base wanted to be a good environmental citizen. It was, however, keenly aware that it was essentially a small aviation business and, in flying aircraft, was responsible for greenhouse gas emissions.

RFDS Base Townsville is an original block construction building with a steel hangar

RFDS Townsville also wanted to maximise the funds spent on providing core services by minimising its electrical spend.

Bonus Outcome
The Townsville Base served as a pilot site for energy conservation and demand management initiatives, proving their business benefit for all eight RFDS bases across Queensland.

As a result of its participation in Ergon Energy's Townsville Network Demand Management Pilot, the Townsville Base also initiated and took the lead in drafting the organisation's first Environmental Policy, which is now being implemented statewide. Consequently, having an Environmental Policy has helped put RFDS Queensland on the front foot when competing for contracts with State and Federal Government, which increasingly require its service suppliers to address environmental management.

The aviation team's participation in the local project also led Townsville Base to re-examine flight planning procedures relating to the optimum altitude flight levels in order to reduce consumption of aviation fuel. Interim results are looking promising.

In total, RFDS Townsville Base has taken leadership in demonstrating that aviation businesses can take action that leads to improved environmental management.

Improved lighting at the nurses' dispatch station.

Insulation in the ceiling cavity.

Measurement and Verification (M&V) Results Table			
	Business as usual	Post EMC implementation	**Savings / annum**
Energy consumption (kWh)	56,396	38,477	**31.8%**
Demand (kVA)	16.09	9.4	**41.6%**
Greenhouse gas emissions (tonnes)	57.5	39.2	**18.3 tonne**
Operating & maintenance costs	$10755	$8730	**18.8%**
Capital cost ($ or %)		$8180*	
Payback period (years)	2 years		

* This dollar figure includes in-kind donations

Energy Management Plan overview

Given budget constraints, RFDS Townsville Base committed to potentially reduce demand by 10kVA through a range of simple and relatively inexpensive modifications to the office environment and staff behavioural change.

Ergon Energy agreed to pay RFDS up to $2300 on delivery of that commitment after the demand reduction was independently measured and verified.

Background

RFDS is a not-for-profit organisation dedicated to providing critical medical support to anyone living, working or traveling in rural and remote Queensland. Its iconic emergency retrieval service operates 24 hours a day, seven days a week. Last year, RFDS Queensland provided health care to more than 70,000 Queenslanders – that's one patient every seven minutes.

RFDS Townsville Base was established in 1996 to provide aeromedical retrievals and inter-hospital transfer services covering an area from Mackay to Cairns and west to Richmond. Often, however, it is called on for emergency flights in and out of Horn Island, Mount Isa and Brisbane. Townsville Base operates two Hawker Beech Super Kingair aircraft and in 2009-10 flew almost 1 million kilometres, conducting general practice and health clinic services and transporting 1664 critically ill patients. Townsville Base has 22 staff, including seven pilots, two doctors, 11 nurses and two administration staff.

LED lighting brightens the office areas.

RFDS Townsville Base owns its office and hangar space on land leased from the local airport. The office building is of original block construction with no insulation. It is adjoined by a steel hangar. The building is cooled by a number of 2-4kW domestic split-system air-conditioning units.

RFDS Townsville Base operates 24 hours a day, with three 12-hour shifts. The offices are open Monday to Friday from 8:30am to 5pm.

Business as usual scenario
To continue business-as-usual operations, RFDS Townsville would have to spend an increasing amount of its limited funds on electricity bills.

In 2010, its annual electricity bill was estimated around $11,200 utilising the business Tariff 20.

The main energy consumers in the building were air-conditioning, lighting and a steriliser unit.

The lighting solution employed T8 tri-phosphor fluorescent tubes, of which 50% would fail prematurely, adding to maintenance costs.

Demand Management solution
An energy audit of the premises identified opportunities to reduce energy consumption by 28 per cent. However, RFDS was not in a position to invest in all the recommended Energy Management Concepts (EMCs), instead prioritising concepts according to value for money.

Initiatives undertaken included:

- insulating the roof cavity to reduce air-conditioner use
- installing a heat pump and retiring the electric hot water service
- replacing 20 36-watt T8 tri-phosphor fluorescent tubes with high-efficiency LED lamps
- switching off the steriliser unit when not in use, that is, reducing use from 24 hours to an average three hours a day
- optimising natural ventilation opportunities in cooler months by opening doors and windows
- maintaining air-conditioner compressors, filters and fins to ensure optimal performance, and
- encouraging staff behavioural change.

Results
RFDS Townsville Base reduced consumption by 31.8% (17,920 kWh) and demand by 41.6% (6.7 kVA) through implementing the above energy management concepts. In addition, it has reduced its daily electricity cost by 18.8%.

Cost
RFDS Townsville base invested less than $5000 in energy efficiency initiatives. The labour to install the roof insulation and heat pump were donated by local suppliers. The LED lighting was donated by Ergon Energy as RFDS's major corporate sponsor.

Ergon Energy made an incentive payment of $1541 on delivery of a demand reduction of 6.7kVA.

Partners
Heat pump and insulation supplier: Allsafe Energy Efficient Products
M&V: Energy Decisions

Customer testimonial
"While I started initially talking about reducing emissions and helping save the environment, and Ergon Energy was talking about managing demand, we found we were working on the same agenda just using different language. At the end of the day it's about business sustainability as much as anything else," said RFDS Base Manager David Mowat.

RFDS Townsville Base has since installed timers on its apron flood lights.

Future initiatives
RFDS Townsville Base is installing a timer on the hangar and apron flood lighting to automatically switch lights off after emergency flights have departed.

In June, a 1.5kV solar array will be fitted to the roof of the building, thanks to a State Government grant (In late 2011, it was advised that this had been done).

Building plans for a new RFDS base at Mount Isa have been peer reviewed by Ergon Energy to ensure maximum energy efficiency within the building designs.

Network Demand Management Case Study – Good Shepherd Nursing Home

June 2011

Toward Q2 Tomorrow's Queensland

Queensland Government

ERGON ENERGY

Network Demand Management Case Study – Good Shepherd Nursing Home

Key challenge
The Good Shepherd Nursing Home was nearing its electricity capacity with plans to construct a new chapel and an additional residential wing of 1500 square metres of air-conditioned space in the next five years.

The Good Shepherd Nursing Home.

Already, air-conditioning accounted for 60 per cent of the home's electricity spend. The home needed to drive down air-conditioning costs and become more energy efficient while also allowing for expansion.

In addition, the existing air-conditioning plant was piecemeal with three separate chilled water systems varying in age and efficiency and no cooling redundancy, which is critical for an aged care home to deliver comfortable conditions year round.

Bonus outcome
The Good Shepherd Nursing Home is expected to have the electrical capacity to power and air-condition an additional 1500 square metres of living space with no upgrade to its electricity network. As well, the cost of the future building program will be reduced as the air-conditioning infrastructure is already in place.

Additionally, the home is now in a position to pursue an opportunity to become a showcase aged care facility for energy efficiency and solar energy in tropical Queensland.

The upgrade of the air-conditioning system consolidated the existing systems into one high efficiency plant, with expansion and redundancy built in to the design.

Measurement and verification (M&V) results table			
	Business as usual (2007)	**Post EMC implementation**	**Savings / annum**
Energy consumption (kWh)	3,069,416	2,451,309	**20.14%**
Demand (kVA)	873	696	**20.34%**
Greenhouse gas emissions (tonnes per annum)	3130	2500	**630**
Operating & maintenance costs	$391,000	$325,000	**$66,000**
Capital cost (over 25-year life cycle)	$24,690,000	$17,030,000	**$7,680,000**
Payback period (years)	3.5		

Energy Management Plan overview
The Good Shepherd Nursing Home instituted a number of smart Energy Management Concepts, including upgrading its air-conditioning plant to a high energy-efficient Central Chiller Plant with base load Thermal Energy Storage.

Ergon Energy assisted the home by offering an incentive payment for its commitment to reduce demand on the network by potentially 175kVA.

Background
The Good Shepherd Nursing Home is an aged care facility comprising 13 residential, staff and service buildings with a total air-conditioned floor space of 10,200 square metres. The home is situated in tropical Queensland and requires year-round cooling and dehumidification to maintain a comfortable living environment for its elderly residents.

The home had plans to add an additional wing of 1500 square metres of air-conditioned space in the next five years, which would have necessitated installing a new transformer on site.

Business as usual scenario
Air-conditioning was consuming some 60 per cent of the home's electricity spend.

All air-conditioning plant were air-cooled and comprised a mix of three chilled water systems and multiple DX ducted and split systems of varying age and energy efficiency. Air-cooled plant typically is relatively inefficient during hot weather and the chilled water plant had a history of poor reliability. Maintenance costs were high due to multiple plant spread across the entire site.

Thermal Energy Storage tank (at bottom right) with air-handling units above.

Benefits of central chiller plant:

- lower air-conditioning energy usage, higher reliability and lower maintenance costs
- expandable air-conditioning system
- significant maintenance, operating and capital cost savings over the next five years
- reduced electrical cost through reduced consumption and access to non-peak tariffs
- reduced environmental impact due to smaller refrigerant charges, lower energy usage and better control over water use
- reduced land footprint required for central chiller plant as opposed to multiple chiller and DX plant
- reduced plant replacement cost due to refurbishment of aged pipework serving existing buildings
- reduced capital cost for constructing new buildings
- longer plant economic life cycle
- reduced noise levels
- built-in redundancy
- reduced site electrical infrastructure, and
- ideal part-load operation.

There was no spare or standby capacity in the air-conditioning systems, posing a real concern in the event of a failure given the home's aged population.

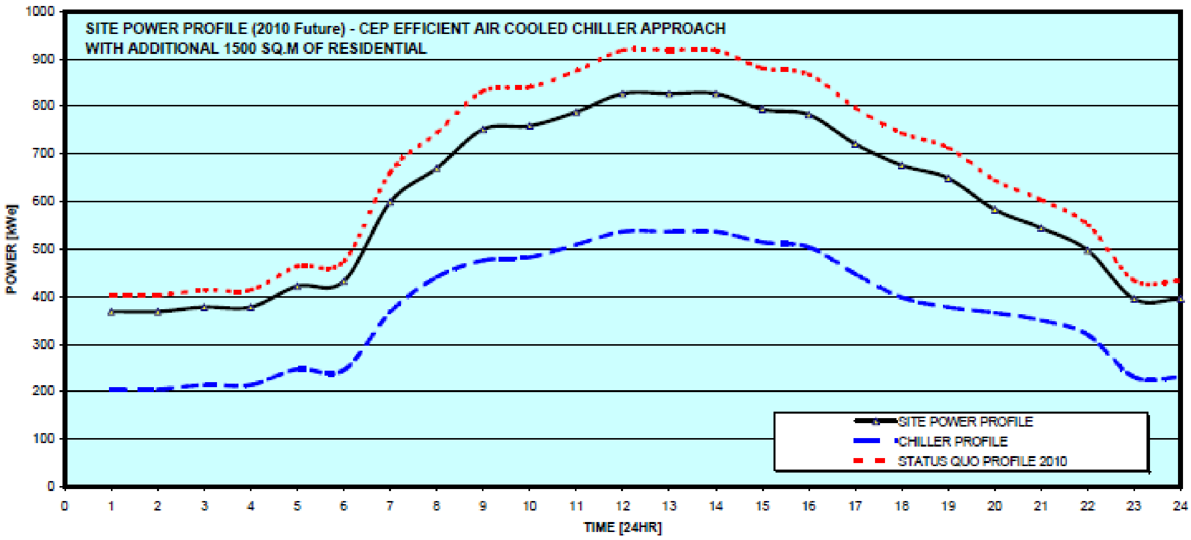
Some of the split-system air-conditioners were nearing the end of their life and would need to be replaced.

On forecasts, the site's electrical demand would exceed the capacity of the 1000kVA transformer (with a power factor of 0.8, that is, 80 per cent utilisation of energy to the site) by 2010, with load increasing from the current 735kW to 915kW.

Demand management solution

Retire all air-cooled plant and replace the three chilled water air-conditioning systems with one modern Central Energy Plant (CEP) with a Thermal Energy Storage (TES) tank to meet all cooling requirements of both existing and planned buildings. Distribute the chilled water across the entire site by re-using the existing chilled water pipework where possible and adding new reticulation pipes as required.

The life cycle cost of the demand management solution equated to a cost saving of approximately $7.68 million over 25 years against the business-as-usual scenario.



Graph 1: The estimated site power profile for 2010 with the Central Energy Plant and low load Thermal Energy Storage, showing a reduced power profile (black line) as opposed to the business-as-usual profile (red dotted line).

Results:

The Good Shepherd Nursing Home exceeded expectations, reducing demand by 178kVA.

Cost:

The capital cost of installing a Central Energy Plant with a low load Thermal Energy Storage tank was $1.4 million, as opposed to a business-as-usual solution of $1.43 million.

Ergon Energy paid the Good Shepherd Nursing Home $40,000 for delivering a demand savings of 178kVA.

Partners:
MGF Consultants (NQ) Pty Ltd
Design engineer: Craig McClintock
M&V: Energy Decisions

Customer testimonial: “Our consumption is definitely down and we have achieved 95 per cent of the goals we set to improve our electrical efficiencies,” said Chief Executive Officer Brian Matthews. “We are likely to add another wing to the home within the next five years. The energy savings will allow us to power the new wing without having to put in a new transformer at considerable cost.”

Future initiatives:
Good Shepherd Nursing Home has begun painting its extensive roof area with heat reflective paint.

It also has attached a DIY solar heating system to a disused 4000-litre water tank to preheat water used in the laundry and kitchen dishwasher by an additional 6°C, which allows the gas hot water systems to operate without the use of electric boosters. This $700 DIY solution is saving the home some $12,000 a year in energy costs.

Good Shepherd Nursing Home is considering the financial viability of installing a 30 kilowatt solar array on the roof and continues to monitor the option of upgrading to LED lighting where suitable.

Chilled water is used to air-condition the home’s large laundry, saving a significant amount of energy over conventional DX air-conditioning.

The temperature on the near roof painted with heat-reflective paint is 18° cooler than the far roof yet to be painted.

The DIY solar water heater uses pool blankets coiled on the rooftop.