



Experience the benefits of the Industrial Internet of Things through variable speed drives

Industrial stakeholders can achieve lower total cost of ownership, greater efficiency, and improved energy management

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Life Is On

Schneider
Electric



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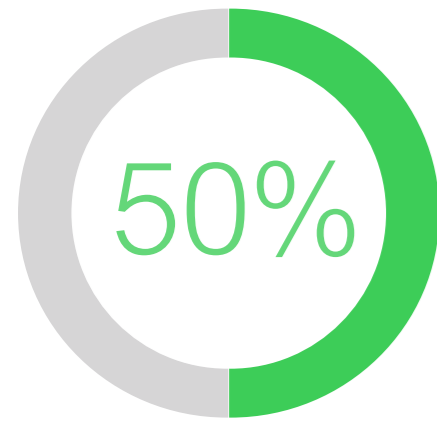
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“By 2050,



worldwide energy consumption will grow by **50%** if current consumption trends persist.”

– International Energy Agency

The Industrial Internet of Things: Meaning and impact

The industry of tomorrow will be different. More volatile markets, new technology capabilities, and increased pressure on performance will precipitate the change. But with change comes opportunity...the Industrial Internet of Things (IIoT) has unleashed huge potential for industrial customers. There is a reported \$14 trillion of new business growth up for grabs – and your goal of better business performance can help you earn your fair share of that growth. How can you make the most of this potential?

As IIoT begins to evolve, the following characteristics are emerging:

- Digitization across industries is often thought of as revolutionary, but in fact it is an evolution of a few distinct market and technology changes – ubiquitous connectivity, mobility, cloud and analytics
- Digitization is enabled by connected products – An IIoT device is a smart device (which has built-in intelligence to gather data) that is connected (giving that device the capability of passing along that gathered data)
- Connected products represent only part of the picture. Automation companies like Schneider Electric provide integrated systems from shop floor to top floor with end to-end built-in cybersecurity
- IIoT-ready devices already exist within your plant...although you may not know it

“IIoT could add \$14.2 trillion to the global economy.”
– Accenture



“Smart connected products provide opportunities to increase operational efficiency from the plant floor to the supply chain by optimizing data, information, and analytics.”
– ARC Advisory Group

01 | The variable speed drive (VSD) = IIoT personified

Many VSDs are installed in industrial sites across the globe. However, these devices are often being underutilized. The VSD is no longer just a shaft turner, it has the potential to be a connected product that can provide business optimization through enhanced energy management, asset management, and process optimization.

VSDs are designed with TCO in mind:

- They are a class of equipment with a very long lifecycle (decades)
- They can last for the entire life of a particular application (with appropriate maintenance)
- Their cost continues to come down, which helps to justify investments in such solutions

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02 | The emergence of the services oriented drive

Services oriented drives are the next iteration of VSDs, designed to reduce TCO, improve efficiency and energy management. The main purpose of services oriented drives is, of course, to run a motor by controlling its speed. But a services oriented drive provides much more than only this functionality:

Here's how it works:

- Energy management – Services oriented drives measure energy consumption, efficiency and performance with an excellent accuracy
- Asset management – Services oriented drives are capable of advanced asset diagnostics which drive optimized predictive maintenance strategies, giving complete asset performance management of the drive, motor and mechanical transmissions
- Process optimization – Services oriented drives control attached ancillary systems like motors, pumps, fans, conveyors by maintaining their operation at best efficiency point thereby reducing electrical consumption by at least 30%



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The emergence of the services oriented drive

Drive connectivity is not new to the market, but what is new in services oriented drives is embedded sensing capabilities, primarily based on electrical measurement to provide an electrical signature that can be translated into operation performance dashboards. Integrated intelligence improves asset performance, both in terms of operational automation performance, energy performance and maintenance costs reduction, hence improving TCO.

In addition, services oriented drives have advanced web capabilities such as Ethernet connectivity and Web Server to integrate seamlessly with IT functions and Supervisory Control and Data Acquisition (SCADA) systems.

Essentially, services oriented drives provide an embedded web page that can be customized by the customer and accessed through a choice of web browser running on smart phone, tablet or PC.



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“Cyber crime costs are projected to reach \$2 trillion by 2019.”
– Juniper Research

03 | Cybersecurity: Anticipating and neutralizing the risks

IIoT is accelerating the need for cybersecurity in industrial control systems and industry stakeholders should consider the following:

- From fiscal year 2011 to fiscal year 2014, the number of cyber incidents involving industrial control systems rose from 140 incidents to 243 incidents
- A 20% increase in Integrated Control System (ICS)-related attacks was observed in 2015, across a wide range of US industry sectors
- Cyberattacks are costing companies worldwide an estimated \$300-400 billion each year and that number is projected to increase sharply

Cybersecurity in the IIoT age must be comprehensive, from end to end. Cybersecurity is not a late stage add-on, it must be designed into the components that make up an automation system. In addition, the adoption of industrial security standards with certification is essential to ensure the security not just of individual assets but also of larger systems and systems of systems.

Cybersecurity: Anticipating and neutralizing the risks

Within leading global automation companies like Schneider Electric, VSDs have cybersecurity features as part of the evolved role of the product in a plant. Today standards and certifications address the communication robustness of the device, functional security and software development process security. Certifications like Achilles Level 2 for VSDs can increase customer confidence at the device level as well as within the wider cybersecurity system.



**“The average cost of a data breach in 2020 will exceed \$150 million, as more business infrastructure gets connected.”
– Juniper Research**



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04 | Electro-mechanical driveline benefits

Most VSDs are installed within a “chain” of other electromechanical devices (such as transformers, circuit breakers, motors) or mechanical devices (gear box, mechanical transmission). Together these form a “driveline.” VSDs minimize their own downtime and also function as smart sensors for the entire driveline (monitoring motor torque, temperature, main voltage, and load energy consumption).

How it works:

- Application models embedded within the drive issue warnings when parts are likely to wear out and when warranties are about to run out
- The VSD collects data on all of the key parameters affecting the driveline’s lifetime
- The drives can anticipate future outcomes for those chain elements that are predictable

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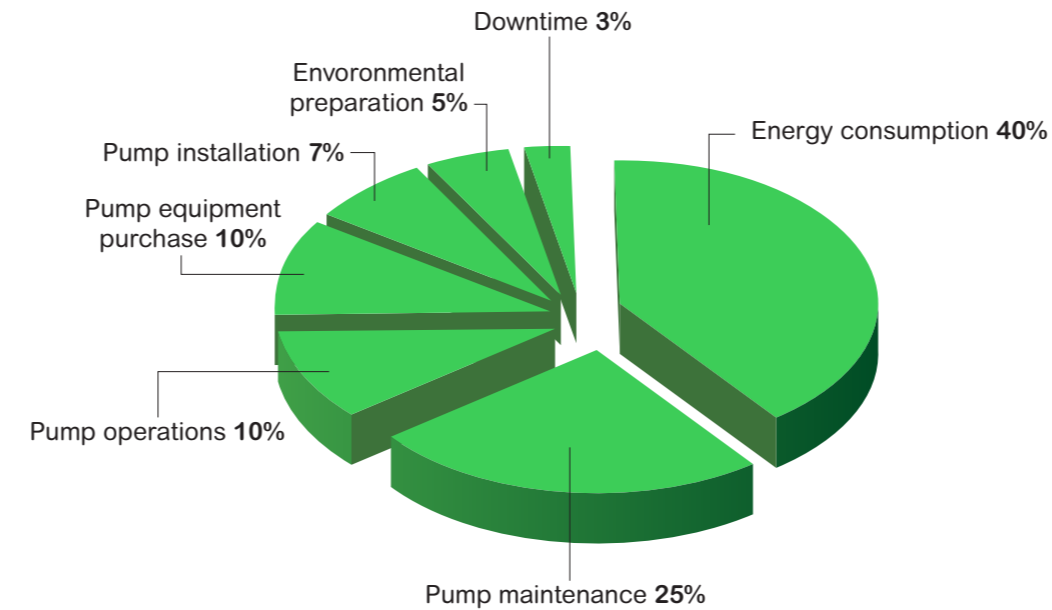
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For industrial pumping systems, energy cost represents 40% of the TCO of a typical pump. It is possible to reduce the electrical consumption by at least 30% through appropriate energy management practices (such as integration with VSDs) while reducing the maintenance cost. The way pumping systems are controlled plays a major role in how efficiency can be improved.

In pumping systems, inefficiencies are characterized by the following:

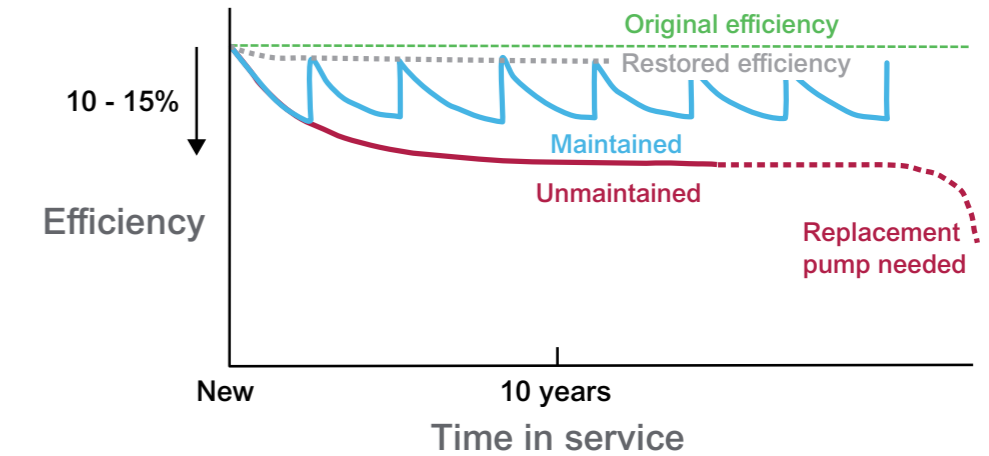
- A mismatch between the pump deployed and the actual system requirement (i.e., undersized or oversized)
- The improper use of throttling valves and damper technologies to control the flow of liquids
- Lack of maintenance - efficiency drops by 10 to 15% for an unmaintained pump

Connected to a pump, a VSD can control speed, pressure, and flow in conjunction with dynamic process and production requirements.



Typical pump life cycle cost profile (courtesy of Hydraulic Institute and Pump Systems Matter)

**“Physical assets such as pumps need to be maintained on an ongoing basis. Maintenance costs represent 25% of TCO.”
– Schneider Electric**



Average wear trends for maintained and unmaintained pumps (courtesy of ETSU – Energy Savings in Industrial Water Pumping Systems).

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“In industrial applications, electric motors account for roughly 60% of electricity consumption; in the process industries, electric motors account for more than 70% of electricity use.”
– US Department of Energy



05 | Mining, Minerals & Metals: Supply chain efficiency

Future success in the Mining, Minerals & Metals industries relies on managing productivity and improving efficiencies. These environments are becoming increasingly dynamic. The amount of reaction time that is available for planning teams is decreasing. New tools and methodologies such as VSDs help to optimize sustainable operations across all the functional areas so that throughput, quality, and profit can be improved.

In Mining, Minerals & Metals industries, VSDs support motors that are used for multiple applications, such as pumps, fans, gas compressors, kilns, conveyors, crushers, and hoisting devices to name a few.

VSDs in Mining, Minerals & Metals environments provide value in the following ways:

- Services oriented drives enable condition monitoring and predictive maintenance analytics software to identify equipment performance issues before they cause delays or stoppages
- They collect, store, and integrate all energy-related data to create a layer of energy intelligence that exposes energy waste or unused capacity

Case study: click here [First Quantum Minerals Mine, Finland](#)

Maximize production, overall efficiency and asset utilization in Metals, Mining and Minerals with [Altivar Process ATV 900](#)

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06 | Water & Wastewater: Conservation and cost management

Every time a water utility gathers, treats, and distributes water — every time a pump starts, a tank fills, or a tap opens — data is generated and distributed. Each water management activity creates data that can reveal valuable network operations and business insight. VSDs are a key component of these “smart” water networks.

Here’s how VSDs support these Water & Wastewater environments:

- Service oriented drives take a pump’s characteristics into account when they are configured, and follow its efficiency levels using dedicated firmware algorithms
- For applications like water level control, the algorithms can ensure the pump is always operated at the system’s “Best Efficiency Point”
- By combining integrated power measurement and the pump’s characteristics, the service oriented drive provides a specific energy consumption KPI (kWh/M3)

All of these points enable operators to monitor and manage the energy performance of every pump in their installation in real time.



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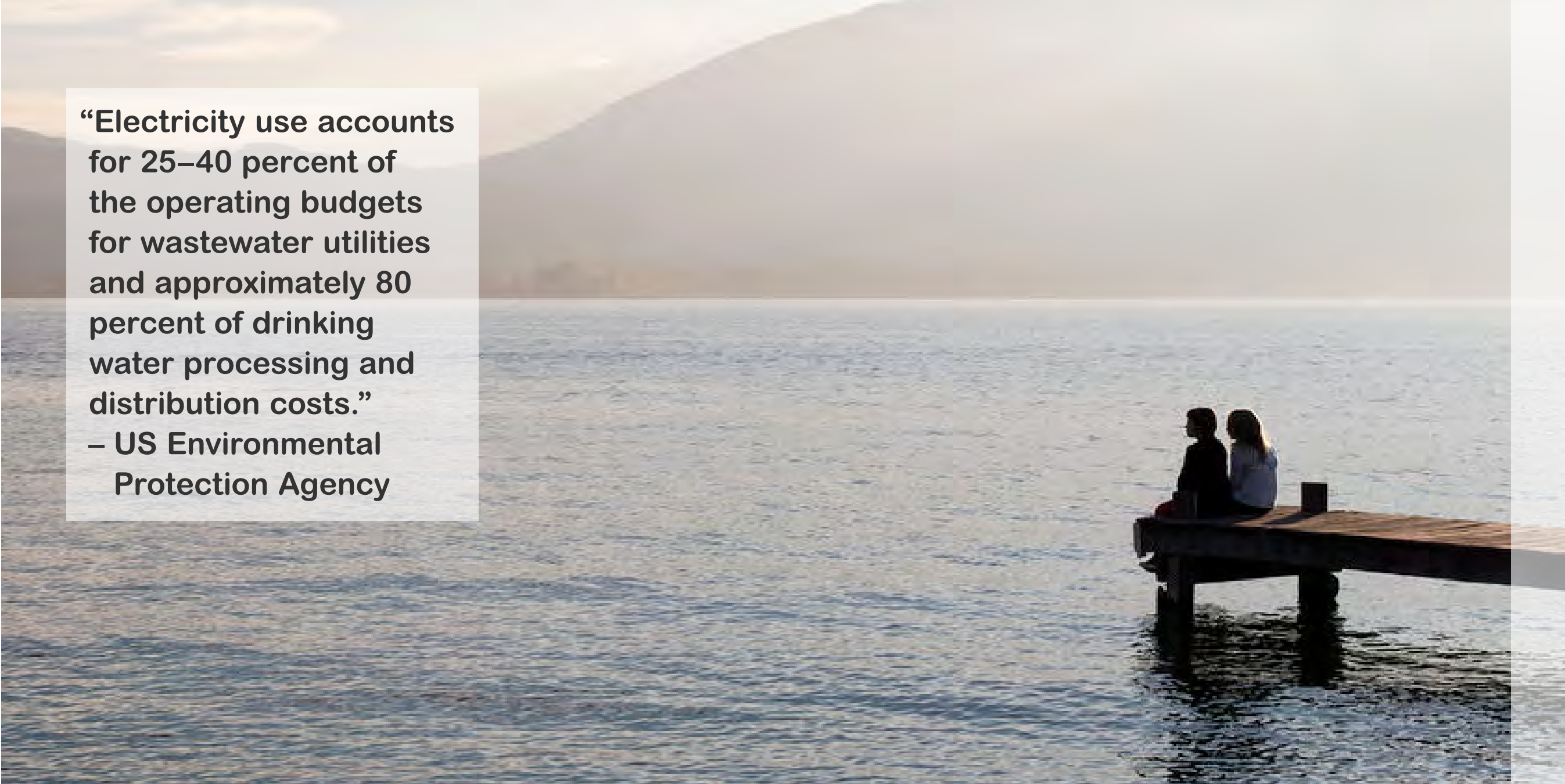
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“Electricity use accounts for 25–40 percent of the operating budgets for wastewater utilities and approximately 80 percent of drinking water processing and distribution costs.”
– US Environmental Protection Agency

Water & Wastewater: Conservation and cost management

Newly manufactured water and wastewater plant VSDs arrive with built-in IP capability. They integrate with motors and pumps easily, and at low cost. VSDs help achieve improved efficiency within wastewater lift/pump stations and sewer collection systems.

Efficient water pressure management usually combines the installation of equipment and devices — e.g., pressure reducing valves and variable speed pumps — with their respective control software. Advanced network operations are characterized by dynamic valve settings and pump scheduling based on variable water demand.

Case study: click here [Herning Water Utility](#)

[Explore how](#) Altivar Process ATV 600 can improve operations in your plant

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07 | Food & Beverage: Reducing waste and improving sustainability

Up to 30% in energy savings can be gained by making improvements to inefficient and outdated Food & Beverage equipment components that waste electricity and by modifying wasteful business processes. Technologies that support efficiency improvements include replacing fixed speed drives with variable speed drives so that operators can specify the flow rate within the recipe parameters. On the process side (in cleaning operations for example), adjustments can be made by better balancing rinsing time to rinsing volume.

Consider the following:

- Integrated and data-driven energy and process efficiency solutions such as VSDs not only reduce a company's carbon footprint, but also provide greater transparency when it comes to sustainability
- The convergence of information technology and operations technology (IT and OT) enhances process performance, a basic element of the Food & Beverage industry
- 49% of Food & Beverage CFOs see a significant link between sustainability performance and financial performance



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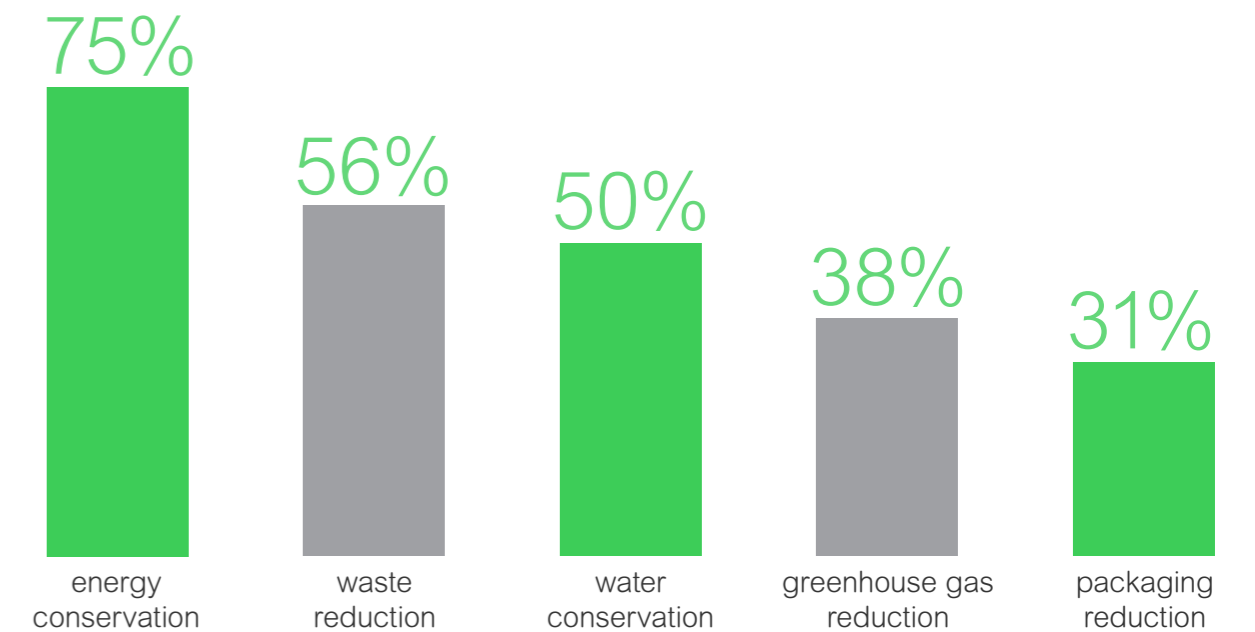
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Food & Beverage: Reducing waste and improving sustainability

Equipment like thermocouples, motors, and compressors can degrade over time and may not be operating at full potential. It is difficult to know when components are wearing out and whether the process will be affected. VSDs provide visibility to hidden potential problems.

Top sustainability priorities of food & beverage and consumer products industries include



Source: Making an Impact: Environmental Sustainability Initiatives in Canada's Food Beverage and Consumer Products Industry, KPMG



“In 2015 the energy market spent \$7 Billion on IIoT solutions. Projected compound annual growth rate of this spending is expected to climb to \$22 Billion in 2020.”
– Markets and Markets

08 | Oil & Gas: Driving new life cycle efficiency

Low fuel prices are forcing powerful innovations in the way Oil & Gas development and production processes are executed and managed. Recent IIoT-related developments are facilitating changes that are resulting in the reduction of unit costs of oil production and ultimately higher returns on capital employed. VSDs are leading the way by enabling connected fans, air compressors and pumps to run much more efficiently.

These IIoT devices will grow in popularity for the following reasons:

- The cost of connected sensors has plummeted, allowing Oil & Gas companies to accelerate digitization programs and to leverage a higher mobility of workforce
- Connectivity is now widespread and huge volumes of process data are being delivered to the cloud for management
- New software analytics programs can monetize the astounding level of real-time data now available, thereby transforming the efficiency of the Oil & Gas value chain

Field maintenance simplified

Tools such as QR (Quick Response) code technology (for non-connected drives), and remote monitoring (for connected drives) can help to link service-oriented drives to the diagnostic experts. By flashing the QR code with their cell phones, the maintenance personnel can directly connect to the drive manufacturer hotline so that a drive's parameters can be communicated and drives can be started up to the proper specification.

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The Industrial Internet of Things (IIoT) is often presented as a revolution that is changing the face of industry in a profound manner. In reality, it is an evolution that has its origins in technologies and functionalities developed by visionary automation suppliers more than 15 years ago. Schneider Electric, for instance, has been driving connectivity into the industrial sector since 1997. Digitization, connectivity, embedded systems and software – are all familiar ground. Schneider Electric’s business has always been about “things” like machines, transformers, circuit breakers, drives, and PLCs.

The IIoT evolution will help industries progress in a cost-effective manner for the following reasons:

- End users and machine builders can continue to leverage their existing investments in technology and people while taking gradual advantage of available new IIoT technologies
- Introducing IIoT solutions using a “wrap & re-use” approach, rather than a “rip & replace” approach will enable greater business control
- A measured approach will drive the evolution towards a smarter automation for industries that is more efficient, safer, and sustainable



“Since IIoT solutions can be engineered to minimize components and are custom engineered to maximize the reliability and efficiency, ongoing operational cost savings reduce the total cost of ownership.”
– ARC Advisory Group

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Converting the promise of IIoT into practical solutions

Over the last two decades Schneider Electric innovation around digitization and connectivity has allowed for the development of an advanced range of IIoT solutions. These industry-leading platforms include:

- Altivar Process – A fully integrated, adaptable, programmable motor drive that is highly energy efficient and that allows for predictive maintenance
- Modicon M580 – The Ethernet backplane of this PLC allows users to access I/O devices connected to the programmable automation controller (PAC) through the PAC itself. This enhances cybersecurity without compromising safety or process uptime.
- Eurotherm Online Services – An online, cloud-based records control system that enables intelligent and cost effective maintenance through the use of data analytics
- Line Performance Suite – Leveraging the power of Wonderware, this suite is a turnkey offering that allows users to visualize and control packaging, thereby optimizing output and better managing quality

“Internet connectivity allows industrial devices equipped with AC drives to be controlled and monitored more intelligently than ever before, resulting in added value for industrial operations.”
– ARC Advisory Group

Altivar Process: A higher form of intelligence

By enhancing operational technologies with a layer of intelligence, connected solutions are energizing workspaces. The efficiency of businesses is improving while power consumption is being radically reduced. The next chapter in industrial automation begins with learning how to leverage the exponential growth of data. Almost 90 percent of all the data in the world has been generated over the past two years alone. People and machines are gaining easier access to more and more intelligence, and they expect solutions that connect to that intelligence and help them make sense (and good use) of this avalanche of data.

The Altivar Process family of VSDs is a reflection of this new trend of converting more data and advanced intelligence and analytics into higher degrees of operational efficiency, energy management, and reduced total cost of ownership.

[Learn more](#) about Altivar Process, the first Service Oriented Drive, with energy management services and assets management capabilities.



Altivar Process: The award-winning service oriented drive

Energy Manager Today 2015 Product of the Year Award

“The Altivar Process VSD fills an important gap in an area long overlooked - monitoring motor energy consumption and pump efficiency. End users can then optimize pumps remotely, without additional hardware.”

– *Energy Manager Today*



Processing Magazine 2016 Breakthrough Products Award

“Altivar Process drives are different because they are connected and provide advanced operational intelligence to plant operators and process professionals while offering embedded guidance for operations and maintenance personnel. These standard features help optimize business performance by reducing commissioning time and significantly improving production uptime.”

– *Processing Magazine*



Control Engineering 2017 Engineer's Choice Award



“Built to leverage the benefits of the Industrial Internet of Things, the Altivar Process 900 Variable Speed Drive helps customers realize process performance improvement, energy optimization and asset management.”

– *Control Engineering*

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To learn more about the transformational impact of Variable Speed Drives explore this sampling of Schneider Electric™ white papers and blogs:

- [White Paper: Three steps for reducing total cost of ownership in pumping systems](#)
- [White Paper: An Improved Approach for Connecting VSD and Electric Motors](#)
- [White Paper: How Service-Oriented Drive \(SOD\) Deployments Improve VSD Driveline Uptime](#)
- [White Paper: The Industrial Internet of Things: An Evolution to a Smart Connected Enterprise](#)
- [Blog: A case study: Comparison of MV and LV solutions for mine conveyor applications](#)
- [Blog: Unleash the Service and Energy Efficiency Benefits of Variable Speed Drives \(VSD\)](#)
- [Blog: About Energy Efficiency of Induction Motor Applications: Two Reasons to Choose a Variable Speed Drive \(VSD\)](#)
- [Blog: Variable speed drive: Back to the features](#)

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Schneider Electric Canada Inc.

5985 McLaughlin Road
Mississauga, ON L5R 1B8
Phone: 1 800-565-6699
www.se.com/ca

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