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Maximizing power usage and efficiency to meet demands in food and beverage industry

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Introduction

Over recent years, consumer demand trends and regulatory compliance have accelerated both levels of complexity and risk for food and beverage (F&B) operations. The flexibility and reliability required to address this complexity depends heavily on how to efficiently ramp production power consumption up and down to minimize energy cost variations.

As energy constitutes approximately one-fifth of all costs associated with food manufacturing, more manufacturers are recognizing the importance of energy efficiency in their operations. Part of this electricity cost is associated with a legacy electric power infrastructure that also presents a higher risk for both production line downtime, arc-flash hazards and other electrical and non-electrical dangers. Energy savings not only dramatically impact production costs, but can also help companies reduce their carbon footprint, thereby increasing their visibility as an earth-friendly supplier of foods.

Fortunately, modern systems that digitalize the plant and supply chain electrical infrastructure can help F&B companies to meet their growing marketplace challenges. Modernization of electrical systems help increase flexibility, reduce operating expenses, improve energy efficiency, enhance production line availability and improve employee safety, thereby boosting overall competitiveness.

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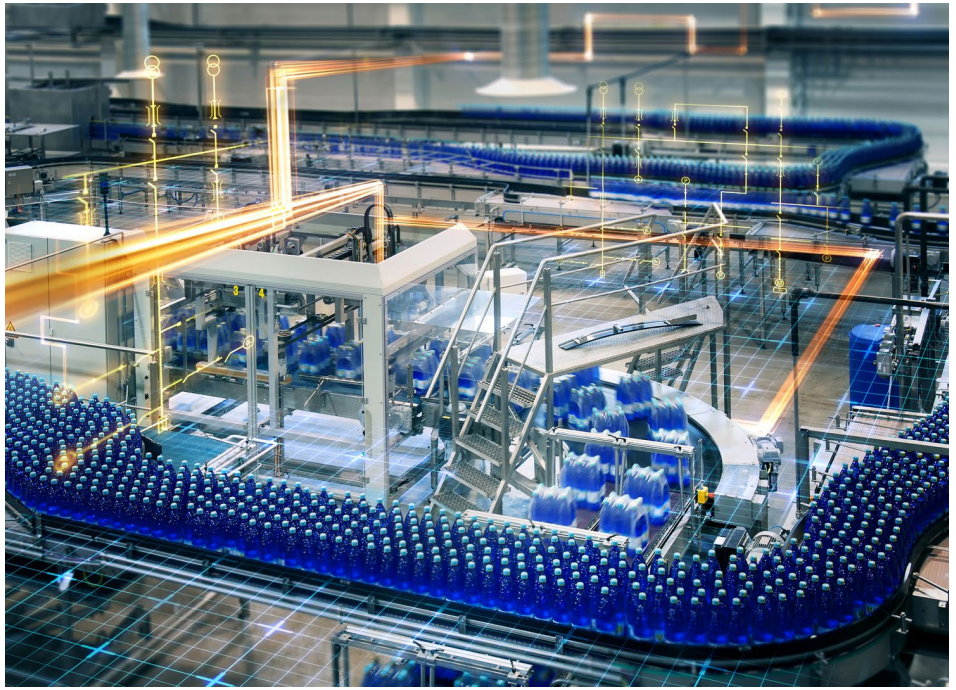
Efficient compliance to worker safety and regulatory standards



Risks within F&B environments include high temperatures, air contaminants and workers operating in close proximity to fast-moving equipment and hazardous locations. Dust explosions, for example, can occur in manufacturing environments related to grain products, confections and other foods prone to generating airborne particulates. In fact, almost one quarter of all reported industrial dust explosions occur in the F&B industry. The consequences can be deadly—an explosion of sugar dust at a plant in Georgia killed 14 people and injured 38 in February of 2008.

In such cases, when fuel, oxygen, and an ignition source occur simultaneously, the risk of an accident is high. Plants and warehouses filled with clouds of dust are the sources of two of these conditions. Electric arcs can be an ignition source.

Employee safety standards, such as Occupational Safety and Health Administration 29 CFR 1910 Subpart S (301-335) and NFPA 70E (R): Standard for Electrical Safety in the Workplace (R), mandate how workers should be protected from electrical shock and fire-related injuries, such as arc-flash, when working near electrical equipment. Siemens industry and global expertise helps F&B facilities managers perform systematic and accurate assessments of core electrical systems in order to maintain high safety levels and to meet local and national code regulations such as OSHA, NFPA, and IEEE guidelines. In addition, Siemens Sm@rtGear™ technology offers features like Temperature Monitoring that help reduce arc-flash hazards. This new solution can be placed on any wire or bolted joint and when combined with current can identify hot spots when they occur.

To minimize the risk of arc-flash-triggered explosions, outdated equipment should be upgraded or modified and operators should be trained regarding electrical safety best practices. Siemens offers electrical safety consulting and can recommend **solutions** that are specifically designed to minimize electrical risks. Examples include SIPROTEC relays for arc protection, tiastar™ low-voltage, Arc-resistant motor control centers, SIEBREAK™ metal-enclosed interrupter switchgear, and Dynamic Arc-flash Sentry (DAS) devices that help lower released arc-flash energy by reducing arc-flash incident energy. Siemens also offers many options to move operators outside of the arc-flash boundary through remote operation solutions, such as its **SIERS integrated electrical racking system** and **Sm@rtGear options**.

Sm@rtgear Power Distribution Solution delivers safety, reliability, and efficiency with remote monitoring, configuration, and control. Commissioning is fast and costs are reduced by using communication versus point-to-point

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wiring when connecting. Sm@rtGear technology allows the user to select the best version for their application with various options including Sm@rtgear Pro and Sm@rtgear Mobile. Sm@rtgear Pro comes standard with a remote HMI panel, maintenance mode, auto-throw-over schemes, and 30-day load study among other features. Sm@rtgear Mobile is our new streamlined offering for Mobile devices, which allows users to access the whole system through a single wireless or hardwired access point.

In addition to arc-flash safety challenges, many of the electrical components in a plant, such as capacitors, transformers, switchgear, and fuses, can contain hazardous and non-biodegradable chemicals such as PCBs, silicone oils, high-temperature hydrocarbons, and tetrachloroethylenes. To ensure that these chemicals are not released from equipment and into the food supply, Siemens high-voltage switchgear uses natural ester, an environmentally friendly and operationally safe alternative to traditional harmful chemicals. Siemens teams can help identify potentially hazardous low- and medium-voltage equipment in F&B facilities and can recommend end-to-end, more environmentally friendly solutions.

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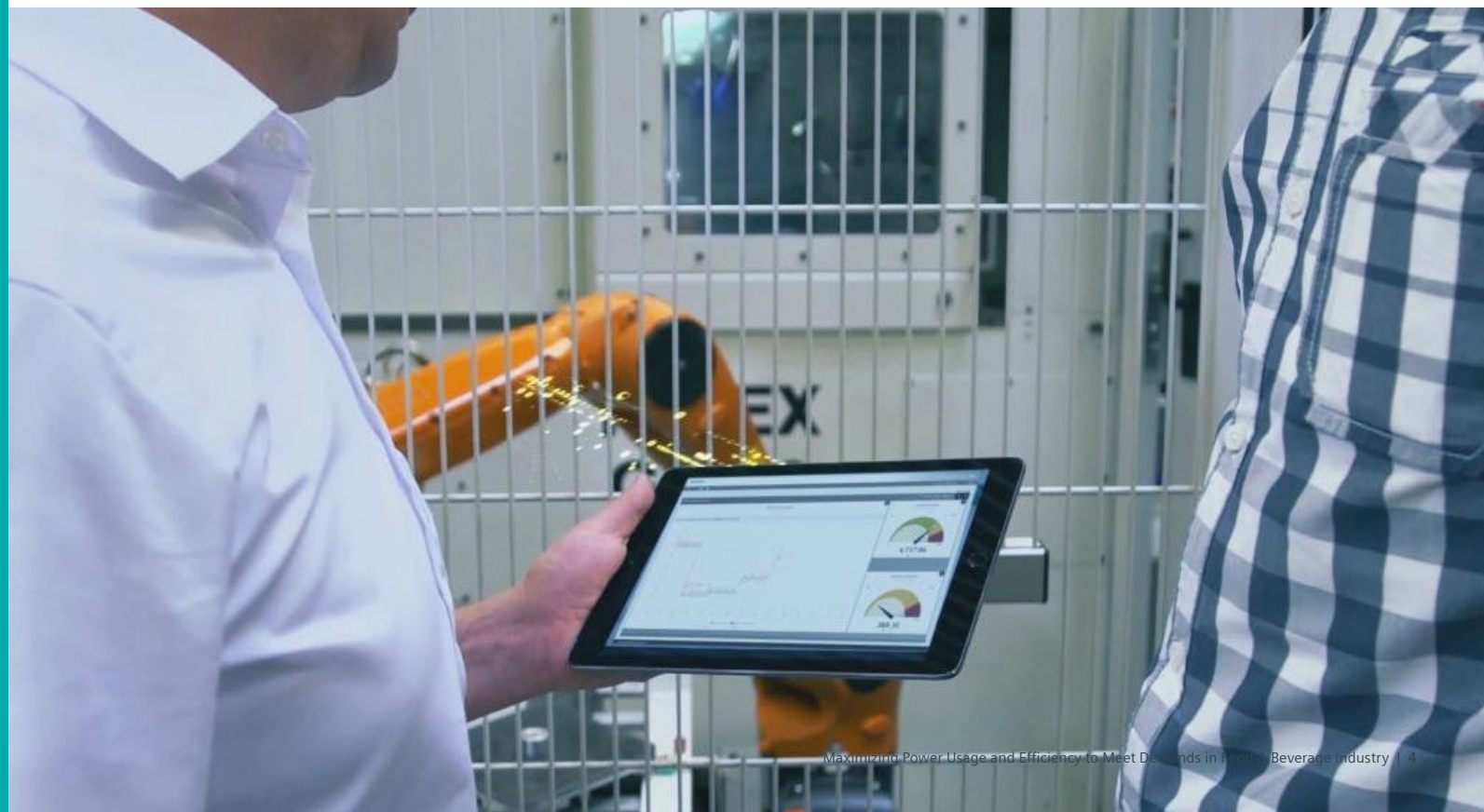

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Enhancing electric power quality, reliability and resilience

Many F&B plants run continuously, making efficient energy and power management a business differentiator. However, producing significant energy savings requires a focus on more efficient equipment and processes, and increased operator engagement. Strategies for energy-efficient production must also embrace a holistic approach in order to achieve worldwide targets of 20% to 30% reduction of carbon emissions.

Core elements for pursuing a holistic approach to effective power management include the following:

Power monitoring and diagnostics reporting

The first step to managing energy usage and implementing energy savings strategies is by monitoring energy consumption in order to establish a baseline for tracking how the plant uses its resources. Once a robust monitoring system is in place, plants can implement changes that result in higher energy efficiency thereby reducing operation costs.

At the device level, F&B manufacturers have traditionally used statistical process methodologies that relied on hand-plotted points on charts for power monitoring. Today, automated data logging and analysis is provided by Siemens Sm@rtGear by using its Siemens SIMATIC HMI to monitor power consumption of switchgear, motor control centers, motor controllers, and panelboards. When power consumption outliers are identified through a monitoring system, engineers can move quickly to address the source of the problem whether it is equipment wear and tear, power quality from the utility, inefficiency of power system configuration, or perhaps cyber-attacks or meddling from outside agents.

Siemens industrial controls can also be implemented to help F&B manufacturers save money and get the right diagnostics which can be used in condition-based monitoring scenarios.

Some of these controls, like, Siemens SIMOCODE, is an intelligent motor management system which can be used in a variety of ways to provide power and condition-based monitoring of motors by monitoring multiple parameters such as voltage, current, temperature, etc. It can also monitor ancillary parameters around a motor or pump like flow, pressure, and vibration. SIMOCODE can be monitored for subtle changes in performance over time that are usually indicative of early mechanical or electrical failures.

Siemens IO Link technology can be employed to provide monitoring of critical parameters like voltage, current, temperature, and energy consumption and can drastically reduce labor and installed costs by eliminating wiring. A single IO Link Master can reduce labor up to 75% and installed costs up to 25% by eliminating the need for discrete IO and its associated wiring within a panel.

Siemens industrial controls can also be implemented to help F&B manufacturers save money and get the right diagnostics which can be used in condition-based monitoring scenarios.

SIRIUS ACT Pilot Devices, in addition to being built to withstand harsh environments, (and IP69K/NEMA 4X-rated) can lower wiring costs, discrete IO, and engineering by communicating over PROFINET. By connecting these devices to either PROFINET or IO Link communication protocols within a panel, you eliminate the need for wiring and IO modules.

On-site generation and microgrids

Another way to prevent production loss due to power interruption is to consider onsite power generation. Distributed energy systems allow businesses to better control and manage their power resources and more intelligently make contingency plans. More and more F&B organizations are turning to on-site generation to provide the resiliency needed to keep production up and running. Solar power, combined heat and power (CHP) and energy storage, such as batteries, provide companies with the option of building their own microgrids; disconnecting from the utility grid when required. Siemens Microgrid Management System integrates and optimizes decentralized

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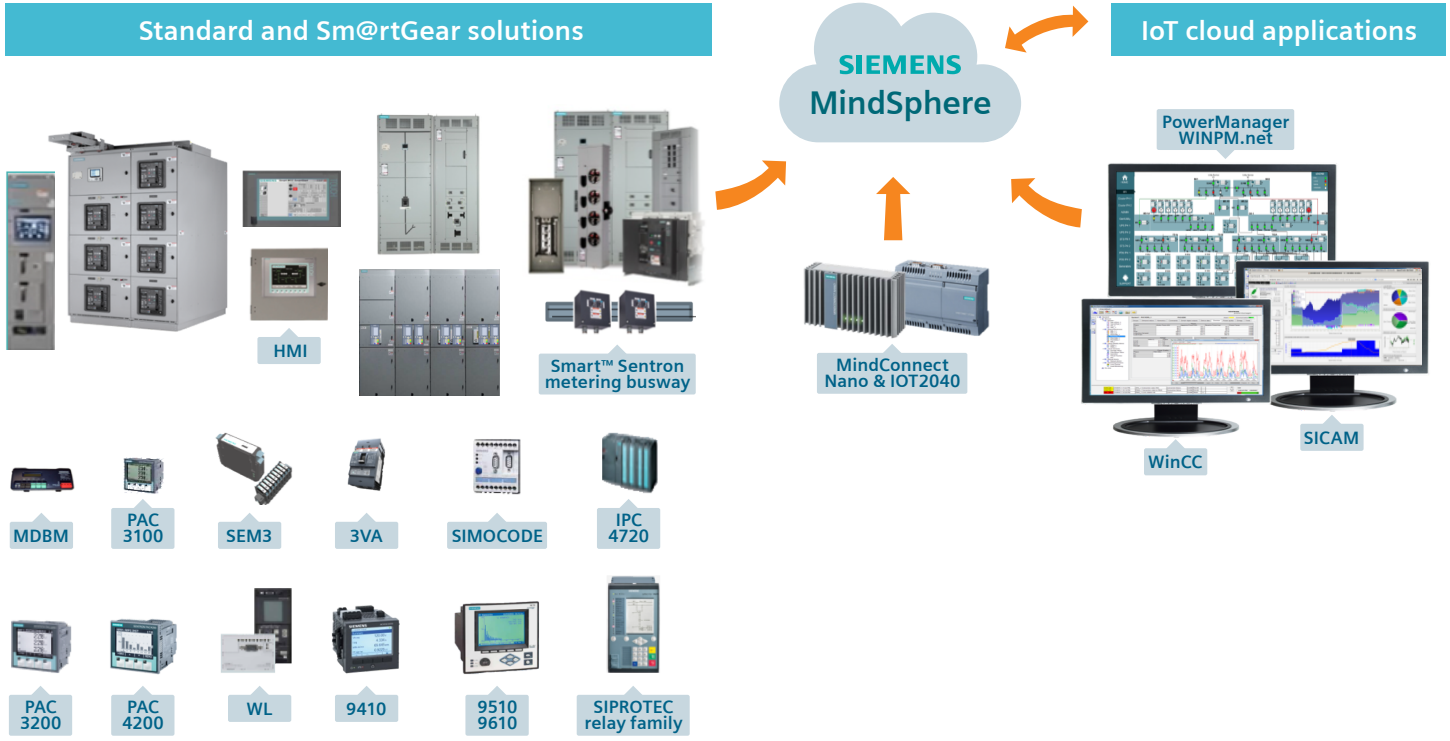
power generation assets and controllable loads to ensure enablement of energy infrastructure functionality. This advanced software solution manages grid assets and ensures that cost control targets are met while fulfilling energy demand.

On-site dedicated substations

Industrial on-site high-voltage dedicated substations also allow customers in the F&B industry the flexibility to control their own power, and avoid costly disruptions to production. Siemens has the necessary know-how and world-wide project experience for delivering turnkey substations. Depending on the project, Siemens takes responsibility for the complete power substation project; from consulting, to design, to installation, and commissioning.

Siemens optimized electrical distribution architectures improve site performance and reliability, deliver safety and efficiency, and provide software that uses economic and process data to optimize plant performance. Power experts offer a complete set of solutions to manage renewable energy production, electrical distribution, and energy optimization.



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Reducing operating expenses

Digital technology innovations, the rapid decrease in price of these technologies, and digital energy services are all trends that can help F&B organizations reduce their operating expenses. With the Industrial Internet of Things (IIoT), F&B plant infrastructures now have the capability of becoming more intelligent at a lower cost. As these devices gather more data, translating that data into actionable intelligence is how F&B manufacturers can drive a dramatic increase in operational efficiency. In some cases, "big data" allows for highly accurate forecasts of equipment behavior and energy consumption. As a result, energy waste is minimized and CO_2 emissions are reduced.

In resource constrained F&B plant environments, motor and electrical component maintenance emerges as a critical factor for limiting production line downtime. Until recently, most F&B operations focused on break/fix approaches. 40% of a typical maintenance budget is consumed by expenses related to reactive procedures. However, as marketplace demands become more intense, plant managers are required to minimize any downtime and to control the costs of maintaining their plant equipment. Waiting until actual failure to deploy fixes can result in more costly and lengthy repairs. **Maintenance programs** for your power systems offer an effective means to reduce these costs. Aligning with your specific needs, Siemens can deliver power system consulting, engineering, analytical studies, and specialized field services to help optimize your system.

Predictive maintenance is another approach to ensuring reliability. In a predictive environment, the equipment is monitored on an ongoing basis. "Vital signs" are monitored and if conditions change, a detailed diagnostic is performed and a calculated estimate of remaining uptime is projected based on historical trends. The estimate recommends the best time for when that machine or component will require a fix (prior to breakdown). This helps to minimize costly interruptions to uptime. Reducing the number of times critical parts are replaced in an equipment's lifetime not only saves in maintenance costs, but also extends the life of the asset.

An example of predictive maintenance is provided in cloud-based service models that give insight into the health of electrical distribution assets. The steps executed in the process include the following:

1. Gathering of behavioral data through sensors
2. Consolidation of collected data via a dashboard
3. Monitoring and analysis of that data on systems and by power experts
4. Transformation of data to action.

All of this translates into the minimization of unscheduled plant downtime. Tools such as **Siemens MindSphere**, a cloud-based Industrial Internet of Things (IIoT) platform, allow production facilities to move beyond energy usage and capture other types of manufacturing process data resulting in actionable business information.

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Such software solutions can detect the smallest variations in data trends, allowing F&B organizations to fine tune their processes and transform collected data into productive business results.

The value of recommissioning and retrofitting

Plant modernization strategies, such as recommissioning and retrofitting, can play a useful role to achieve goals, like improving plant efficiency and reliability.

Standard commissioning ensures that a new plant operates as the owner intended and that staff are prepared to operate and maintain the systems and equipment. Recommissioning is an update to an existing system to reflect the changes that have occured over time in a plant's operations (e.g., the introduction of multipurpose production lines). Recommissioning improves a plant's operations and maintenance (O&M) procedures to enhance overall performance. Digitalization solutions of Siemens gear, such as **Sm@rtGear**, provide users with quick and cost-effective tools to remotely perform commissioning and recommissioning tasks.

Some changes require your equipment to be replaced or retrofitted. Whether your equipment was made by Allis-Chalmers, Westinghouse, GE, Federal Pacific, ITE, McGraw Edison, or another manufacturer, Siemens will assist you in evaluating which replacement or **retrofit solution** best meets your needs. Any other manufacturer's models and ratings can be engineered by Siemens by customer request.

Siemens industry finance teams offer a range of asset finance solutions that take into account growth goals and liquidity management.

Optimizing asset control

Within many food manufacturing and packaging processes, electric motors play a critical role in driving conveyor belts, pumps, compressors and other critical infrastructure assets. Management and monitoring of such assets is critical for preventing defects in core processes such as mixing of ingredients. Tools, such as the **Siemens tiastar™ motor control center**, provide operators with the ability to accurately monitor the energy usage of ovens, coolers, and conveyor belts and to pinpoint areas for improvement, such as adding thermal insulation, optimizing heat transfer, or even moving equipment to different locations. In addition, monitoring the power usage of bearings and motors that drive conveyor belts can help maintenance crews quickly identify equipment degradation before any unscheduled downtime can occur.

These Siemens solutions integrate with distributed control and SCADA systems, offering plant-wide data transparency, so that plant stakeholders can increase process efficiency, support new growth, and optimize timing of maintenance and other equipment intensive efforts.

Crafting cyber secure solutions

As F&B plants move ahead with their digitalization and modernization plans, cyber security issues grow in significance. Both internal operations and consumers must be protected from any malicious attack that target food and beverage lifecycle processes. In this regard, Siemens systems are designed to meet NERC/SIP compliance directives. The combined security intelligence and modular design of Siemens switching and control equipment enables clients to prevent disruption of critical applications. Integrated software enables secure access of distributed devices, as well as continuous network monitoring and threat detection to prevent network intrusions in real-time. In addition, Siemens helps with industrial **cyber security** analysis to understand exactly where your systems might be vulnerable.

The advantage of innovative financing

One of the barriers to the adoption of digitalization, for smaller F&B manufacturers in particular, can be budgeting, and attaining the proper balance between the implementation of new technologies and the desire to drive new products to market. Siemens industry finance teams offer a range of asset finance solutions that take into account growth goals and liquidity management. Siemens unique **financing solutions** make equipment and technology more accessible and often provide alternatives to traditional credit channels. Responsiveness at every step of the way makes the process of arranging finance easier and adds value over the long term.

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Strategies for further improving sustainability

F&B manufacturers must balance profitability with a focus on delivering high quality, safe products in a sustainable manner. To date the F&B industry has met many of the sustainability requirements of global and local legislation, and leads all sectors in sustainability disclosure. Yet governmental regulations are still challenging F&B organizations to increase transparency of operations.

Besides assuring that the food they eat is safe, consumers also want F&B organizations to reduce resource waste in their operations. In addition, utilities can request manufacturers who exceed their limits to either shut down production at certain times, or pay a hefty utility fine. Therefore, F&B companies must find new ways to reduce both water and energy consumption (the two are often related). However, in many F&B operations, traditional power infrastructures have aged and become stretched thin. This not only increases the risk of downtime, but also limits the ability of stakeholders to capture electrical system performance data for efficiency.

Digitalized electrical distribution solutions enable plant components to share data and communicate to business systems for both operator and plant manager accessibility. Questions such as "Where is the device located?", "What is the status of the device?", "What is the status of its parts?", "Is the connected motor about to fail?", "Are the field buses working well?" are all answered in a simple and straightforward manner. This data feeds into consolidated analytics that allow operators to make the right decisions at the right time for higher energy efficiency. Tools such as Siemens **ACCESS™ Energy Management and Control Systems** and Siemens **Energy Management Software** help users to understand power and energy management from a regional and global perspective, and efficiently and safely monitor their power distribution systems.

Besides the introduction of more digitalized plant operation solutions, forward-looking F&B companies are also searching for sustainable ways to guard against the unpredictability of traditional utility transmission and distribution systems. **Distributed energy systems** and microgrids allow companies to reduce the risk of power interruptions and lost production costs by self-generating power outside of the traditional utility grid, through the deployment of wind, solar, and combined heat and power (CHP) solutions. Under such a scenario, the F&B operation can choose to source power from the utility, from the **microgrid**, or from both. In fact, **SICAM Microgrid Controller** can switch between sources based on variables such as marketplace energy prices, time of day, and load requirements. In this way, energy costs are reduced and energy supply is more stable, dependable and predictable.

Batteries and other energy storage technologies are employed to keep critical systems up and running. As a trusted partner for developing a reliable power infrastructure, Siemens experts develop innovative solutions which enable energy systems to adapt to sustainability challenges. For example, the Siemens **Smart Grid Suite** enables a multitude of customized solutions for smarter, greener infrastructure grids and introduces opportunities to further stabilize systems and identify sustainability opportunities.

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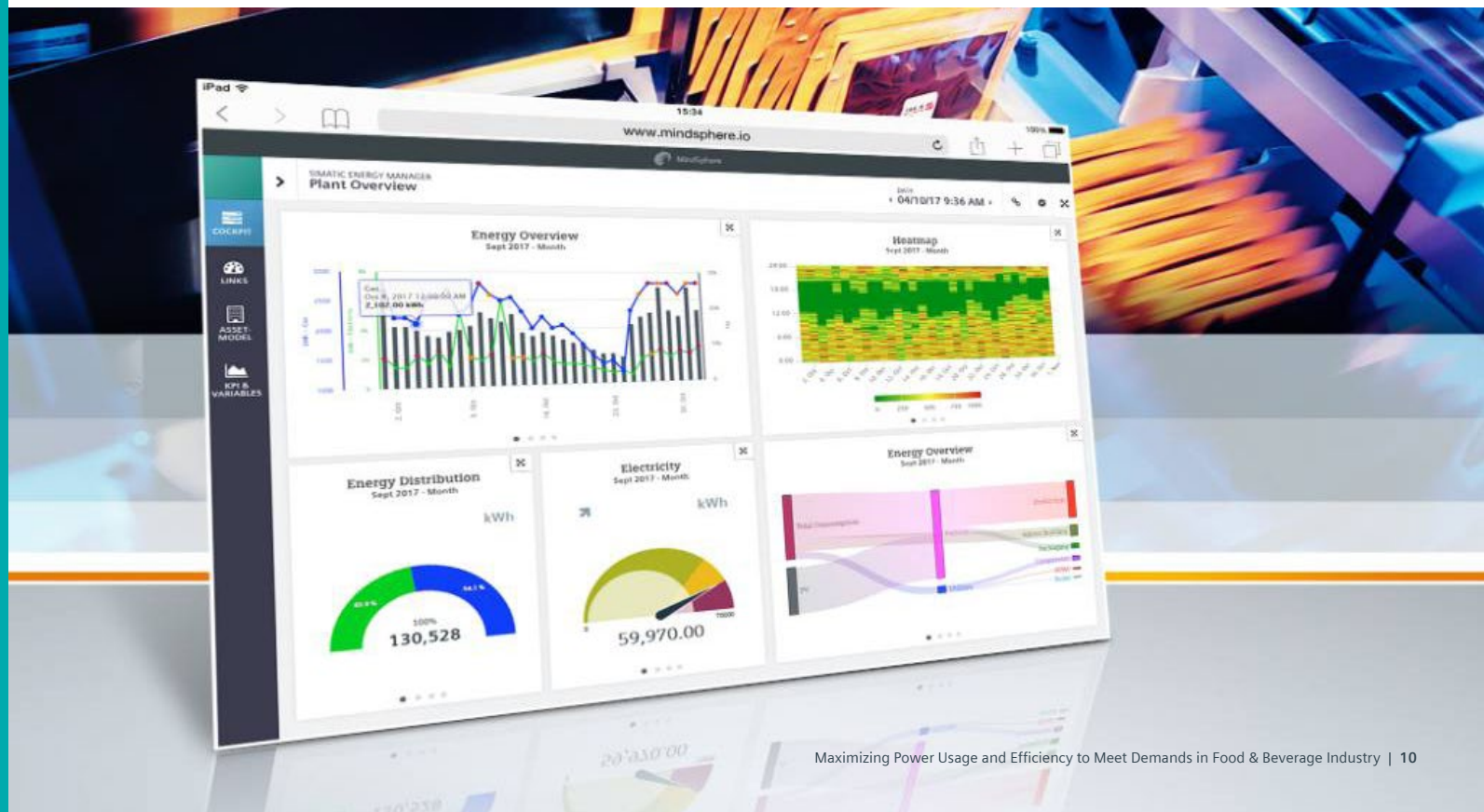
Conclusion

Siemens: a partner of choice to drive efficiencies and productivity

Food consumers are demanding insight into the sustainability initiatives of F&B manufacturers. Data-driven digitalization tools improve energy and process efficiency thereby reducing both corporate and societal carbon footprints. Better yet, the financial impact of energy efficiency projects can be accurately determined. All of this is linked to the collective peace of mind of a society focused on improving the environment of the planet, the well-being of its people and the profitability of its corporations.

Siemens has the global F&B industry expertise to help F&B manufacturers bring plant costs down through enhanced energy and power efficiency. By teaming up with an expert provider of end-to-end energy solutions, F&B companies can maximize both existing system productivity and design new systems that will enhance agility and the flexibility to respond to rapid changes in marketplace tastes.

Smart energy management and digitalization moves the F&B industry a step towards achieving the dual goals of sustainable production and profitability. Siemens, an experienced global technology provider, delivers total F&B manufacturing lifecycle service and support, expertise and quality solutions to ensure reliability, while lowering costs through predictive maintenance and arc-flash mitigation solutions. Whether upgrading to Sm@rtGear to create data streams that drive better decisions or implementing a cloud-based IIoT monitoring system, such as what Siemens MindSphere can provide, teaming up with a strong partner like Siemens will lower risk and help drive opportunities for future growth.



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CASE STUDY

Digitalization helps craft breweries establish a competitive edge

Cameron Cane, president of Deutsche Beverage Technology finds himself on the front line of helping large and small breweries to succeed in streamlining and modernizing their industrial brewing operations. “Digital systems will help more microbreweries become more competitive,” says Cane. “Many small brewers work in small shops with a limited amount of manpower, they need digital technology to help spur growth.” Brewers agree that digitalization is key to scalable growth and embracing partnerships that can guide them along the journey of transformation is critical. “As a small brewer, we are always looking for the next level of data analysis to produce more consistent and high quality beer.

Digitalization allows breweries to select the system capabilities that address their specific needs without having to deploy all features up front. Brewers can manage facilities within current cost constraints while maintaining the scalability to expand in the future. This provides their operations with the power of automation that enables them to realize the benefits of digitalization in a way that makes sense for their operations. As their business evolves, changes and upgrades can be implemented without having to re-engineer or repurchase the control system. Such affordability, scalability and ease of use were the primary reasons why Deutsche Beverage selected Siemens as a technology partner.

The ability to implement automation system adjustments on the fly helps brewers better serve rapid market demand.

As part of its partner search process, Deutsche Beverage analyzed product specifications and conducted blind tests to determine the look and feel of the various solutions. Siemens products came out a clear winner during these comparisons. The due diligence process was thorough and included everything from complete evaluation of the digital design and architecture, down to the quality of the equipment, for example, push buttons.

According to Deutsche Beverage electrical engineer Chris McAbee, the Siemens SIRIUS ACT push buttons and switches not only offered digital connectivity, but also stood out from the competitors because of their ergonomic look and feel, the ease of wiring, and the time saved during installation.

Consumer demand for craft brews and the level of competition for innovation and efficiency is increasing for craft beer producers. As a result, more and more craft brewers are choosing to implement new automation solutions as critical contributors to success. By combining industry knowledge with efficient technology solutions, companies like Siemens and Deutsche Beverage Technology enable brewers, large and small, to enhance quality and time-to-market through digitalization-driven flexibility and scalability improvements.

To learn more about how Siemens' products and solutions can help, please contact your local Siemens representative or contact us here.

Published by
Siemens Industry, Inc. 2020.

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