Internet of Things (IoT) Solutions for Energy Management

Travis Kan

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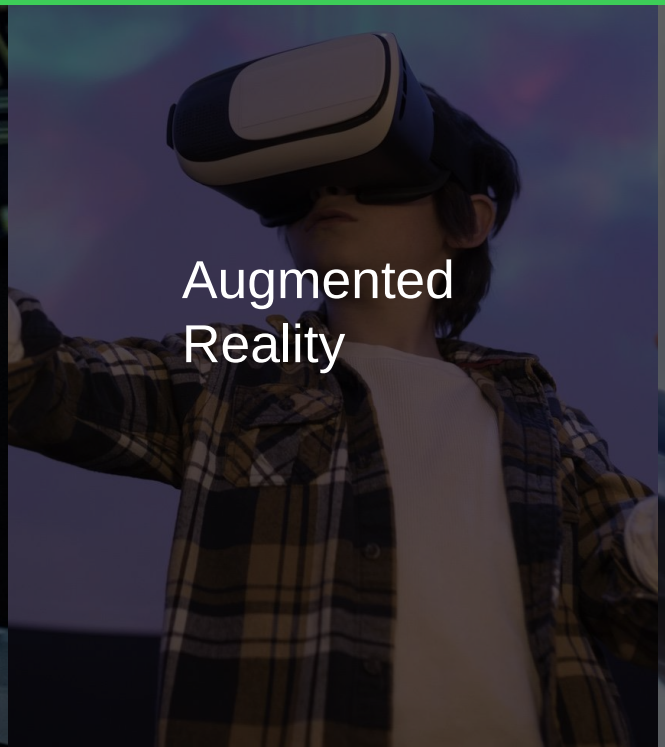
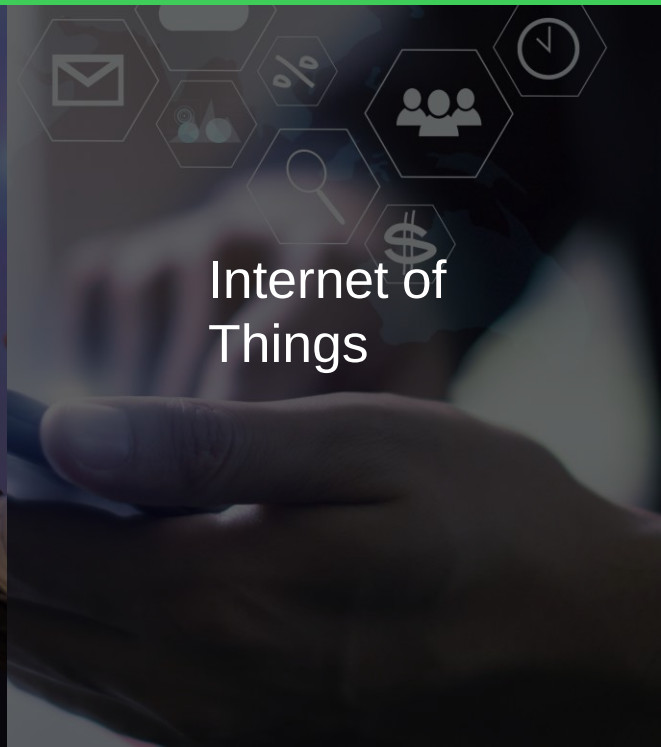
The Present is Digital

Artificial Intelligence

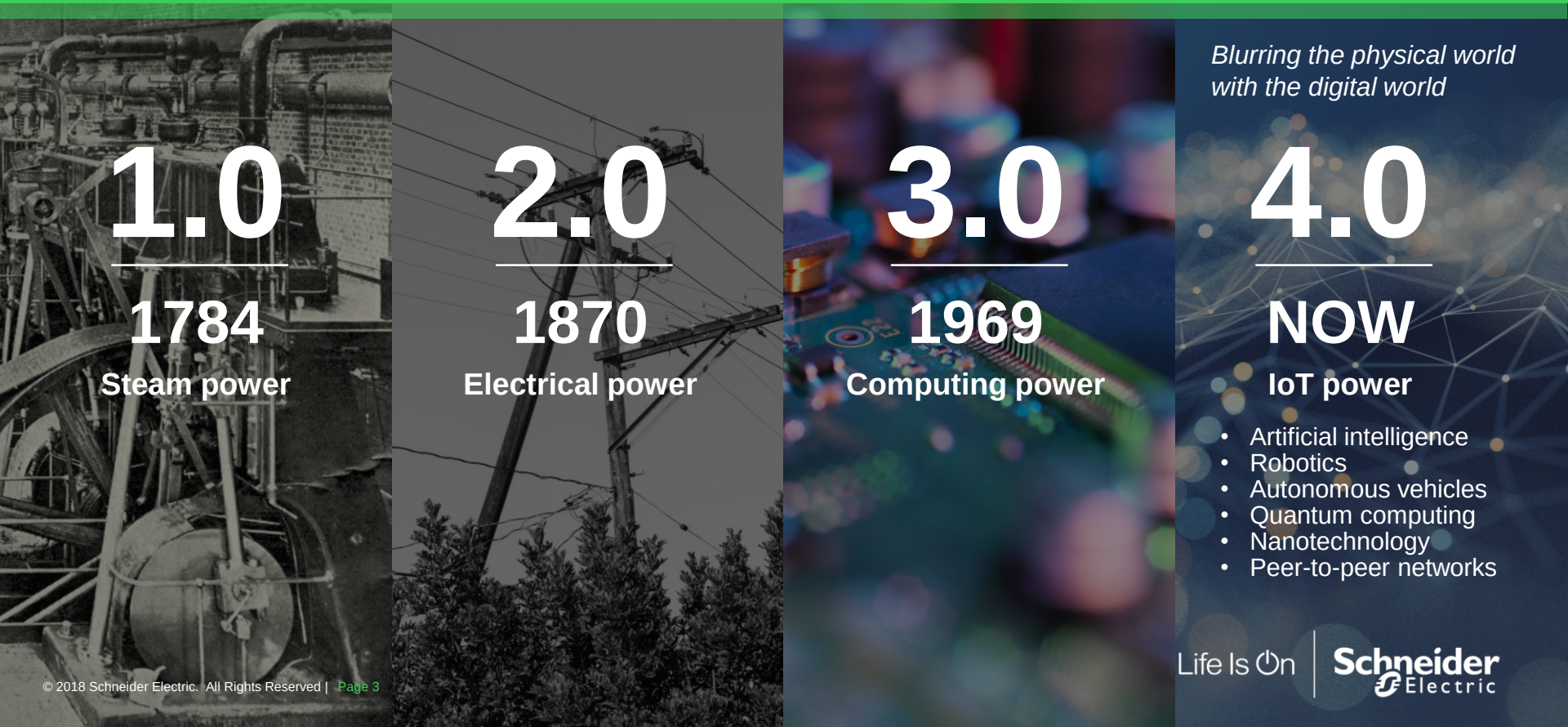


Augmented Reality



Internet of Things

The Fourth Industrial Revolution



1.0

1784

Steam power

2.0

1870

Electrical power

3.0

1969

Computing power

Blurring the physical world with the digital world

4.0

NOW

IoT power

- Artificial intelligence
- Robotics
- Autonomous vehicles
- Quantum computing
- Nanotechnology
- Peer-to-peer networks

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Industrial Revolution 4.0 is disrupting energy ecosystems

IoT devices

8.4 billion

connected “things" in use in 2017

Artificial intelligence

40% reduction in the amount of electricity needed for cooling at Google

Decentralized energy

>1.5 million households supply their own electricity in Germany

Energy storage

5 to 300 gigawatt-hour growth globally from 2016 to 2030

Peer-to-peer networks

$1.6 billion value of the assets administered via blockchain globally

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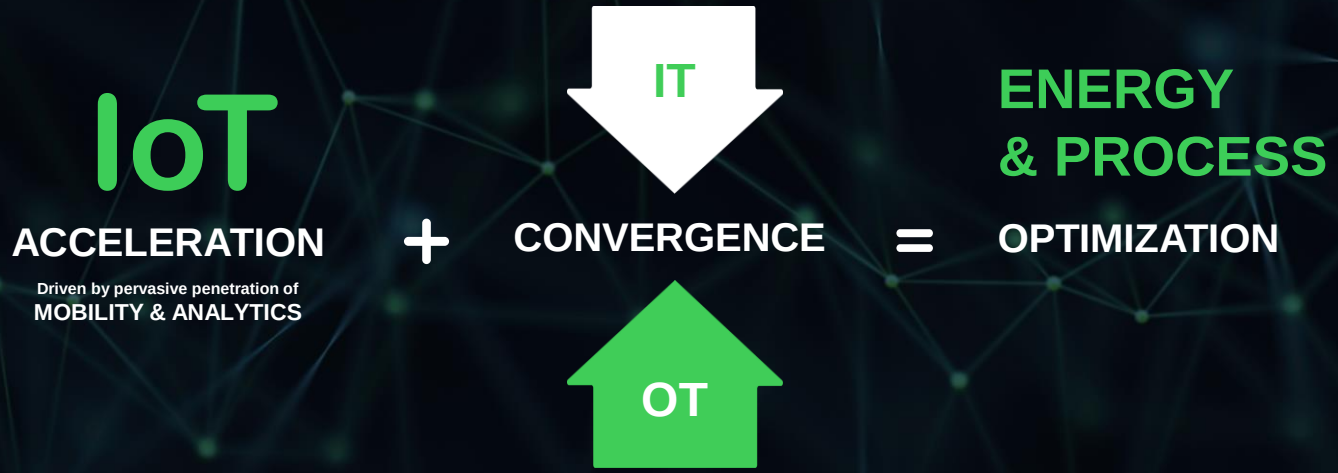
Digitization disrupts Efficiency to a new level



Internet of Things | The Open Innovation Platform of Buildings

Connected Products

- Open: easy to connect 3rd party devices and IoT sensors at scale
- Scalable and future-ready: IP architecture / data highway and wireless

Edge Control

- Open: easy integration and collaboration with other systems through SDKs and exposed APIs
- Scalable: multi-site capabilities, global platform
- Future-ready: designed for mobile workforce

Apps, Analytics & Services

- Open cloud platform
- Data exposed in a structured manner for leveraging by 3rd parties
- Focus on providing insights

Internet of Things (IoT) Architecture
EcoStruxure™

EcoStruxure™ Innovation At Every Level for Building

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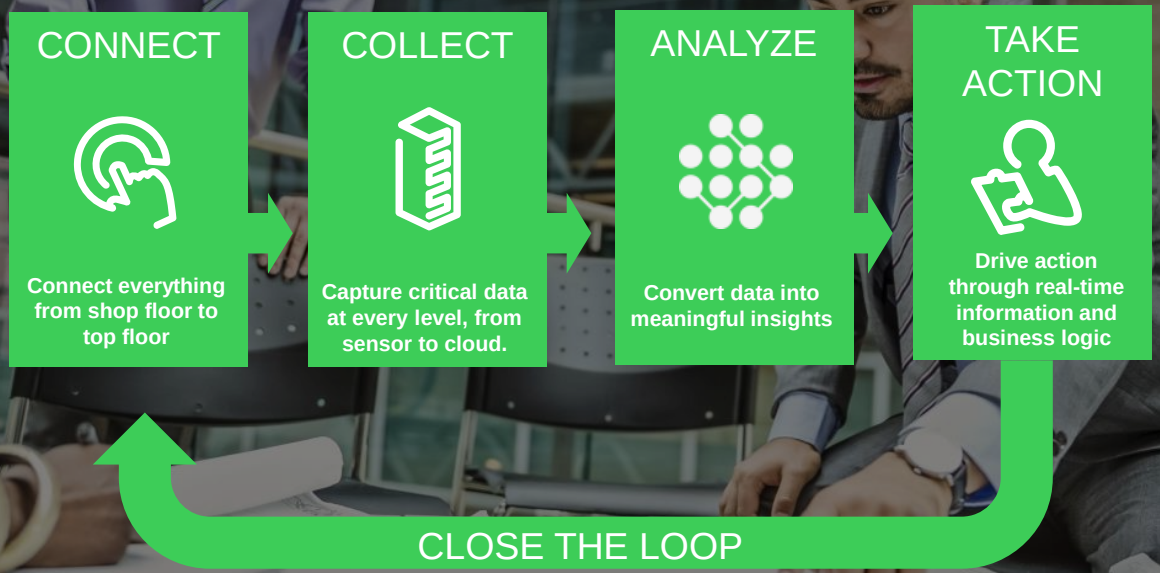
A closed-loop architecture that maximizes data's value

Translating data into actionable intelligence and better business decisions



Powering and Digitizing the economy

Energy efficiency

Up to

~65%

Average (30%)

Productivity

Up to

-50%

CapEx (integration)

-30%

OpEx

Reliability & Safety

Up to

50%

fewer incidents

Sustainability

Aiming at

0

emissions

*From monitoring and analysis of data

The Edge (Deloitte)

The world's most sustainable office building

Customer Challenge

- Maximize energy efficiency and sustainability
- Ensure the comfort, health and productivity of occupants

The Solution

- EcoStruxure™ Building Operation
- EcoStruxure™ Power Monitoring Expert
- Automation Servers, electrical distribution and field devices
- Installed by an EcoXpert™

Customer Benefits

- Leverage single IP backbone for all building ecosystems
- Improve occupant control room comfort via smartphone
- Access building data via simple dashboards

The Results: Life is On with...

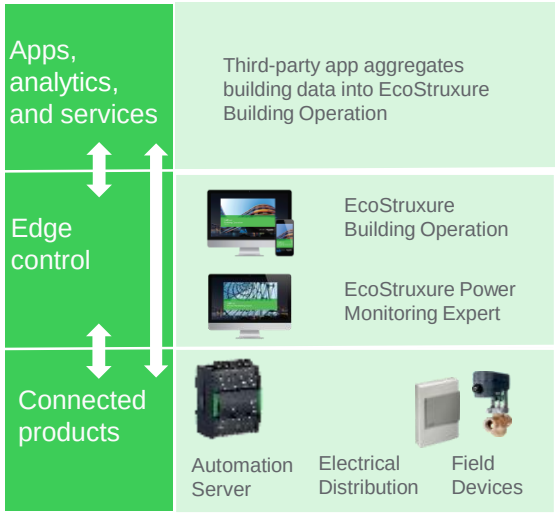
Awarded highest score ever by Building Research Establishment (BRE) **98.36%**

"Sustainability is about more than a great BREEAM rating. It is also about a building's overall comfort and efficiency for its occupants."

Coen van Oostrom,
Founder and CEO of OVG Real Estate
(owner/developer of The Edge)

40,000 m² multi-tenant office building in Amsterdam consumes **<0.3 kWh/m2/yr**

EcoStruxure™ Innovation At Every Level for Building



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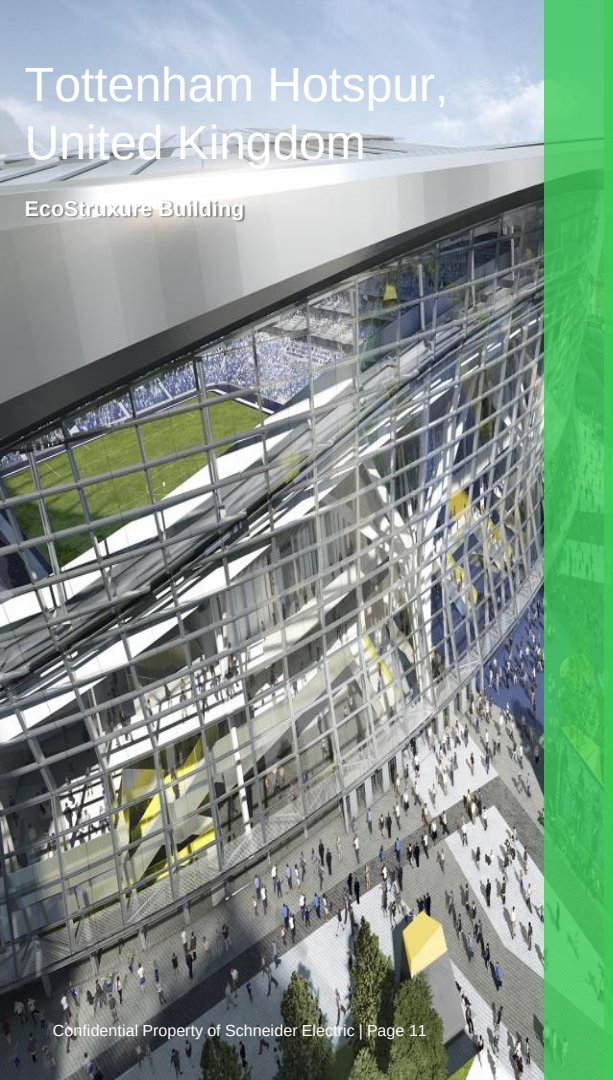


Tottenham Hotspur, United Kingdom

EcoStruxure Building

Customer Challenge

- The largest football club stadium in London and the most technologically advanced stadium ever built
- A world class 61,500 capacity multi use stadium in Tottenham, North London

The Solution

- Full BMS, PME, pitch automation, MV/LV panels and EV charging, plus advanced monitoring for preventative maintenance

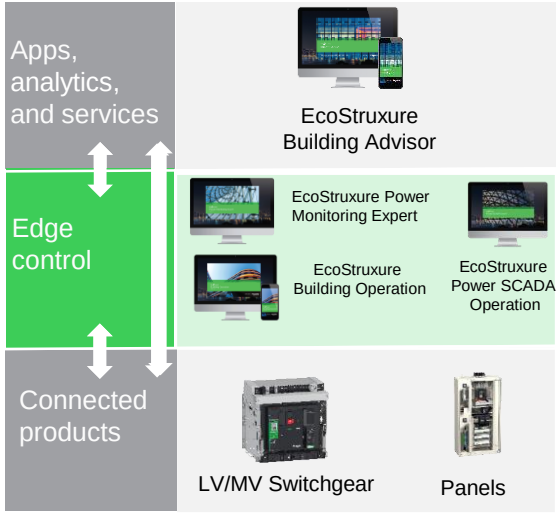
Customer Benefits

- EcoStruxure™ will provide real-time monitoring for preventative maintenance, reducing downtime and costs.
- Building Analytics software will perform system checks every five minutes, totaling 60,000 checks every hour onsite.
- Personalized visitor experiences, including aspects such as temperature and lighting conditions.
- 33% satisfaction increase
- 20% energy savings

"We have the upmost confidence in its ability to deliver a best-in-class energy management system, which will power one of the most technologically advanced stadiums in the world."

Matthew Collecott, Director of Operations, Tottenham Hotspur

EcoStruxure™ Innovation At Every Level for Buildings



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Hilton Worldwide
Washington, DC

One of the top three hotel chains in the world

Customer Challenge

- Improve resource efficiency
- Maintain superior guest satisfaction

The Solution

- EcoStruxure™ Resource Advisor
- Real-time utility pricing and consumption data is visible, comparable, and actionable across Hilton's global portfolio of properties
- Energy and Sustainability Services consultants drive pricing negotiations with utility suppliers, identify energy-saving opportunities for Hilton, and advise on equipment maintenance

Customer Benefits

- Management of resources, including electricity, water, gas, steam, and waste
- Energy savings & environmental stewardship
- A consistently excellent guest experience

The Results: Life is On with...

14.5% energy savings since 2009

"Energy is a major cost component for Hilton Worldwide. It's the second largest expense to labor."

Thomas Webster,
Director of Strategic Sourcing
Energy Management,
Hilton Worldwide

4,500 properties with
765,000 rooms in
100+ countries

EcoStruxure™ for Hotels
Innovation At Every Level

Apps, analytics, and services	EcoStruxure Resource Advisor
Edge control	EcoStruxure Building Operation EcoStruxure Guest Room Expert Integration with Property Management System
Connected products	Automation Server Room Controllers

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Pulse Data Center, Australia

Customer Challenge

- Design & construct region's first Tier III Uptime certified data center
- 100% Uptime SLA's with large scale expansion up to 50MW to cater for international web giants
- 6 single level data halls, part of 29 hectare Technology Park with renewable energy options

The Solution

- EcoStruxure DCIM DCE & DCO software
- EcoStruxure Power Monitoring Expert
- EcoStruxure Building Operation Expert
- 3-phase UPS with Lithium-ion batteries
- Uniflair Chillers, CRACs & InRow Cooling
- NetShelter SX Racks, Stagio Fibre Duct
- LV/MV transformers power solutions
- Pelco Security & Uniflair raised flooring

Customer Benefits

- Integrated solution optimized to reduce cooling requirements and energy costs, managed by our BMS, Power Monitoring and DCIM offerings and monitored by our cloud-based remote monitoring service

The Results: Life is On with...

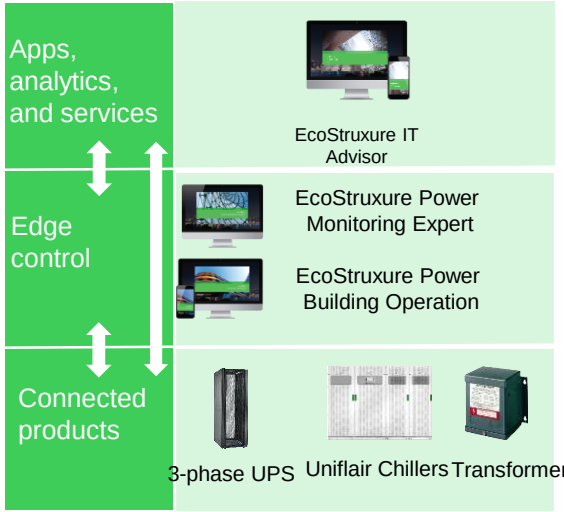
First Tier 3 regional data center in Australia

+15% asset utilization

"Together with Schneider Electric, it is great to be part of the next generation in building innovation, and creating an opportunity to attract national and global tech giants to Toowoomba."

Gary Gardner, Pulse Data Center (FKG Group Chairman)

EcoStruxure Innovation At Every Level IT



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City of Milford USA

Customer Challenge

- Offer power resiliency during inclement weather, at a time when the US Department of Energy's 2017 Grid Reliability Study includes microgrids as a way to provide necessary resilience.

The Solution

- EcoStruxure for Grid will offer Milford cost savings by reducing electricity consumption at four city buildings and heating fuel consumption at the Parsons Government Center

Customer Benefits

- Main objective is increased resiliency of electrical network
- +20% efficiency in energy & heat ;
- It will allow the city to use Virtual Net Metering Credits to reduce electricity costs at its other facilities.
- 15%-30% annual savings on energy spend
- The microgrid will be powered by a clean and efficient combined heat and power system, which generates electricity and heat more efficiently than traditional generation. The microgrid will be solar-ready, with infrastructure installed so that solar PV panels may be added in the future for additional cost savings and sustainability, and will use a battery energy storage system to reduce peak power consumption from the local energy grid. These solutions will combine to make Milford's energy consumption more sustainable.

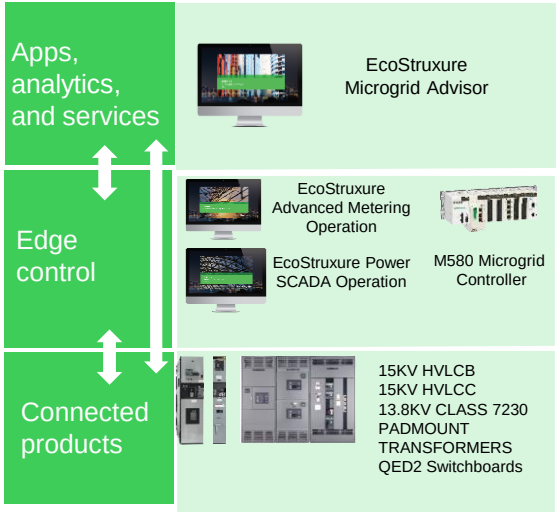
15%-30%

annual savings on energy spend

"When [power] goes down, lights at five buildings will stay on: The senior center, Toulson building, Parsons, City Hall and Harborside"

Ben Blake, City Mayor

EcoStruxure™
Innovation At Every Level



IoT is more accessible than we think

~10% of data are utilized today

Unlimited benefits of connecting the connected, from…

reactive to proactive

onsite to mobile and remote

site by site to enterprise

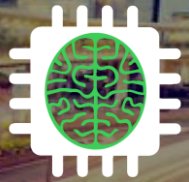
limited to a new scale of computing and artificial intelligence

Taking EcoStruxure to the Next Level… An Exciting Future

End-to-End Information Architecture

From customer journeys to asset lifecycle

Machine Learning & Deep Learning



Connected Ecosystem

- **Partners**
- **Developers**
- **App Store Marketplace**

Mixed Reality & Augmented Reality

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