Internet of Things in Strata

POINT OF VIEW

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WATTBLOCK

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Overview

> *The definition of the Internet of Things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of Things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", covering devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances).*
>
> Wikipedia

At the start of the new decade in 2020, residential strata schemes have installed the following technologies into common areas:

- electricity monitoring devices (common area meters & individual apartment meters)
- water meter monitoring devices
- smart irrigation systems for gardens using wi-fi to connect to local weather stations
- Sensors in carparks to measure carbon monoxide levels and turn on ventilation fans
- Solar monitoring systems which measure solar production
- Electric vehicle charging stations with cloud-billing platforms
- Emergency lighting systems where emergency lights report compliance via an app
- Carpark entry networked lighting systems
- Smart thermostats
- Blockchain energy trading

This whitepaper will explore each of these “Internet of Things” technologies which have been installed into residential strata schemes. The purpose is for a strata committee member, strata manager or facilities manager to understand the technologies and be able to evaluate if they are of benefit to the particular apartment building or complex.

It is inevitable that more “internet of things” technology will be installed into residential strata schemes in the next decade as buildings become more connected.

However, it is important to evaluate the priority of installing this technology and determining when it will actually add significant value to the apartment block, from a safety, cost-saving or convenience perspective.

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Electricity Monitoring Devices

Why would a strata scheme install on a common area meter?

Many strata schemes have a common area electricity meter which has been upgraded to a Smart Meter. However, many older strata schemes in NSW still have an analogue electricity meter for the common areas. Even Smart Meters may only take an electricity reading every 15 minutes to 30 minutes. Higher resolution electricity monitoring devices can take electricity meter readings as quickly as every 5 seconds and can be installed next to either a smart meter or analogue common area meter. This can allow strata committee members to log into a website and view the consumption of their common areas.

This can be used to detect sudden spikes in electricity consumption (e.g. a faulty ventilation fan or pool heater) or determine if a tradesperson (e.g. fire compliance) left equipment on the wrong settings after their visit to the building. The devices can be used to detect billing errors from energy companies who may be using “estimated meter reads” instead of actual meter reads. From a futureproofing perspective these devices can be used to help prepare the building for a solar system through better estimating the correct size of the solar system or working out how many electric vehicles could charge simultaneously in the building without causing a capacity problem. The data from these devices can also assist consultants to work out better energy saving strategies for the building e.g. shifting the time of ventilation fans running or determining if an existing solar system is working correctly. These devices are also useful if the building wants to participate in demand/response programs. These are programs where a building can offer to allow a grid provider to turn off key assets e.g. air conditioning, during times of peak load on the grid, in return for compensating the building.

The connectivity for data to be retrieved from these devices can be wi-fi or using existing mobile phone telecommunication networks. Most strata schemes do not have a house “wi-fi” account which means most of these systems use a mobile phone data plan to send the data into the cloud.

There are a range of different devices which collect the data through “pulse” which is using an optical sensor to read a flashing light on a smart meter through to clamping with a CT clamp on the actual electricity cable connected to the meter.

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Water Monitoring Devices

Most strata schemes constructed prior to 2016 do not have individual cold water meters for each apartment, which can be a perilous situation where there are a lot of tenants living in the building. Most strata schemes constructed prior to 2016 do have a hot water meter for each apartment, when apartments are served hot water from a common hot water plant.

Why would a strata scheme install water monitoring device?

In strata, water monitoring devices are most commonly installed on the head water meter for the building, at the point at which water first comes in off the street. The main idea is to identify base-load leakage – e.g. water leaks which never stop and continue 24 hours a day.

If a water monitoring device is installed for 1 or 2 weeks, it is possible to see if water in the building use drops to nothing at 3am in the morning. If it never drops, there is a possibility that there are leaking pipes, dripping garden taps, a leaking tradesperson toilet, leaking ball joints on common hot water system etc If the building doesn't have cold water meters for each apartment, an individual apartment with a leaking showerhead, tap, toilet or isolation valve can be responsible for the base load leakage for the whole building. There have been examples of a resident having a leaking toilet and going overseas for an entire year and the rest of the owners in the strata scheme paying for the leaking toilet inside an apartment via their strata levies.

In some inner-city high-rise, water monitoring tags which use radio frequency to communicate with a radio base station, have been installed on cold water meters into every one of 271 apartments in the building. Total water consumption across all apartments in the building dropped by 37%. One individual apartment owner noticed their individual water bill go down 87% after the monitoring equipment was installed, the leaking apartments identified and fixed.

In a drought-stricken country, the water savings that can be achieved in residential strata schemes through introducing the ability to measure water consumption in individual apartments for the first time is nothing short of phenomenal.

Smart Irrigation Systems

Where an apartment building does have a garden, there can be a large investment of both money and volunteer residents time in maintaining it. During times of water restriction, this means the garden can wither.

Why would a strata scheme install wi-fi irrigation systems?

Some strata schemes currently have irrigation sprinkler/drip systems. If these existing systems are on a timer, then they come on and water the garden at the same time every day. However, through installing a wi-fi connected irrigation system on the tap, the irrigation system can be made smart. Through the internet it can connect to the nearest weather station. If there has been rain or rain is forecast in the future, then the irrigation system doesn't water the garden. For example, an irrigation system which might be scheduled to come on and water the garden every second day, might actually go 14 days without watering at all, if there has been sufficient precipitation.

This is a water saving which saves money for all owners in the strata scheme.

These devices can be installed on different taps, which are within range of wi-fi. Where the strata scheme doesn't have its own wi-fi connection, a resident with a nearby balcony or courtyard can install the receiver device on one of their private power points. The system can then use a tiny amount of the individual owner's internet plan for communicating with the nearby weather station.

More than one committee member can download the smartphone app. This allows more than one person to be able to change the watering schedule, remotely… even when they are not physically present at their strata building. A notification can be received on the individual's smartphone that each watering cycle has been completed. Different "zones" can be setup with different watering cycles for different parts of the garden, as appropriate.

While a couple of these items are not palatable to all owners (sharing their personal wi-fi), remember that in residential strata schemes there is often a volunteer ethic which comes along with maintaining common area gardens. These are the people who the committee can empower with wi-fi irrigation.

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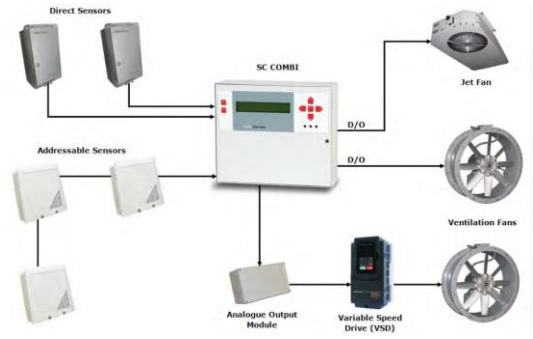
CO Sensors for carpark fans



Why would a strata scheme install a CO Sensor on its carpark ventilation?

Carpark carbon monoxide ventilation systems are regulated under AS1668.2 and AS 3666.2-2002 – Air handling and water systems of buildings – microbial control. Newer apartment blocks are installed with CO sensors, which detect the level of carbon monoxide before turning on the extraction fans. However, many old strata schemes have these large, ageing ventilation fan systems running on timers e.g. 2 hours in the morning and 2 hours in the evening, every day of the year. In some cases, residential strata schemes have the fans running continuously, 24 hours a day.

In either of the latter two cases, where the carbon monoxide ventilation system exists and it is running on a timer or continuously, further energy savings can be made through retrofitting smart technology. CO sensors can be installed at various locations through the carpark. If the sensors detect that the CO levels have risen beyond a safe limit, they can automatically turn on the exhaust fans. The CO sensors will continue to monitor the air quality while the fans are running and once a safe level is detected, they can send another signal to turn off the carbon monoxide ventilation fan.

This type of system is compliant to the standards which residential strata schemes have to maintain. They are also much more efficient. In a two level carpark, the carbon monoxide ventilation system might only trigger once a fortnight and run for a maximum of half an hour.

The CO sensor systems can be integrated into the fire compliance cabinet in residential strata schemes to provide integrated reporting across fire compliance assets.

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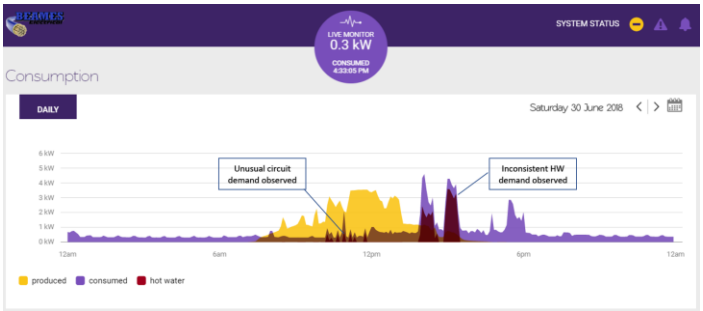
Solar Monitoring Systems



Why would a strata scheme install a real-time solar monitoring system?

About 1% of residential strata schemes have a solar photovoltaic system, mostly providing power for the common areas. A couple of early adopter apartment blocks have a battery system. Most of these solar systems do not have a real-time monitoring system installed.

Solar systems can easily “trip off”, which means the strata scheme is not getting its savings from solar generation. There are cases where this has gone for months, without anyone knowing that the solar system isn’t working.

There are often situations where leaves, debris, dust, bird droppings can accumulate on the panels and reduce their performance.

Solar inverters, which convert the DC power generated on the panels back into AC power can also develop faults. This is a critical piece of infrastructure which keeps the solar savings going.

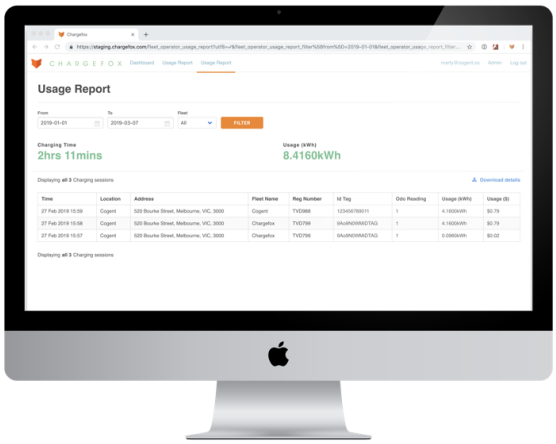
The alerts which can be received via a smartphone app connected to a solar system, can notify a residential strata committee member that solar production has ceased, has dropped or that there is another problem which needs investigation. This could be an electrical fault, which might even have a fire safety angle to it.

The modern solar monitoring systems measure:

- energy consumption from the grid
- solar generation
- exports of solar electricity into the grid
- exports of solar electricity into batteries
- discharge of energy stored in batteries into the common areas

This is some of the most “state of the art” internet of things technology which has been installed into residential strata buildings.

Electric Vehicle Charging Cloud-billing



Why would a strata scheme install an electric vehicle charging cloud-billing system?

Electric vehicles are coming to residential strata schemes faster than ever, following the release of the Tesla Model III. The actual charger which comes with Tesla vehicles is a 'dumb' charger, which doesn't have any functionality beyond connecting the vehicle to the nearest electricity source. For example, it doesn't measure how much electricity is consumed in each charging session.

Smart charging systems are now available from 3rd party vendors. These are important in a residential strata context, where the electric vehicle is charging off common power and this amount of energy needs to be metered and billed.

A smart charger itself, can be an Internet of things connected device, with its own wi-fi connection or 4G connection. There are also 'communication hubs' which can be installed in a strata building's switch room or comms room, which smart chargers can connect to via radio communications. These hubs are then connected via wi-fi or 4G in order to send data up into the cloud.

A cloud-billing system can then issue invoices to individual residents, specifically for the common area power which they consume when charging up their electric vehicles and collect payment for this through the internet, without burdening the strata committee, building manager or strata manager.

It has proven that equity amongst all owners is an important consideration as there are no petrol bowsers in our strata carparks providing fuel to internal combustion engine cars.

These electric vehicle charging cloud billing platforms can also communicate with smart chargers from different manufacturers, provided that they comply with the Open Charge Point Protocol (OCPP).

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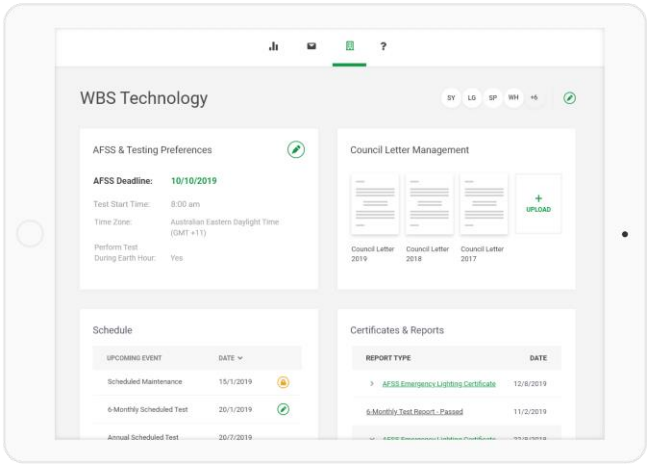
Emergency Lighting systems with online compliance reporting



Residential strata schemes need to comply with: AS2293.1-2005 Emergency Escape Lighting and Exit signs for Buildings – System Design, Installation and Operation and AS2293.3-2005 Emergency Escape Lighting and Exit Signs for Buildings – Emergency Escape Luminaries and Exit Signs

At present, residential strata buildings have a fire compliance audit annually, which involves dropping power to common area lighting for a “90 minute” test, and then having a human being walk through all the common areas checking that all the emergency battery backed up lights are still working. This includes running man exit lights and normal lights which have an emergency battery in them. If an emergency light has failed, then it is manually annotated into a report, which is sent to the strata committee to review. The strata committee then instructs either the fire compliance company or their resident electrician to replace the faulty lights.

In the current state, there are often issues with the original fire compliance report accurately describing the location of the emergency lights which needs to be replaced, sometimes leading to the wrong lights being upgraded. The costs of fire compliance audits have escalated over the years and a number of strata schemes are finding that their fire compliance costs are very high.

Some strata schemes have now installed emergency lights which are in a radio network with each other and can automatically self test and send a report on whether they are working or not. These emergency lighting IOT networks also communicate with the cloud. This allows an emergency lighting report to be automatically generated from a website dashboard and letters to be automatically generated for the local council, where required.

Having emergency lights in fire stairs in a communication network also has additional benefits. When someone enters fire stairs on one particular floor which has dimmed down LED lighting, the light will flare up to full strength and also send a signal to the lights one floor above and below in the fire stairs, telling them to flare up to full strength, as it is likely someone is coming through shortly.

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Carpark entry lighting system with wireless network

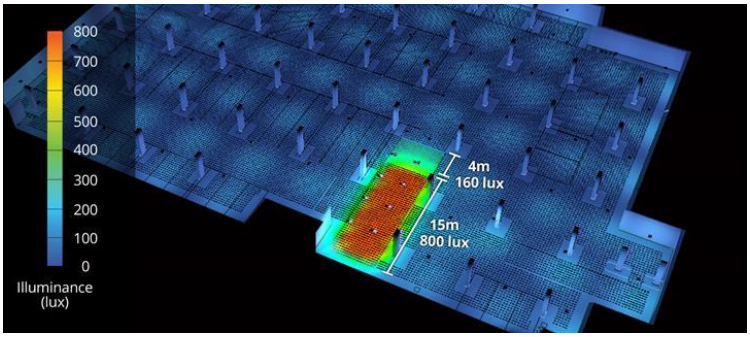
Why would a strata scheme install a carpark entry lighting system?

This is a project which many strata schemes need to do to achieve AS1680 compliance. AS1680 specifies a lighting level of 800 lux for the first 15 meters of a car park entrance during the day and 160 lux at night, followed by 160 lux for the next 4 meters at all times. This helps transition the lighting level upon entry and exit and reduces the effects of blinding on the driver.

Strata schemes can potentially face large litigation claims if accidents occur at carpark entrances or exits where poor lighting has contributed to the accident. e.g. a child riding a bicycle is hit by a driver as he or she exits onto the street. In addition to the people safety perspective, strata schemes are also paying far too often to fix roller doors and gates which are hit by exiting vehicles. In one case in Chatswood an NRMA vehicle, which had been attending to a residents car inside the underground carpark, hit the garage door as it was exiting creating $2,000 of damage.

A carpark entry lighting system has a photoelectric sensor installed outside to measure the ambient light at different times of day. This sensor system then communicates to the lights installed inside the carpark perimeter, increasing their brightness to 800 lux during daytime and then decreasing their brightness to 160 lux during the night time.

The lights installed in the first 19m inside the carpark can be installed in a communications network with each other. The communications network is smart enough to only increase the brightness of the lights within the first 15m zone during the day time, while leaving the lights in the next 4m zone at 160 lux through both day and night.



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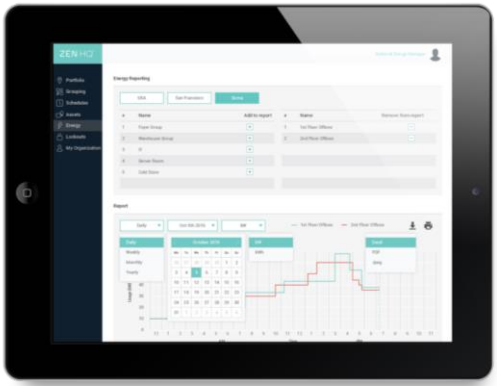
Smart thermostats

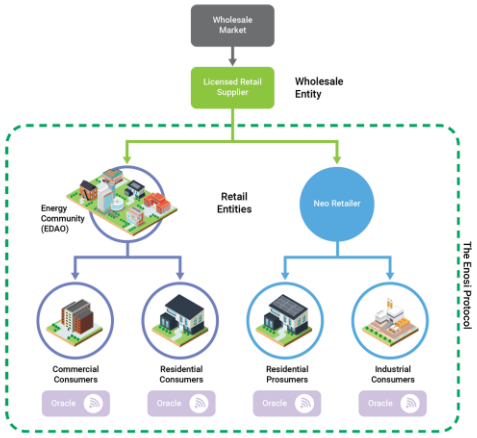


Smart thermostats are thermostats that can be used with home automation and are responsible for controlling a home's heating and/or air conditioning. They perform similar functions as a Programmable thermostat as they allow the user to control the temperature of their home throughout the day using a schedule, but also contain additional features, such as sensors and Wi-Fi connectivity, that improve upon the issues with programmable thermostats.

Like a connected thermostat, they are connected to the Internet. They allow users to adjust heating settings from other internet-connected devices, such as a laptop or smartphones. This allows users to control the thermostat remotely. This ease of use is essential for ensuring energy savings: studies have shown that households with programmable thermostats actually have higher energy consumption than those with simple thermostats because residents program them incorrectly or disable them completely.

ARENA, the Australian Renewable Energy Association, selected Zen Ecosystems for a Demand Response trial. This includes incentives being paid to reduce air conditioner use during periods of peak demand on the electricity grid.

Blockchain energy trading for solar and batteries



Why would a residential strata scheme implement blockchain energy trading?

Residential strata schemes solar/battery energy trading were an original case study made famous by Jemma Green of Curtin University and stimulated the creation of Power Ledger, one of Australia's first blockchain companies. This technology has been trialled at White Gum Valley and more recently integrated into the De Havilland development in the eastern suburbs of Perth.

Since the original case studies from Power Ledger, WePower ran a blockchain energy trading trial in South Australia and another Australian startup, Enosi entered the blockchain energy trading space. AGL also ran a trial of trading excess energy from solar systems amongst some of their residential customers in South Australia, using traditional database technology, rather than blockchain technology.

One of the limiting factors for apartment blocks to implement blockchain energy trading has been the need to implement an embedded electrical network first. Many residential strata schemes in NSW and Victoria have found it very difficult to retrofit an embedded electrical network as the precursor to blockchain energy trading.

The smart meter data is collected and put into the cloud, to enable this type of trading. The benefit is that individual residents, or the strata scheme as a whole may be able to get more money for excess solar fed into the grid. This amount of compensation may be higher than the amount which is achievable through the existing energy contract with an energy retailer which has a feed-in tariff of 6c - 20c per kW.

This is an embryonic technology, which is likely to remain at pilot/trial level for residential strata schemes in 2020.

Conclusion

The term Internet of Things is now 21 years old. There was a high level of excitement about the possibilities of Internet of Things in 2014 as devices and sensors started becoming smaller and cheaper to produce.

Now that the market has had a chance to digest different pieces of internet-connected hardware and software, there are useful applications of IOT for residential strata buildings emerging.

Not all apartment blocks need all the Internet of Things devices listed in this article. Some of the applications, such as blockchain energy trading, are probably only ready for early adopters or are more suited to being installed during development of the apartment block.

Other technologies such as electricity/water monitoring devices are expected to become mainstream in the near future as they are mature products, some of which have been through multiple product iterations over a dozen years.

The recent water restrictions due to drought conditions have seen a high uptake of wi-fi connected irrigation systems when connected to a drip watering system. Governments have made special allowance for this type of device to be permitted to be used.

Over the course of 2020, we expect to see further innovation in the connectivity of smart thermostats into existing building management systems which are used by higher end buildings.

Most residential strata schemes are not high-rise and do not have building management systems. This means these point solutions using IOT technology, will actually become the backbone of small to medium apartment blocks becoming "smart buildings" and connecting to the internet for the first time.

Who is Wattblock?

Wattblock was co-founded by Brent Clark, Ross McIntyre and Charlotte Yarkoni (muru-D Pty Ltd) in 2014. They are joined by Jacky Zhong and Wilson Huang solar engineers, Peter Langley industry analyst and a team of interns from UNSW.

What is Wattblock's mission?

The energy wasted in Australia's strata buildings has a bigger impact on carbon emissions than the cars driving on the roads. Wattblock aims to **crowdsource** the achievement of Australia's national carbon emission reduction target.

How many strata buildings has Wattblock assisted?

Wattblock has assisted approximately 1,000 strata buildings across Australia with energy reports. Wattblock has also directly project managed the upgrade of 100 buildings with LED lighting, solar, ventilation and hot water. To date it has identified over $25m of annual energy waste across townhouses to high-rise residential skyscrapers. Over 140 strata buildings have participated in electric vehicle recharging studies.

Who is partnering with Wattblock?

Jobs for NSW, Advance Queensland, North Sydney Council, Microsoft CityNext, Telstra's muru-D, UNSW Entrepreneurship, Griffith University, University of Queensland and Queensland University of Technology.

Who is covering Wattblock in the media?

SBS, North Shore Times, Foxtel, BRW, The Australian, Business Insider, Computerworld, StartupSmart, StartupDaily, LookupStrata, Technode, Fifth Estate, One Step Off the Grid, Renew Economy, Inside Strata, Beyond Zero Emissions, Your Strata Property Online, Impakter, Telstra's Behind the Mic.

Wattblock Awards

Innovation of the Year - Strata Community Australia (NSW), Best Social Change Entrepreneur 2015 (Start-up Smart) Energy Winner at 1776 Challenge Cup Sydney, CeBIT Community Support Finalist (2015).

Who is backing Wattblock?

Wattblock has received investment from muru-D as part of Telstra's startup accelerator program, Eastern Hill Investments, an Asian-based environmental engineer, a UK-based energy company consultant, a U.S.-based hi-tech investor, a NZ sustainability funds manager, a Sydney-based environmental impact investor, a Sydney-based clean tech consultant, a Sydney-based clean technology finance consultant and an innovation laboratory research director.

Where is Wattblock located?

Wattblock is based at Michael Crouch Innovation Centre at UNSW in Sydney.