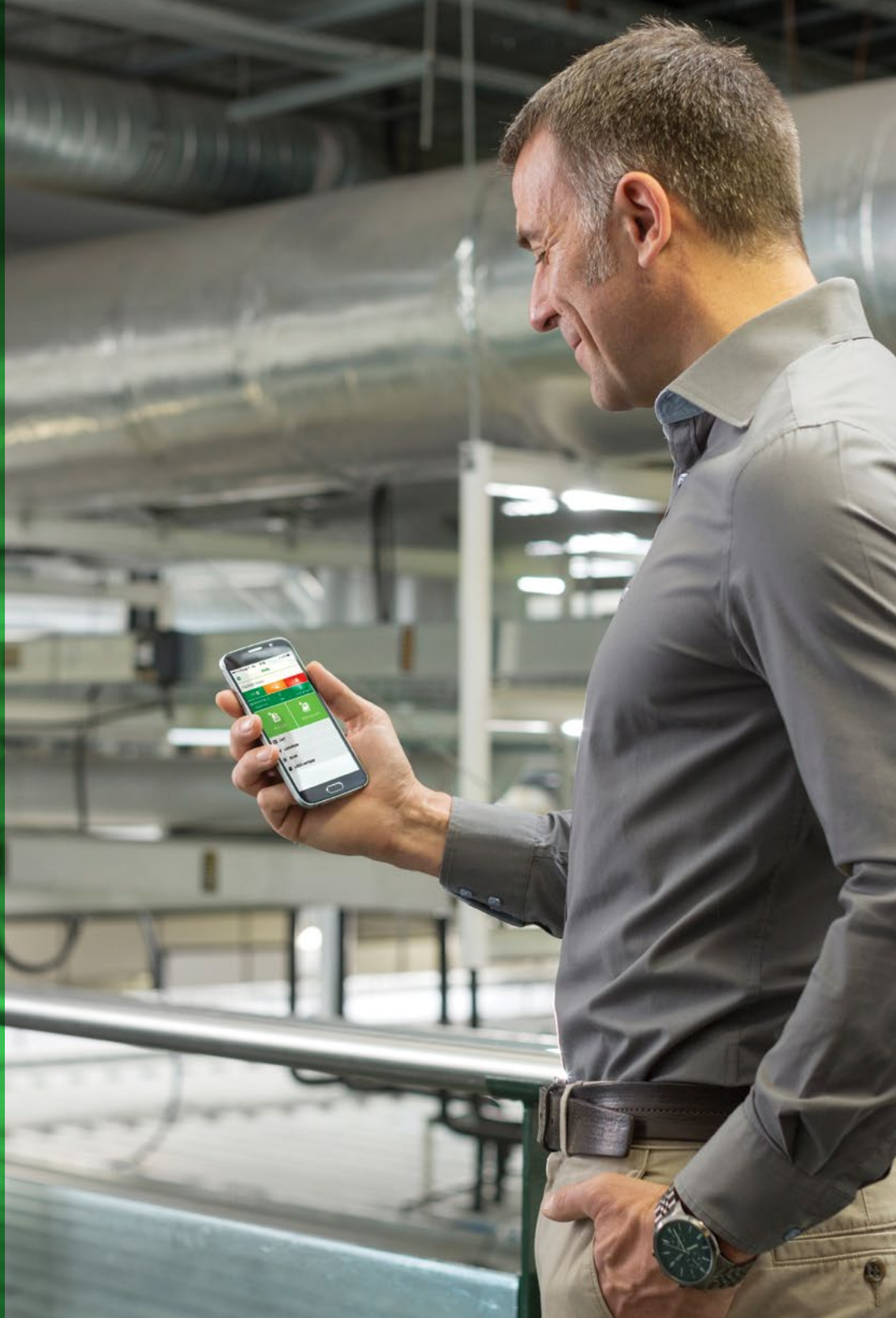


Modern HVAC/R strategies

Connectivity, control and
efficiency using the IIoT

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Powered by the Industrial Internet of Things (IIoT), smart technology has gained a foothold in the HVAC/R industry.

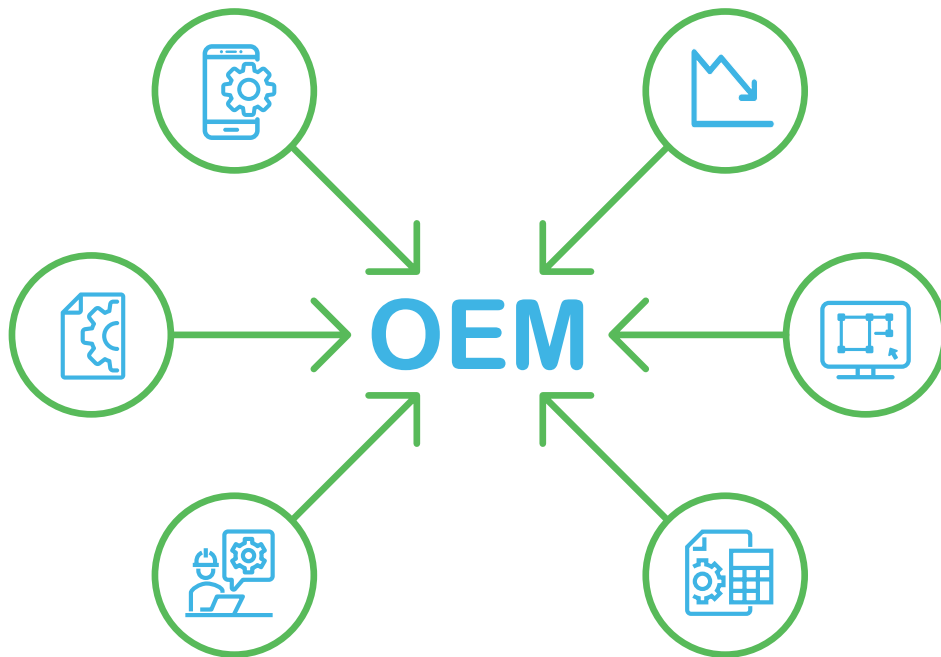
The IIoT is transforming the way OEMs approach connectivity, apps, analytics, cybersecurity, and services across the entire operation. This applies not only to large-scale, complex systems, but also in simpler, more self-contained applications such as HVAC/R.

HVAC/R OEMs should take a closer look at the wide array of benefits that the IIoT can offer – providing users with smart technology that powers better communication, remote control and monitoring, and predictive maintenance tools. Further, these new solutions can be scaled to the machine, offering additional benefits without adding unnecessary features or significant costs. As a result, you will be able to provide better services and smarter machines for your customers.

Advantages for the *smart* HVAC/R OEM:

- » Reduced time to market
- » Increased profitability
- » Improved efficiency
- » Simplified integration and maintenance

The pressures facing HVAC/R OEMs



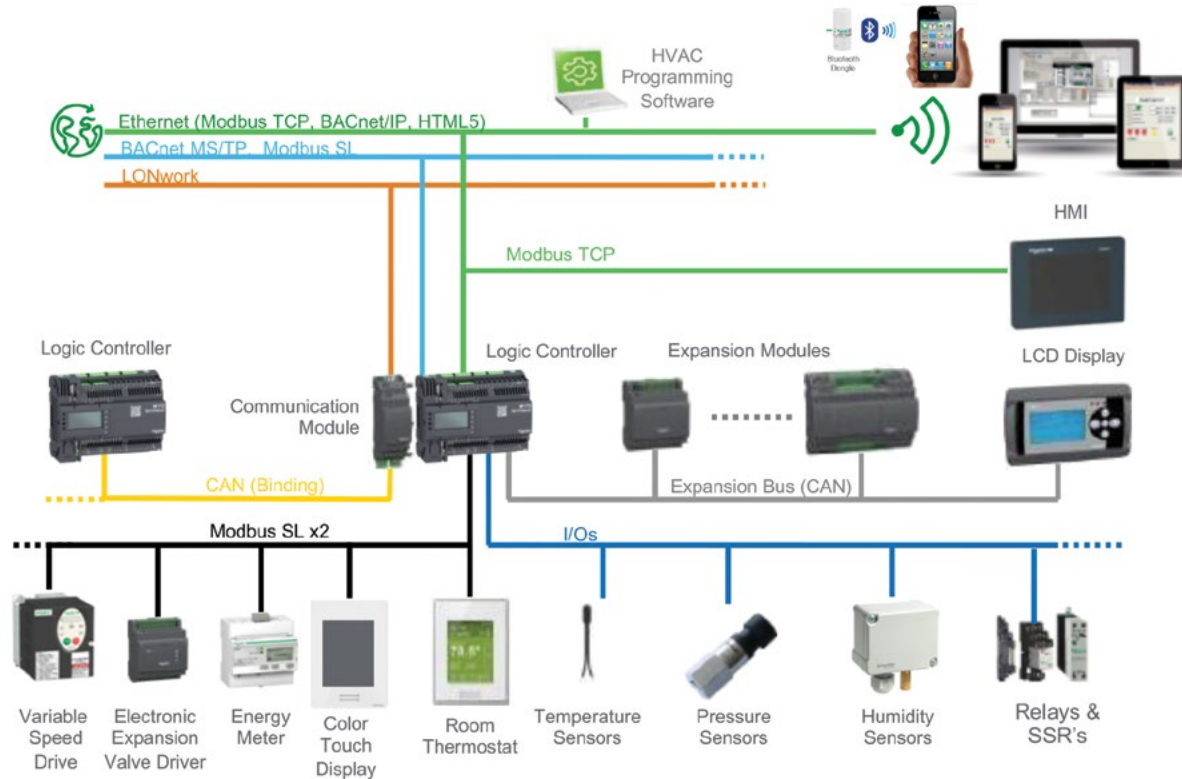
- » Staying up-to-date with **changing technologies** to incorporate innovation into products – while maintaining competitive pricing
- » **Maintaining margin** by reducing manufacturing costs while preserving competitive product pricing
- » Maintaining internal resources to **manage market requirements**
- » Ensuring **compliance with new codes and standards**, such as California Prop 39, Title 24
- » Supporting **financial growth** (and ROI for the shareholders of larger companies)
- » **Reducing the costs** of components
- » Being able to get the **parts that they need, when they need them**

What does an IIoT HVAC/R system look like?

✔ More flexibility

✔ More efficiency

✔ More connectivity



For more information, read ["Make the Most of Energy in your HVAC/R Systems."](#)

The impact of increasing digitization



MORE THAN
50 billion
devices

will be connected to the internet by 2020, resulting in more traffic, more data, more storage, and more energy consumption.¹



ONLY
9.1%
of the more than 23.8 billion
process and discrete automation
elements are currently networked.²

The rise of the smart HVAC/R system

The IIoT-enabled HVAC/R machine is more flexible, connected, efficient, and safer than the traditional machine:

- » **REMOTE CONNECTIVITY** – Operators can connect to the system with mobile devices and wireless systems – saving time and money, and increasing safety.
- » **SMART TECHNOLOGY** – Innovations including automated monitoring and analytics make it easier to comply with energy efficiency and green building regulations.
- » **PREDICTIVE MAINTENANCE** – Total cost of ownership is reduced thanks to embedded tools that help service or maintenance teams be more efficient.





For more information, read "[Putting the 'smart' in HVAC will make everyone's lives better.](#)"

Improving data management

The analytical software needed to deliver the potential of the IIoT is already in place to help process the deluge of HVAC/R operating data that could be flowing in. Increasingly, this takes place in the cloud, using advanced storage and compression technologies.

Today's systems can collect and archive:

	Data for analysis and reporting on asset operations, health, maintenance, and regulatory compliance
	Continuously streaming time-series data from critical control, monitoring, and smart devices

The IIoT enables the real-time collection of data on the HVAC/R system operation, which can extend the lifespan of any asset and reduce capital expenses. Improved operating data also helps capture the knowledge of experienced workers, which flattens the learning curve for new hires and helps minimize unplanned downtime.



Improving maintenance






Increasing digitization will impact HVAC/R system maintenance at all levels: reactive, preventive, predictive, and prescriptive.³

<p>REACTIVE MAINTENANCE <i>Things are not fixed until they break – probably the most widely used strategy</i></p>	<p>The IIoT can improve reactive maintenance by enabling a more efficient, more informed response. Instead of traveling to a remote site when an alarm goes off, maintenance engineers or technicians can see documentation, review codes and connect to the PLC – all with a click. They could then engage local maintenance personnel to address the issues.</p>
<p>PREVENTIVE MAINTENANCE <i>Performed on a given schedule to reduce the likelihood of failure</i></p>	<p>Smart machines powered by the IIoT can help ensure that routine service schedules and protocols are carried out correctly and on time.</p>
<p>PREDICTIVE MAINTENANCE <i>Based on the assumption that assets deteriorate at predictable rates based on age and utilization</i></p>	<p>The IIoT may improve tracking, scheduling and other aspects of predictive maintenance, and promises to enable condition monitoring based on the analysis of complex variables.</p>
<p>PRESCRIPTIVE MAINTENANCE <i>Process data is monitored to identify trends and issue alerts prior to failure</i></p>	<p>Prescriptive (sometimes called proactive) maintenance strategies stand to gain the most from the IIoT, which delivers advanced data and analytics – increasingly in the cloud.</p> <ul style="list-style-type: none">• For simple systems, single variable math can be used to predict failure.• More complex systems involve prescriptive condition monitoring where multiple variables are analyzed to predict failure.

Improving control technology

HVAC/R control technology is evolving as programmable logic controllers (PLCs) have evolved into more powerful programmable automation controllers (PACs), capable of implementing preprogrammed application libraries and open, advanced, object-oriented engineering environments.

These five IIoT trends are helping more companies achieve maintenance benefits:

	<p>Advances in edge control enable flexible deployment of control systems with the power and flexibility to handle advanced analytics and the big data needed to support them.</p>
	<p>Expanded use of Ethernet connectivity in controls is making it easier to capture and share data, then analyze it with advanced applications.</p>
	<p>Deeper cybersecurity protection leverages the value of open standards that are essential to realizing the full potential of IIoT with less vulnerability to cyberattack.</p>
	<p>Advanced object-oriented engineering environments are simplifying the deployment of strategic asset management models.</p>
	<p>Asset management models themselves are evolving.</p>

New technology equipped for the IIoT is already having a positive impact:

- » Increased productivity
- » Increased operational visibility
- » Cost-efficient energy management
- » Cybersecurity protection

Improving energy efficiency

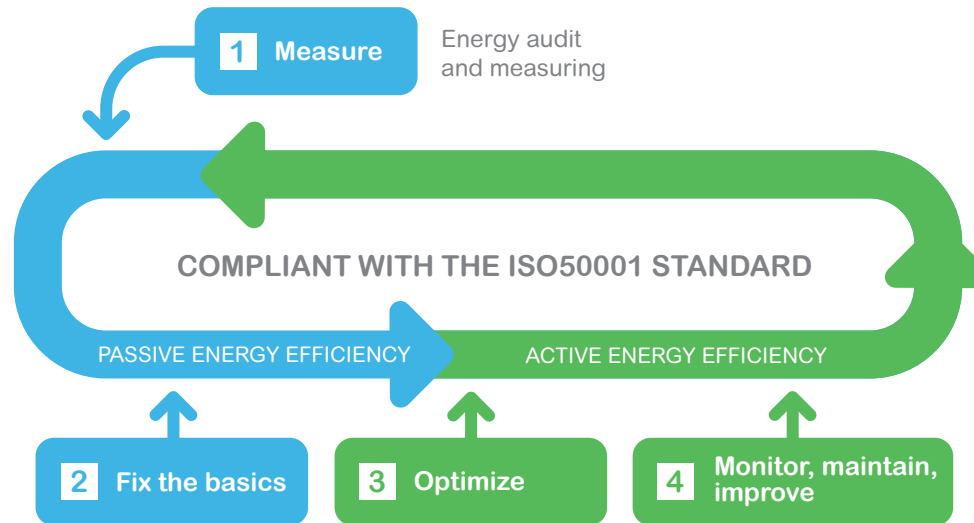
HVAC/R functions can represent over 40% of energy consumption in many buildings and facilities. Improved control and management of ventilation, temperature, and system usage will reduce energy consumption and sustain it at the optimal level.

1 MEASURE energy use with expert auditing and energy meters to identify potential savings on the machine.

2 FIX THE BASICS and reduce energy consumption by choosing the right devices.

3 OPTIMIZE your machine's power consumption with energy operation modes or application function blocks designed for energy efficiency.

4 MONITOR electrical energy consumption with power meters and correlate with thermal energy.



View animation: [Increasing HVAC energy efficiency with advanced control functions](#)
For more information, read "[Make the Most of Energy in your HVAC/R Systems.](#)"

Improving compliance with new codes & standards

Working with the right solutions provider can help you be aware of – and ready to meet – new codes and standards impacting the HVAC/R industry. One primary example is California Prop 39, Title 24 – the first state industry efficiency regulation, expected to expand to other states or become national in the future.

Smart HVAC/R solutions provide the flexibility to help you comply with evolving applicable regulatory requirements, and working with the right manufacturer can make it simple to bring machines up to code easily.

Schneider Electric offers products that allow you to be dynamic, with easy programming to facilitate quick updates and versatile hardware for use in an array of machines (or in the same machine as it evolves to meet these challenges). We also offer engineering expertise to support you and help you stay competitive as you update your product designs and production facilities in response to changing environments.

For example, incorporating the Schneider Electric Modicon M172 controller could enable your machine to meet the energy-efficiency regulations under California Prop 39, Title 24.



A closer look at California Prop 39, Title 24

The HVAC/R requirements of California Prop 39, Title 24 are intended to lower operating costs for building owners, as well as to improve occupant comfort and indoor air quality. Below is a high-level summary of some of the mandatory requirements related to condenser fan control and compressor systems.

- » Condenser fans for new air-cooled or evaporative condensers, or fans on air- or water-cooled fluid coolers or cooling towers, **must be continuously variable speed.**

- » To minimize overall system energy consumption, **the condensing temperature control setpoint must be continuously reset** in response to ambient temperatures, rather than using a fixed setpoint value.

- » The SCT (saturated condensing temperature) control setpoint for **evaporative condensers or water-cooled condensers** must be reset according to ambient wet bulb temperature, and the SCT control setpoint for **air-cooled condensers** must be reset according to ambient dry bulb temperature.

- » The control temperature difference over a period of time should be optimized such that the fan speed is in a range of **approximately 60-80% during normal operation.**

- » Split air-cooled condensers are sometimes used for separate refrigeration systems, with two circuits and two rows of condenser fans. **Each condenser half is to be controlled as a separate condenser.**

- » Compressors and multiple-compressor suction groups must have floating suction pressure control to **reset the saturated suction pressure control setpoint** based on the temperature requirements of the attached refrigeration display cases or walk-ins.



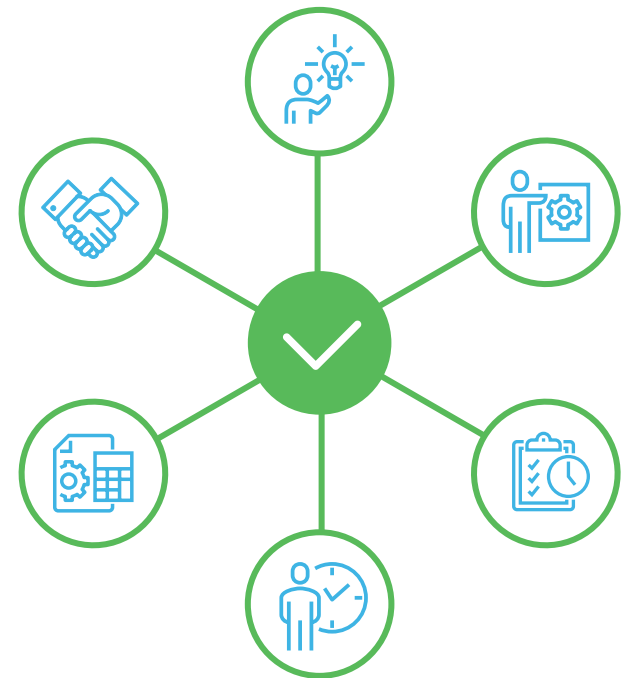
For more information, read "[Controlling Refrigeration Compressor Speed Using Variable Frequency Drives.](#)"

The competitive edge

The smart HVAC/R segment is growing faster than the overall HVAC/R market. This is in part because smart technology – like monitoring and analytics capabilities – makes it easier for machine builders and end users to comply with regulations around proven energy efficiency and green buildings.

What are some other ways you can maintain the edge over your competitors?

- » Offer **unique, innovative solutions** that match the customer's or user's specific needs (not adding features just to add features, or the cost that comes with that).
- » Capture **attention with innovative marketing** that gets prospective customers to take action.
- » Provide **quantitative value** to customers with every offer (helping them not just “save energy” but “reduce energy spend by XX%”).
- » Be **available to provide support/maintenance** as needed – go above and beyond to be there for customers.
- » Balance the need to **manage cost** – from procurement to manufacturing to installation – while **maintaining margin / profitability** and on-time delivery of your products.
- » **Build relationships** based on previous relationships and successful products. Continue to bring customers innovation/benefits in the future for a satisfied, lifetime relationship.





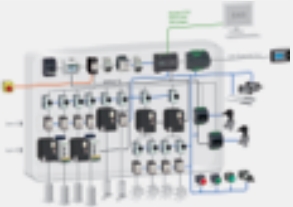


For more information, read [“What’s Driving Innovation in the HVAC Market?”](#)

What to look for in a solutions provider

- ✓ Innovative technologies
- ✓ Wide portfolio of HVAC/R solutions
- ✓ Complete solutions
- ✓ Strong engineering and product support

Schneider Electric is your single source with the widest portfolio for HVAC/R solutions. We offer consistent, scalable solutions for HVAC/R applications, with one software for all your needs, as well as tested, validated, documented architectures for machine level control.

Contactors and Protection Relays	Control Products	Variable Speed Drives and Soft Starters	HMI Products	Machine Level Control
				

Introducing Schneider Electric EcoStruxure™



EcoStruxure™ is our open, interoperable system architecture and platform realizing the benefits of the IIoT for our customers. This allows for the delivery of enhanced value and safety, reliability, efficiency, sustainability, and connectivity. It leverages advancements in IoT, mobility, sensing, cloud, analytics, and cybersecurity to deliver innovation at every level. To date, EcoStruxure™ has been deployed in 450,000+ installations, with the support of 9,000 system integrators, connecting over 1 billion devices.

EcoStruxure™ brings all the innovation that makes up the IIoT into an architecture that can benefit you as an OEM. This allows you to more easily incorporate IIoT-based innovations into your machines to differentiate yourself from competitors and meet your customers' expanding need for connected solutions.



The EcoStruxure™ architecture is based on a three-tiered technology stack, bringing energy, automation, and software together for you. The stack includes:





- » **CONNECTED PRODUCTS** – Intelligent products that serve as the foundation for smarter machines, buildings and plants for incorporation into your machine designs.
- » **EDGE CONTROL** – Control systems that enable simple design, commissioning, and monitoring requiring less complexity for you to manage.
- » **APPS, ANALYTICS AND SERVICES** – A full portfolio of hardware-agnostic software, apps, and analytics to enable optimization within your customer’s existing system, avoiding a costly “rip and replace” solution.

Integrated energy management for buildings

EcoStruxure™ for Buildings brings together Energy, Automation, and Software technology into one integrated architecture, resulting in a convergence specific to the HVAC/R industry.

This architecture combines smart, connected products with monitoring capabilities and management software to help you design, build, and maintain more efficient, cost-effective products.

By incorporating EcoStruxure™ for Buildings, you can easily:

	Add innovation to your current products and designs for future offers
	Increase the connectivity of your products to provide greater process insight
	Incorporate your solutions into existing customer operation, regardless of manufacturer
	Decrease your product time to market while maintaining your margins



Augmented reality today

EcoStruxure™ Augmented Operator Advisor for HVAC/R applications enables troubleshooting without opening a panel.

EcoStruxure™ augmented reality solutions offer **immediate, real-time access to relevant information** in the field, making both operation and maintenance easier. By combining contextual and local dynamic information, this custom application enables users to experience a fusion of the physical, real-life environment with virtual objects. This new solution allows users to reduce downtime, speed up operation and maintenance, and reduce human error.



The following useful data is available on demand, right on the equipment:

- » **Machine log**
- » **Sensor values**
- » **Access to manuals, electrical diagrams, and other documents**

Cloud software to optimize operational efficiency

EcoStruxure™ Facility Expert is a powerful cloud-based software solution designed to make your operations simpler, more effective, and more convenient, enhancing reliability of your processes and assets.

- » **EASIER MAINTENANCE, FASTER CONNECTIVITY** – Benefit from the user convenience of your smartphone, to support you in all your usual tasks.
- » **FASTER TROUBLESHOOTING** – In the event of an equipment fault, you can easily access and share operational data, repair logs, and technical documentation.
- » **WORRY-FREE PREVENTIVE MAINTENANCE** – Monitor your assets. Create and track long-term maintenance schedules.
- » **IMPROVED EQUIPMENT RELIABILITY** – Get everything you need to reduce equipment failures and improve any facility's efficiency and performance.



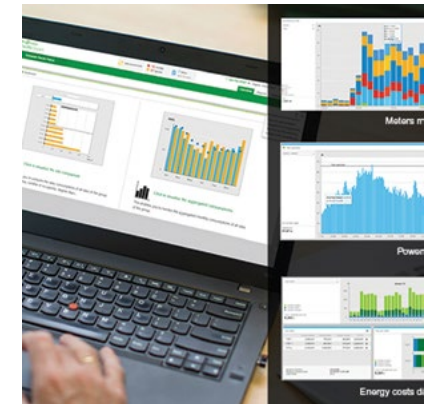
Make repairs faster

In case of equipment malfunction, the EcoStruxure™ Facility Expert mobile app is your dependable partner. Receive notifications and access to event or asset details, and monitor operations wherever you are. Speed up troubleshooting by:

- **Identifying equipment status at a glance and finding problems based on detailed information**
- **Scanning the QR code for easy access to equipment information**
- **Accessing the document repository directly from the field**

Strengthen the effectiveness of your team

Onsite personnel can count on live support from teammates and experts, and user-friendly graphic interfaces enable quicker understanding and worry-free problem-solving. As soon as issues are resolved, receive notifications, complete event logs with images, and generate operations reports for your customers.



Smart, connected innovations in HVAC/R

Mouse over each of the hover spots to see details.



Value of working with a single manufacturer

 PROCUREMENT COST	 PROCUREMENT RELIABILITY	 PROCUREMENT EASE	 STABILITY	 MAINTENANCE
Reducing the costs of components, or the number of components to lower costs	Being able to get the parts that you need, when you need them	Simple to manage relationship with a single supplier	Knowing the supplier and having confidence they will be there tomorrow and further into the future	Single provider for service



For more information, read [“A BEMS Benefit: HVAC and Electrical Cooperation.”](#)

Life Is On



For more information

<https://www.schneider-electric.us>

<https://www.schneider-electric.us/hvac>

Schneider Electric is committed to sustainability and helping OEM customers build more energy-efficient HVAC/R systems. As a pioneer in smart automation technologies, Schneider Electric also makes it easier for you to offer your customers safer, better connected, more flexible, and more efficient HVAC/R applications. We simplify the integration between products, HVAC/R systems, and processes to boost business efficiency and sustainability, both today and tomorrow.

¹ <http://blogs.cisco.com/news/cisco-connections-counter>

² <http://industrial.embedded-computing.com/articles/industrial-will-manufacturing-devices-networked/>

³ <https://www.linkedin.com/pulse/optimize-asset-performance-industrial-iiot-analytics-ralph-rio/>