



WHITEPAPER

# Energy and water resource efficiency

In future global competition, a high level of energy and water efficiency will be crucial for the lasting success of food and beverage manufacturers. Digital solutions will facilitate the smarter use of natural resources so that companies can manufacture more efficiently, minimize costs, and reduce their carbon footprints.

**SIEMENS**

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**END-TO-END APPROACH**

# Using energy and water efficiently – **to save costs and protect the environment**

An end-to-end approach that covers all systems, processes, buildings, and infrastructure and their impacts on the environment can help drive sustainable development in the Food & Beverage sector. The challenge is to improve transparency in order to achieve specific reductions in energy and water consumption – while keeping product quality the same or even improving it. Optimizing the use of increasingly limited resources leads to significant savings.

**Automation and digitalization open up new opportunities**

The Food & Beverage sector in Germany is currently facing various challenges, including growing cost pressures and changing consumer preferences, both of which require a swift response. There are also calls for greater sustainability, energy and water efficiency, climate protection, and better product traceability. Automation and digitalization offer new opportunities for more flexible, efficient, and resource-friendly production. Growing demand in all in all of these areas can be satisfied thanks to smart networking, the Internet of Things (IoT), cloud and edge computing, simulation software, artificial intelligence, and Blockchain technology.

„Digitalization offers new opportunities for more resource-friendly production.“

### Food and beverage manufacturers have a special responsibility

The move away from using fossil hydrocarbons as fuels and raw materials – decarbonization – is a key action area in the fight against climate change. Many industries and businesses have already committed to fully implementing this step by 2050. In addition to utilizing renewables and building a green hydrogen economy, a tangible reduction in energy consumption coupled with improved energy efficiency will make a crucial contribution to achieving this objective. The same applies to the need to manage our natural resources carefully, especially drinking water, which is becoming increasingly scarce. As an energy-intensive industry that consumes huge amounts of water, Germany's food and beverage manufacturers have a special responsibility – as well as the opportunity to act as trailblazers, which will boost their global competitiveness over the longer term.



Digitalization makes energy and water consumption in manufacturing more transparent thus allowing targeted measures to be implemented for improving resource efficiency. That's not just good for the environment and the climate, it also creates cost benefits for the industry trailblazers.

## ENERGY EFFICIENCY

# How the Food & Beverage sector can reduce its **energy consumption**

Three central goals are driving investments that improve energy efficiency in food and beverage production: creating more sustainable production with a reduced carbon footprint, observing all legal requirements, and boosting both productivity and cost-effectiveness. In an ideal scenario, all three will be achieved together.

## **Energy accounts for up to 30 percent of operating costs**

Food and beverage processing involves a wide range of processes that require operating power as well as energy for heating and cooling. Although the Food & Beverage sector (F&B) is only in sixth place among the top energy consumers<sup>1</sup> in German industry, with an average 5.6 percent share of the operating costs, this issue has now become much more important for many businesses. Actual energy consumption, however, differs greatly between the various sub-sectors. For example, butcheries in the meat processing industry and producers of frozen goods, which need energy-intensive cooling systems, consume much more energy than, say, tea or specialty food manufacturers. The sugar industry, milk processors, producers of baked goods, and breweries are also among the largest consumers of energy in the Food & Beverage sector.

To mention just one example: In the dairy industry, energy costs account for an average share of five to eight percent of the added value generated, whereas energy costs in the meat processing industry make up to 15 percent<sup>2</sup> - and thus are more than twice as high. Breweries spend between five and ten percent of their operating costs<sup>3</sup> on energy, whereas this figure can reach as much as 30 percent in the sugar industry<sup>4</sup>. Oil and hulling mills are also very electricity-intensive. And energy costs are especially relevant for companies that require huge volumes of heat for their production or that use electric drive system to move raw materials and products. Given the tight margins in this sector, even small savings can make a positive difference.

**Sustainability as an important competitive advantage**

The Food & Beverage sector is a consumer-oriented market where consumers' desires for increasingly personalized products and services play a crucial role; and sustainability in terms of both products and their manufacturing processes is also influencing consumers' buying decisions to a greater and greater extent. That's why smart manufacturers are examining the environmental impact of their entire systems, processes, buildings, and infrastructure and are continuously optimizing their energy consumption. This end-to-end approach enables them to move forward with activities aimed at decarbonization. This results in significant cost benefits, in addition to contributing to a cleaner environment.

**Integrated energy data management in the production process**

Implementing an energy data management system is essential food and beverage manufacturers to enhance their efficiency and comply with legal requirements. It also contributes to a "green" and sustainable image, and enables companies to unlock the many opportunities offered by the energy transition.

At the same time, the integration of energy data management into the production process provides the necessary transparency to make fast and confident decisions. Digitalization now offers entirely new opportunities in this context.

As an element in Industrie 4.0 strategies, the internet of Things (IoT) helps to obtain comprehensive machine and plant status, consumption and productivity information – both quantitative and qualitative – and combine it to establish meaningful key figures. The first step is to capture the necessary data from all processes and save it for current or subsequent analyses. In a later stage, the data can be organized as required and linked with other relevant information: for example, to include building control technology or electricity generation infrastructure in efficiency calculations.

**Flexibly**  
to the new tasty



### **Energy savings of 45 percent possible**

Europe's Food & Beverage sector has tremendous potential to improve its energy efficiency and use renewable energy sources. This is demonstrated by the result from about 250 energy audits of businesses in the sector performed as part of the EU GREENFOODS project. In fact, the results suggest that it is technically possible to save roughly 45 percent of the energy currently. Overall, the companies on which detailed analyses were performed would be able to reduce their annual energy consumption by 150,000 MWh and their greenhouse gas emissions by 30,000 metric tons of CO<sub>2</sub>. This means that a large number of companies could reduce their energy consumption by 10 to 25 percent by applying measures that require very little investment or even none at all.

### **Multiple starting points for improving energy efficiency**

Opportunities range from replacing and upgrading obsolete equipment to the comprehensive modernization of drive trains and electric motors in production facilities, to improving the efficiency of HVAC systems. Significant energy savings can also be achieved by modifying parts of the production process: for example, reducing the steam temperature in a given process without compromising overall process quality. In addition to the greater transparency provided by state-of-the-art energy management systems, another way to achieve significant efficiency gains is to apply smart control procedures and automation technologies that utilize digital solutions and go beyond simple system monitoring.

Generating "green" electricity at the local level contributes to long-term decarbonization, as does converting heating systems using combined heating and power (CHP) systems and lower high-temperature heat pumps. Even though energy storage alone doesn't directly result in carbon savings, it can still serve as an optimization method to facilitate those savings. Microgrids, the infeed of renewable energy as well as high-performance electricity storage systems create a flexibly adaptable power supply system that contributes to the sustainable reduction of a company's environmental footprint.

# Incentive systems **drive the climate transition forward**

## **Carbon pricing makes climate-unfriendly production more costly**

The carbon pricing of fossil fuels has been part of the German federal government's climate package since the beginning of 2021. Business initially have to pay €25 for each metric ton of carbon dioxide generated by the combustion of diesel, gasoline, natural gas, LPG, and heating oil. This will not always be the case, because the price for the required carbon allowances will gradually rise to €55 by 2025 before actual emissions trading will begin in 2026 at an initial price range of €55-65 per metric ton of CO<sub>2</sub>. The goal is to create an additional financial incentive to save energy and utilize renewables.

## **Federal funding program for energy efficiency in the commercial sector**

This development currently presents many businesses in the Food & Beverage sector with the challenge of tackling more complex energy-efficiency and climate-protection measures, which have not been implemented in recent years due to low fuel prices or generally unfavorable conditions. The German government is providing financial support for this effort with its federal funding program for energy efficiency in the commercial sector ("Bundesförderung für Energieeffizienz in der Wirtschaft"), initiated in early 2019, which consists of four modules. As last updated on December 1, 2020, the program can be accessed to fund the procurement of highly efficient standard technologies and the most appropriate system solutions and optimizations.

### **Module 1: Crossover technologies**

This module provides support for investments aimed at improving energy efficiency by using technologies available on the market. Funding is available for investments to replace or obtain new highly efficient systems or assemblies for industrial and commercial use, including electric motors and drives, frequency converters, pumps, ventilators, compressed air systems, and systems for using waste heat or heat recovery from wastewater.

### **Module 2: Process heat from renewables**

This module covers the replacement or acquisition new of systems for supplying heat from solar panel arrays, heat pumps, or biomass plants. Over 50 percent of the heat produced by these systems can be used for processes like manufacturing, processing or refining products, and also also for providing services.

**Module 3: I&C, sensor systems, and energy management software**

This module includes support for procuring hardware and software for creating or using an energy or environmental management system. Investment costs eligible for financing include the installation of process control and automation systems, sensors, actuators, data loggers, and gateways.

**Module 4: Energy-related optimization of systems and processes**

Financing from this module is available for investment measures that focus optimizing industrial and commercial systems and processes in order to improve energy efficiency and utilize renewable and waste heat resources for industrial processes. Financing based on Module 4 is not limited to specific technologies and may also include the measures identified in Modules 1 and 3.

The amount of financing provided depends on factors like the nature of the financing, the measures involved, the business size, and the scope of investment. For example, the federal government provides up to €700 per metric ton of CO<sub>2</sub> saved each year for small and medium-sized enterprises (SMEs) and up to €500 for large businesses. In both cases, the extent of the financing depends on the provisions of the individual modules. In modules 1 and 3, for example, a maximum of 40 percent of eligible costs will be covered for SMEs and a maximum of 30 percent for large-scale businesses. There is also an extensive range of other funding programs, such as energy upgrades in buildings.

**COMPLETE SOLUTIONS**

# Siemens Total Energy Management: **A comprehensive approach from a single source**

With its comprehensive Total Energy Management solution, Siemens helps food and beverage manufacturers cut their energy and operating costs and reduce their carbon footprint. This includes reducing energy consumption in addition to self-generation of electricity and low-cost procurement.

**Reducing energy consumption**

By reducing its energy consumption, the Food & Beverage sector can achieve tangible cost reductions, comply with legal requirements, improve its lifecycle assessment, and take steps to decarbonize its production. The implementation of smart automation systems and optimized control strategies contributes to enhancing efficiency while reducing the carbon footprint. We help you analyze your actual situation and unlock the full savings potential, in addition to implementing energy efficiency projects across all disciplines and departments. This can include measures for the improvement of waste heat utilization, energy upgrades to systems, and replacing drives.

**Generating energy locally**

Generating and storing energy locally prevents transport losses, which improves resource efficiency as well as the security of supply. We create plans and studies for the Food & Beverage sector aimed at building in-house energy supplies by integrating renewables and smart storage solutions, and we then implement customized energy systems that safely and efficiently supply energy and media.

„A one-stop shop: Consulting, planning, implementation, operation, service, and follow-up checks“.

### **Optimizing energy procurement**

Making intelligent use of the liberalized energy market and the incentives offered under energy laws is the ideal way to massively optimize energy costs in food and beverage businesses. But since this requires specific expertise, we provide support for participating in the energy and control reserve market and the emissions trading system, for optimizing energy procurement and grid fees, and for making your energy management system more flexible.

### **Data-based services and continuous optimization**

Putting energy and environmental management systems into place in accordance with ISO 50001 and ISO 14001 – integrated into automation systems wherever possible – ensures greater transparency. In fact, precise measurement is a key prerequisite for ongoing optimization, and solutions such as the Siemens Navigator and Simatic Energy Manager Pro will support you in the process. You can find more on this subject in our “Energy data management in the Food & Beverage sector” whitepaper.

[Energy data management in the food and beverage industry.](#)

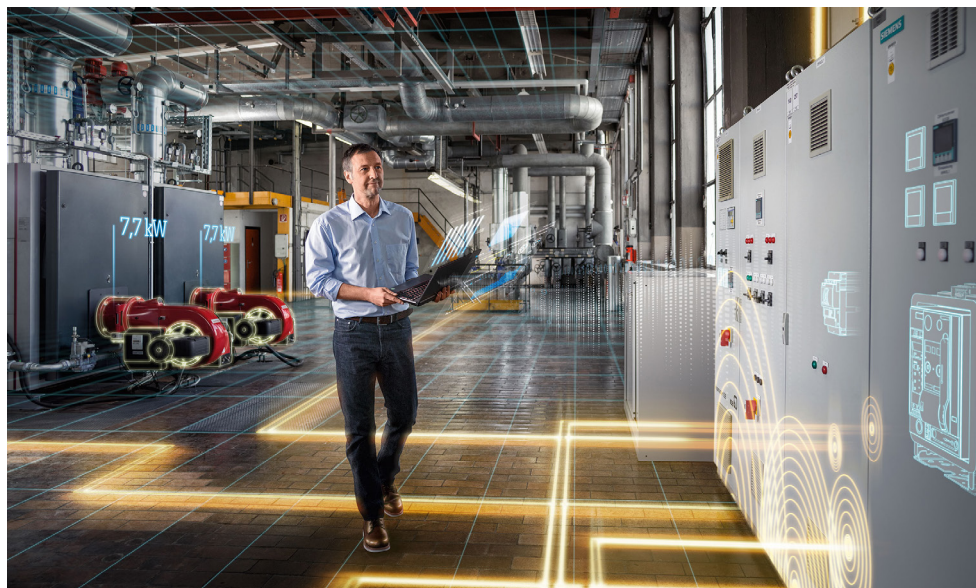
Data-based business management and continuous optimization provide for long-term success on the path to decarbonization. We help with grid quality analyses and monitoring, consumption and load profile evaluations, as well as with ongoing energy and plant performance monitoring based on automated data analyses. Optimizing maintenance and fault management makes another important contribution to improved resource efficiency.

### **The right business model for every operation**

In addition to the production process as the central element, the end-to-end Total Energy Management approach from Siemens for the Food & Beverage sector can also include control technology and infrastructure for the energy supply system. In the implementation stage, we provide support in the form of a business model tailored to company's specific business situation. In addition to traditional self-financing – including the use of incentive programs where possible – we also offer options such as Pay as you Save (you pay based on the amount and time of the savings you achieve); Efficiency as a Service (energy efficiency as a service with no need for investments and an off-balance sheet structure); Gain-Share (we improve your energy efficiency and the resulting cost savings are shared); and energy performance contracts (financing the investment through guaranteed energy savings and ensuring cost-efficiency).

### **Complying with third-party quantity delimitation including protection from manipulation**

Under Germany's Renewable Energy Act, food and beverage companies that generate their own electricity enjoy a certain amount of freedom from the customary levies. But there will be a complication beginning January 1, 2022, at the latest: Under Germany's new Energy Collective Act (“Energiesammelgesetz”), a clear delimitation of third-party quantities is required in order to continue benefiting from tax advantages. For example, if third-party suppliers consume energy made available on the premises, these volumes must be recorded and reported in the future using certified meters in order to prevent the risk of manipulation.



Products in the Siemens SENTRON portfolio, Simatic Energy Manager PRO, and Siemens Navigator meet every transparency requirement and ensure that you can benefit from levy privileges on electricity prices. For more details, see the “Delimitation of third-party volumes in connection with the renewable energy surcharge (EEG surcharge).”

### **Future-oriented technologies are driving the energy transition forward**

Siemens is working at the cutting edge of future-oriented technology solutions enabling the energy transition. For example, the company created a virtual power station for a Finnish subsidiary of the Carlsberg Group based on latest-generation – energy storage technology. A modular 20-megawatt battery half the size of a football field provides temporary storage for renewable electricity, which then supplies production at the brewery around the clock. This energy flexibility facilitates scalable structures while protecting the environment and minimizing costs.

Power-to-X (P2X) processes – in which green hydrogen is generated from excess renewable electricity using electrolyzers – will play a key role in these projects in the future. Using CO<sub>2</sub> from the air, this hydrogen can then be converted into synthetic fuels and other forms of energy (“power-to-heat” or “power-to-cold”). Numerous technologies are available for this purpose, including industrial-scale flow heaters, electrode boilers, electric industrial furnaces, process heat electrification, storage heating units, and electric heat pumps. Both boilers and heat pumps can be produced in orders of magnitude from just a few kilowatts to several megawatts. Power-to-heat systems can supply individual buildings and even entire factories with indoor heating and hot water. And since P2X products are almost climate-neutral, they are a crucial element in the decarbonization of large sections of our economy.

# Driving down energy consumption

## Coca-Cola reduces the carbon footprint of its entire plant

Less waste, reduced electricity, gas-, and water consumption, lower emissions: An energy management system from Siemens has enabled the Coca-Cola HBC Austria plant in Edelstal, Burgenland, to achieve full transparency and analyze its resource and energy consumption in detail at any time. To visualize production data, it uses the Simatic WinCC V7 System from Siemens, and energy management is provided by Simatic Energy Manager Pro. Consumption and costs can now be precisely allocated to each – line and each individual product. In recent years, the company has invested heavily in new machines and plants, including a state-of-the-art high-speed filling line, in order to reduce its consumption of resources such as water and energy.



Its carbon emissions have been reduced to 17.5 g per liter of beverage, half the amount of 2010. Using air to clean bottles also significantly reduces the amount of water consumed.

Upgrading its high-pressure compressors for the blow-molding machines in the PET lines means that they now require between five and eight percent less electricity, depending on their operational status and capacity utilization. And last but not least, the fact that all of the systems at Coca-Cola HBC Austria in Edelstal are powered 100 percent by renewables is another key factor in the decarbonization process.

[Read the full user report.](#)

## Breitenburger Milchzentrale on the road to green production

Quality milk requires a great deal of energy. That's something the experts at Breitenburger Milchzentrale (BMZ) in Itzehoe, Schleswig-Holstein, know very well, because every year they process more than 200 million kilograms of this valuable food. Heat in particular is essential to the production process and to maintaining the temperature in the production and administration areas. The oil boiler used in the past was showing its age, incurring heavy costs and producing excess emissions.



In cooperation with Siemens, the dairy cooperative developed a comprehensive energy strategy that was progressively put into operation. A new hybrid boiler unit is at the heart of the system.

The boiler unit combines efficient steam generation with a flexible electricity load profile and uses natural gas and/or electricity generated by carbon-neutral processes to generate steam in a power-to-heat process. Because this highly efficient plant has significantly reduced emissions, BMZ was able to claim €200,000 in investment grants from federal government subsidies for the project. BMZ also benefits from grid fee refunds of €250,000 per year, because the plant is incorporated into an automated load management system in the Desigo CC building management solution, and its electricity load profile meets the criteria for “intensive grid utilization.” This means that it can save €300,000 in energy and operating costs every year, with an internal rate of return (IRR) of more than 40 percent.

## Südzucker in Zeitz reduces its carbon emissions footprint by 680 metric tons per year

More than 200,000 metric tons of sugar leave the Südzucker production facility in Zeitz, Saxony-Anhalt, every year. The facility operates around the clock between mid-September and early January, and so every kilowatt-hour that can be conserved means a marked reduction in costs, in addition to preventing unnecessary carbon emissions. That is why the company turned to Siemens experts to identify the potential for saving energy in its sugar production processes.



As a result of the Siemens analyses, it was suggested that the company installs a new and more efficient motor with its speed governed by frequency converters for its secondary fan in the power plant. Financing was provided by a multi-year Energy Performance Contracting model.

This incurs just a monthly fee that is partly covered by the energy costs saved, and also includes a maintenance contract in addition to the investment costs. Once the energy-efficient system was installed, the plant's energy requirements fell by 38.7 percent. After deducting the contracting installments, the sugar producer has enjoyed an annual cost advantage of more than €5,000 right from the beginning of the contract. The energy saved – about 930,000 kWh – also results in an annual carbon reduction of 680 metric tons. When the contract was completed in 2021, Südzucker took over the installed technology from Siemens and is now continuing to save both energy and costs.

[Read the full user report.](#)

## Ritter Sport aims for complete climate neutrality by 2025

Ritter Sport isn't just the first major chocolate manufacturer to grow its cocoa sustainably: Its production practices are also gradually becoming more environmentally friendly. This family company has operated its own CHP plant at its main site in Waldenbuch, Baden-Württemberg, since 2002. Following a recent refurbishment, the CHP plant now provides approximately one-third of the company's total power demands and 70 percent of its heat requirements. It also has a number of photovoltaic systems on its roofs. Alfred Ritter GmbH & Co. KG installed a state-of-the-art Siemens energy management solution that detects hidden savings opportunities in its production processes and reduces its energy consumption by 1.5 percent each year.



Simatic Energy Manager PRO now combines all energy data from production, buildings, and energy generation into a single system and links it with process information. This means that a correlation between consumption values and production data can thus be established at any time.

The company gains detailed insights into how much energy is being consumed and by what processes. The system creates greater transparency that enables the management to be aware of all the energy consumers in the company, which allows the team to more accurately decide where to make further improvements in order to achieve their annual energy savings targets. Ritter Sport achieved a major milestone in the spring of 2021: Since then, it has been climate-neutral, and the company is aiming to achieve complete climate neutrality along its entire value chain by 2025.

[Read the full user report.](#)

## SUSTAINABILITY

# Greater Water efficiency improves **productivity and quality**

In addition to reducing carbon emissions, improving water efficiency is another important task on the path to greater sustainability. Key factors include reducing fresh-water consumption, treating and using wastewater, and more efficient water management. In the Food & Beverage sector, higher water efficiency can contribute to improvements in both productivity and quality.

**Water is the elixir of life in the Food & Beverage sector**

Clean water is an essential component in food and beverage production – as an ingredient in the products, for transporting raw materials, generating steam, and cleaning plants and machinery. In Germany, the Food & Beverage sector utilizes about ten percent of all the water used industrially, making it one of the largest consumers. The threat of water shortages in some locations and more complicated approval processes for investing in new projects and expansions are good reasons for looking at this subject in depth, and they are just as critical as the constantly rising costs. The latter involves not just the price of water itself, but also the use of energy (for example, to operate pumps) and the cost of wastewater treatment. Water issues also come under the heading of Corporate Social Responsibility (CSR) and sustainability reporting. Last but not least, the careful management of resources is increasingly influencing consumer purchase decisions, and it plays a significant role in establishing a company's image. Large retail chains already require their suppliers to provide climate-neutral products with small water footprints.

That is why the European Water Partnership non-profit organization developed the European Water Stewardship Standard<sup>5</sup>. Food and beverage companies which obtain certification under this standard have independent proof that they are dealing sustainably and responsibly with water as a resource. Many multinational companies in the Food & Beverage sector – including Coca-Cola, Nestlé, and Unilever in addition to suppliers like Siemens – are also participating in the UN's global CEO Water Mandate initiative<sup>6</sup>. Water-Use Efficiency (WUE) serves as an indicator to determine the gross added value a company, industry, or country generates per unit of water consumed. However, the lack of comparability is a challenge-, because WUE values can vary substantially even within sectors. The brewing industry, for example, produces about 1.9 billion hectoliters of beer per year, and in the process – from cultivating plants to consumption – uses at least 60 liters of water for each liter of beer produced. Whereas one international brewery quotes a WUE of \$1,850 gross added value per cubic meter of water consumed, another competitor claims just \$270<sup>7</sup>.

### **Expect more requirements and more stringent regulations**

The National Water Strategy draft submitted by Germany's federal government in the summer of 2021 lists more than 750 individual measures aimed at ensuring a the more sustainable management of this scarce resource by 2050. In addition to incentives to encourage industry to focus more on controlling its water use, there are also plans for a reform of wastewater fees in order to "make water pollution more unattractive." Businesses in Germany's Food & Beverage sector can therefore expect additional conditions and more stringent regulations to be imposed and should prepare for them sooner rather than later.

### Autonomous power supply from an in-house wastewater treatment plant

In addition to reducing fresh water consumption using a range of technological measures, the Food & Beverage sector is also focusing more on smart wastewater management at a global level as a way to observe the increasingly stringent regulations, reduce its water consumption in this area, and leverage new potentials for decarbonization.

The Theo Müller group of companies in Leppersdorf near Dresden, the home of the Sachsenmilch brand, has built a state-of-the-art combined-cycle gas turbine (CCGT) power plant consisting of two gas turbines, a waste-heat boiler, and a steam turbine. For fuel it uses biogas obtained from wastewater from the plant's own treatment facility as well as natural gas. As a result, one of Europe's most advanced dairy locations – which processes more than 1.7 billion kilograms of milk every year – has an almost entirely autonomous heating and electricity supply and is largely independent of external energy supplies. The power plant responds flexibly to load changes, adapting its generation capacity to changes in electricity requirements very quickly. Surplus electricity can be fed into the public grid.



The power plant control system from Siemens is the heart of the system. It is based on its powerful, flexible, and scalable process control system Simatic PCS 7. Highly available automation stations, fail-safe controllers, redundant process servers, and virtualized operator stations ensure that the power station can operate reliably and contribute to the stability of the public electricity grid.

**Closed water cycles and smart treatment**

Water efficiency doesn't just mean consuming less, it also means recycling more. That is why some food and beverage companies have already adopted a circular economy approach. This involves separating the recyclable resources from the flows of wastewater generated and feeding them back into the cycle. Numerous recycling strategies are available to treat up to 95 percent of the company's wastewater and restore it to process water quality for industrial re-use. But this requires an in-house service water network equivalent to domestic systems for making use of rainwater.

Researchers at the Technical University of Munich have adopted a novel approach involving a fuel cell for purifying wastewater in breweries. Their Brew-Cell makes it possible to purify wastewater and generate electricity at the same time. The process draws on the ability of particular bacteria to process organic matter in wastewater and transfer the electrons obtained to an electrode. The first pilot system went into operation at a large German brewery in the fall of 2019.

In the future, predictive and efficient water management will be a key factor in ensuring reliable industrial production in the Food & Beverage sector. And end-to-end digitalization is a prerequisite. The intelligent combination of data from different sources such as sensors, water meters, and weather data creates new opportunities for using water resources more efficiently and sustainably. A precondition is the end-to-end networking of system engineering, from commissioning and operation to maintenance and ongoing process optimization using a data platform.

## TECHNOLOGY

# Better control over water flows with automation and process control engineering

The Siemens process control engineering and automation portfolio also covers sustainable water management. Furthermore, it includes planning and simulation software for illustrating and optimizing water flows and volumes. Digital solutions from the municipal water and wastewater industry can also be used in the Food & Beverage sector.

## **Process control engineering as the basis for an end-to-end digitalization strategy**

Siemens supports companies in the Food & Beverage sector with a comprehensive portfolio of solutions and products for expanding, optimizing, and upgrading their production capacities. The control system controls, regulates, visualizes, and monitors processes in order to ensure reliable, fail-safe, and energy-efficient plant operation. This also includes smart water management. Our standard Simatic PCS 7 process control systems and the Web-based Simatic PCS neo provide an ideal integrated and reliable solution. In addition, process control engineering is the foundation for an end-to-end digitalization strategy, starting with plant engineering and extending to simulation, commissioning, automation, efficient plant operation, and predictive maintenance. It ensures that the automation components can communicate with each other as efficiently as possible and maintains a consistent flow of information from the field level to the DCS.

„Consistent flow of information from the field level to the DCS.“

**Factoring in water flows and volumes right at the system planning stage**

With our COMOS, plant engineering software, you can take water flows and volumes into account right at the plant planning stage and transfer the generated automation data directly into the process control system. Simit simulation software can detect and rectify errors before the system is actually put into operation. The end point of this linking process is the Digital Twin, a data-based plant model that combines all planning and operational data throughout the entire lifecycle to enable the continuous optimization of planning, operation, and maintenance. Modeling and machine learning can also be used to simplify and optimize water management. For example, data can be collected on-site using sensors, preprocessed directly in the plant using powerful edge computing, and evaluated in the cloud using artificial intelligence and machine-learning applications with Siemens MindSphere. In the context of "Water 4.0," Siemens has developed various innovative solutions for municipal water and wastewater systems that can also be useful for industrial users.

**Comprehensive instrumentation and automation solutions**

Continuous process monitoring is a key prerequisite for reliable, highly available processes in the Food & Beverage sector. With its Sitrans portfolio, Siemens offers smart devices and measuring instruments that ensure extremely reliable process control and can be easily integrated into your control systems. With their assistance, operators can identify problems affecting water flows: throughput, blockages, screening, and filtration faults and cavitation in pumps at an early stage – to prevent unscheduled and costly process interruptions and system outages. State-of-the-art tools can also quickly recognize leaks in your pipe networks using existing measurement and automation systems. By combining a number of methods, they can give employees direct and easy-to-follow feedback within the process control system itself.

**Improving plant efficiency by optimizing the CIP process**

In many plants in the Food & Beverage sector, Cleaning In Place (CIP) is a standard method for cleansing elements like tanks, tubes, and process pipelines – including all connected components such as valves, pumps, and sensors – of product residue, chemicals, microbes, bacteria, and other substances without interrupting production. In a multi-stage automated process using water and a variety of rinsing and cleaning fluids, this type of cleaning doesn't require plant components to be dismantled, which saves valuable labor time and reduces production downtime. Our Simatic PCS process control systems and BRAUMAT, our special solution for breweries, improve a plant's overall efficiency by seamlessly integrating CIP into ongoing production processes. They also optimize the use of time and reduce water and chemical consumption. This allows the fully automatic control of the cleaning process, ensures safe, optimally hygienic conditions, and improves food safety.



### **Working together to achieve the best solution for the Food & Beverage sector**

Siemens implements automation and water management solutions for the Food & Beverage sector both as a full-service provider and in partnership with OEMs, system integrators, and other industry suppliers. If we supply all the components for both greenfield and brownfield projects as a single-source provider– from electrical engineering to drives and pumps, sensor systems and actuators, automation, digital solutions, and software – we can guarantee their seamless integration and interfaces that work. As a global partner in collaboration with process OEMs, we support these plant manufacturers with our many years of industry expertise, our knowledge of water and wastewater treatment, and in-depth experience in electrification, automation, and digitalization. We can find the right solution for any challenge – from electricity supply, industrial communication, cyber security to process analytics and instrumentation. By working together, we can achieve tangible added value for plant operators.

### **Boosting energy and water efficiency with eco-partnerships**

We also foster close collaborative arrangements with machine builders and manufacturers of instruments, valves, and pumps for the benefit of the users. One example is our strategic collaboration with Danish pump manufacturer Grundfos which is based on the UN's Sustainable Development Goals (SDG). Together, we are striving to increase the availability of pumps and motors and to optimize their operation, because pumps account for ten percent of the world's electrical energy consumption. Through this partnership we can provide intelligent, efficient solutions for the Grundfos pumps, which use Siemens electric motors, in order to significantly reduce their energy consumption contribute to combating climate change. At the same time, Grundfos wants to help supply safe, clean water to 300 million people by 2030 and save 50 billion cubic meters of fresh water by applying water efficiency and wastewater treatment measures.

# References: How smart Aquaculture 4.0 **will change nutrition worldwide**

## **Singapore as a testing ground for the food production of the future**

The southeast Asian island nation and city-state of Singapore currently has to import more than 90 percent of its food, because only one percent of its 724-square-kilometer land area can currently be used for agriculture, and production costs are extremely high in comparison to other countries in the region. With its “30 by 30” plan, the country has set itself the ambitious goal of increasing the proportion of the food it can produce for itself to 30 percent by 2030, thanks to creative approaches and innovations in technology and research. One of the main ways to circumvent Singapore’s problem of available space will involve vertical farming systems and multi-level aquaculture facilities that use the most advanced high-tech solutions. Siemens has committed to this future-oriented global nutrition laboratory with a \$9.2 million investment in the pioneering firm Singapore Aquaculture Technologies (SAT).

## **High level of automation and use of artificial intelligence**

In February 2020, Siemens placed its first smart floating fish farm on the market in Singapore. Unlike traditional breeding systems, this aquaculture solution is equipped with a closed recirculating water system that uses a multi-stage water treatment process to create a controlled environment at all times. The fish farm also excels thanks to a high level of automation, efficient solar energy management, self-regulating control loops, and the use of artificial intelligence. This type of smart farm management system ensures a highly productive, scalable, and environmentally friendly operation at all times. Predictive analyses help monitor the health and quality of the tropical food fish, which are raised in a low-stress environment.



In Singapore, Siemens has established an end-to-end digital solution that includes a fully integrated automation system with smart sensors and connectivity to MindSphere, the cloud-based IoT operating system, via a secure network. Machine learning helps monitor operations and data processing.

### Highly flexible and environmentally efficient food production

The insights acquired from the data collected and visualized, with the support of AI, are steadily improving resource efficiency in terms of energy, oxygen, and feed in addition to food quality. The use of predictive video analyses helps anticipate potential biomass growth, prevent disease outbreaks, and reduce mortality rates among the fish. Another benefit of high-tech fish breeding is the higher level of food safety and traceability. The use of antibiotics and chemicals can be reduced to a minimum because the fish are bred in a closed recirculating water system in a controlled environment that is free of impurities and pathogens. And a tracking and tracing system enables consumers to better trace the path taken by their food. With its strategic partner Siemens, SAT is paving the way to highly flexible and above all environmentally efficient aquaculture at all stages of the value chain.

[More information on this project.](#)

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#### Footnotes

<sup>1</sup> Statistisches Bundesamt (German Federal Statistical Office), "Energieverwendung in der Industrie (Energy use in industry)". 2019, December 2020.

<sup>2</sup> Anuga FoodTec, "Energieeffizienz in der Lebensmittelindustrie (Energy efficiency in the food industry)." March 2018.

<sup>3</sup> Fraunhofer IWU Chemnitz, February 2019.

<sup>4</sup> Frontier Economics Ltd., ICC study, June 2018.

<sup>5</sup> <https://ews.info/>

<sup>6</sup> <https://www.unwater.org/>

<sup>7</sup> Pictet Asset Management, "Die Herausforderung der Wassereffizienz (The challenge of water efficiency)." March 2021.