

EFFICIENCY

Driving improved efficiency
and environmental benefits

EASTLINK – Melbourne, Victoria

Seventy per-cent energy savings, and
noise reduction with Schneider Electric's
EcoStruxure™ solution.

#WhatsYourBoldIdea

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Life Is On

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East of Melbourne in Victoria's greenbelt, the EastLink freeway connects around 250,000 vehicles each day to the Eastern, Monash, Frankston and Peninsula Link freeways. The 40 kilometre road network is the largest privately operated freeway network in Victoria, and is a leader in transport sustainability. EastLink has the lowest toll prices in Australia, 480 hectares of landscaping, 4 million native trees, shrubs and plants, more than 60 wetlands that treat road surface rainwater run-off before it is released to local waterways, and the EastLink Trail – 35 kilometres of shared use path, distinctive public architecture and public artworks.

Defining features of the freeway are the twin 1.6 km tunnels which protect the environmentally sensitive Mullum Mullum Valley above. The tunnels are each three lanes wide and reach a maximum depth of 53 metres underground. Up to 115,000 vehicles drive through the EastLink tunnels in a single day. The tunnels run a ventilation system to remove vehicle emissions from the tunnel space and disperse the emissions safely into the atmosphere. Using fans, the system draws in fresh air and removes the exhaust air from the tunnel via ventilation stacks at either end.

Auditing the energy usage of the tunnel system in 2014, Schneider Electric identified areas where significant energy savings could be made. Working directly with EastLink they recommended a solution which could save them more than \$400,000 annually, and also significantly reduce audible noise levels from the ventilation stacks.

The Challenge

The original tunnel ventilation system, commissioned when EastLink opened ten years ago, was designed to expel 100% of tunnel air, including pollutants from vehicles' combustion engines, through two 45-metre high ventilation stacks. The ventilation system has 24 smaller jet fans which are located within the tunnels to control air flow direction, minimising a piston effect caused by traffic movement in the tunnel, and ten axial larger, 275kW, 690vAC, ventilation fans in the ventilation stacks to draw air up from the tunnels for expulsion at the stack tops.



Goal

Improve the ventilation system of the EastLink freeway tunnels for better energy efficiency and a reduction in noise levels from the ventilation stacks.

Story

The EastLink freeway tunnels run beneath the environmentally sensitive Mullum Mullum Valley. As such ventilation of vehicle emissions in the area required special attention.

Solution

An on demand ventilation system using Schneider Electric EcoStruxure architecture, M580 ePAC, Altivar VSDs, Citect SCADA system.

Results

- A reduction in energy usage of 70% and a carbon footprint reduction of around 9,000 tonnes per annum.
- Significant reduction in the noise levels emitted by the ventilation system.

Since the opening of EastLink, the speed of airflows within the tunnels and stacks was controlled in a traditional way - by switching individual fans on and off at pre-programmed times of the day. When switched on, a fan always operated at full speed. This was inefficient, using more electricity than necessary and producing high operating noise levels. It was also causing unnecessary wear and tear on components.

It was clear that an upgrade to the ventilation system was required. The ventilation system, including the ten large ventilation fans, is located in the roof space above the tunnels. Access to this area for larger items is only possible via a shaft through the road tunnel roof, so the work had to be carefully scheduled to keep traffic disruption to a minimum.

The Solution

To address the energy usage and noise issues, Schneider Electric worked with EastLink to upgrade the ten large ventilation fans from fixed speed fully off / fully on operation to a much more efficient self-regulating or closed loop variable speed operation. Schneider Electric's EcoStruxure platform has been used in the solution to bring together automation, connectivity and software for real time control and visibility.

The middle layer of the EcoStruxure solution is a Citect SCADA control system. This provides an interface so EastLink can see how the ventilation system is running, at any time, from anywhere. This allows them to monitor and maintain systems and to see exactly where energy savings are being made.

Two pairs of Hot Standby Schneider Electric M580 ePAC (Ethernet Programmable Automation Controller) have been installed, one pair in each tunnel, to create the new closed-loop system with a ATV61 690vAC variable speed drive (VSD) with Active Front End (AFE) harmonic mitigation installed on each of the 10 axial fans. The ePACs use real-time data from air quality and air flow sensors to dynamically control the speed and number of axial and jet fans that are required to meet traffic demand. Every few seconds, the updated control



system adjusts the VSD on each operating fan to ensure fan operation is fine-tuned according to conditions.

To complete the install, each axial ventilation fan, weighing over seven-tonnes, was separately removed from and re-installed within the tunnel complex in delicate operations conducted at night when traffic was lowest. Remarkably, almost no tunnel closures were required for these works, with traffic management limited to temporary lane closures while at least one lane remained open.

Emergency operation procedures have also been programmed into the system. If a fire breaks out within the tunnel, the VSDs are bypassed and all available fans are set to operate at full speed. This ensures that a tunnel evacuation can proceed safely.

In addition to the upgrade of the tunnel ventilation system to dynamic ventilation on demand, Schneider Electric and EastLink introduced partial tunnel portal emission during day-time, using an algorithm to ensure the portal pressure was 1.5meters/second over a 1-hour rolling average. To verify that air quality standards in the local community have not been compromised, a temporary air quality monitoring station has been installed in a nearby residential area, close to one of the tunnel portals. The testing has verified that the solution is working well. The Environment Protection Authority Victoria has granted EastLink a revised license for this new portal emission level based upon the ability for the EcoStruxure solution to tightly control these requirements.

70%

reduction in energy usage.

“This collaboration between Schneider Electric and EastLink has led to Australia's first on demand ventilation system. This project is an example of infrastructure that will help make our roads safer and more efficient.”

– Doug Spencer-Roy,
EASTLINK

Sound Reasoning

Starting up a ventilation fan from fully off to fully on caused a step-change in noise, which made morning start-ups more noticeable for nearby residents when the old system was in use. With the VSD closed loop system, the fans ramp up slowly and quietly, often not even to the full speed, so the change in sounds is less noticeable. New, quieter impellers were also installed in the fans as part of the upgrade. Together, this means the system operates at significantly fewer decibels that previously.

In addition to this, the sound attenuators in the fan chambers will no longer require cleaning as frequently because of the reduced air flow through them. This will result in fewer man hours spent within the potentially hazardous fan chamber environment, therefore increasing safety.

The Bottom Line

Adding to their sustainability credentials, the successful completion of the solution means that EastLink now has the first ventilation on demand tunnel system in Australia and one of only a few in the world.

The upgrade has resulted in reduction of energy use of almost 70% and carbon footprint reduction of 9,000 tonnes per annum. This is thanks to the use of the EcoStruxure solution with the variable speed drives, and the control algorithms in the M580 ePAC which means the fans are only ever operating at the speed that is

required at the time. This reduction in fan usage will also see an increase in the fan life because of the lower stresses applied to the drive motor and impeller.

“The results of the EastLink tunnels’ innovative dynamic tunnel ventilation on demand system and partial tunnel portal emission have exceeded our expectations, with huge reductions in electricity usage, greenhouse gas emissions and audible noise,” Doug Spencer-Roy from EastLink said. “The ventilation system now responds dynamically, more efficiently and in close to real-time for the volume of traffic travelling through the tunnels, the vehicle mix such as the proportion of large heavy vehicles, and prevailing weather conditions such as wind speed and direction.”

The audible noise from ventilation stacks has been halved with the new solution, confirmed by noise measurements, reducing noise levels for local residents.

“Recently, a noise measuring team was conducting measurements near one of our ventilation stacks. The ventilation system is now so much quieter that the team needed to contact the EastLink control room to verify that the ventilation system was actually running.”

The upgrade with Schneider Electric has contributed to EastLink being awarded the top 5-star GRESB sustainability rating. GRESB has ranked EastLink number 1 private entity road company in the world, and number 5 of 280 infrastructure assets of all types around the world.



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EcoStruxure™

Innovation At Every Level

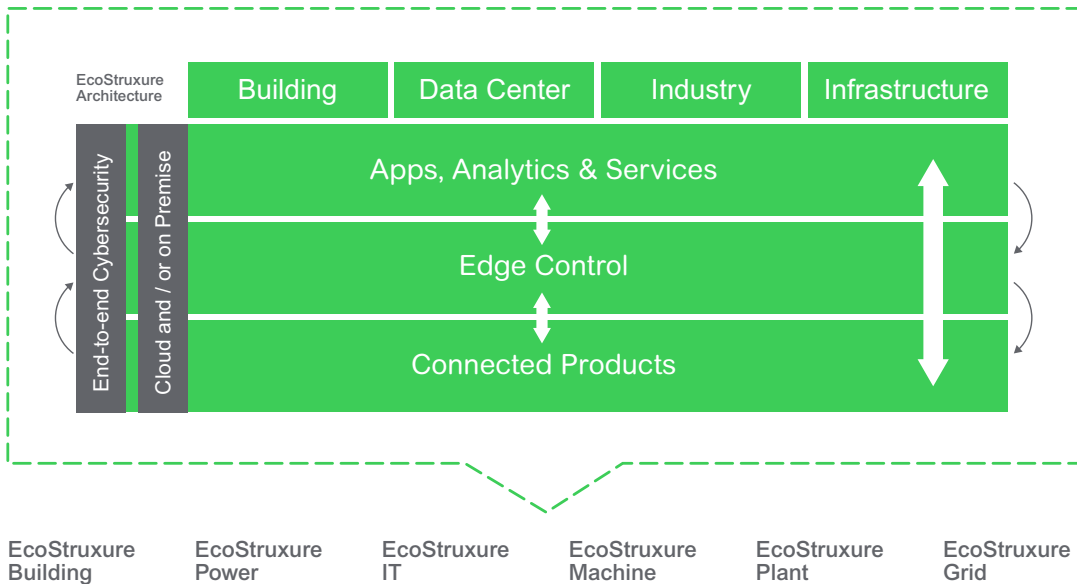
IoT-enabled solutions that drive operational and energy efficiency

EcoStruxure is Schneider Electric’s open, interoperable, IoT-enabled system architecture and platform.

EcoStruxure delivers enhanced value around safety, reliability, efficiency, sustainability, and connectivity for our customers.

EcoStruxure leverages advancements in IoT, mobility, sensing, cloud, analytics, and cybersecurity to deliver Innovation at Every Level including Connected Products, Edge Control, and Apps, Analytics & Services. EcoStruxure™ has been deployed in 480,000+ sites, with the support of 20,000+ system integrators and developers, connecting over 1.6 million assets under management through 40+ digital services.

One EcoStruxure architecture, serving 4 End Markets with 6 Domains of Expertise



Connected Products

The Internet of Things starts with the best things. Our IoT-enabled best-in-class connected products include breakers, drives, UPSs, relays, sensors, and more. Devices with embedded intelligence drive better decision-making throughout operations.

Edge Control

Mission-critical scenarios can be unpredictable, so control of devices at the edge of the IoT network is a must. This essential capability provides real-time solutions that enable local control at the edge, protecting safety and uptime.

Apps, Analytics & Services

Interoperability is imperative to supporting the diverse hardware and systems in building, data center, industry, and grid environments. EcoStruxure enables a breadth of agnostic Applications, Analytics, & Services for seamless enterprise integration.

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