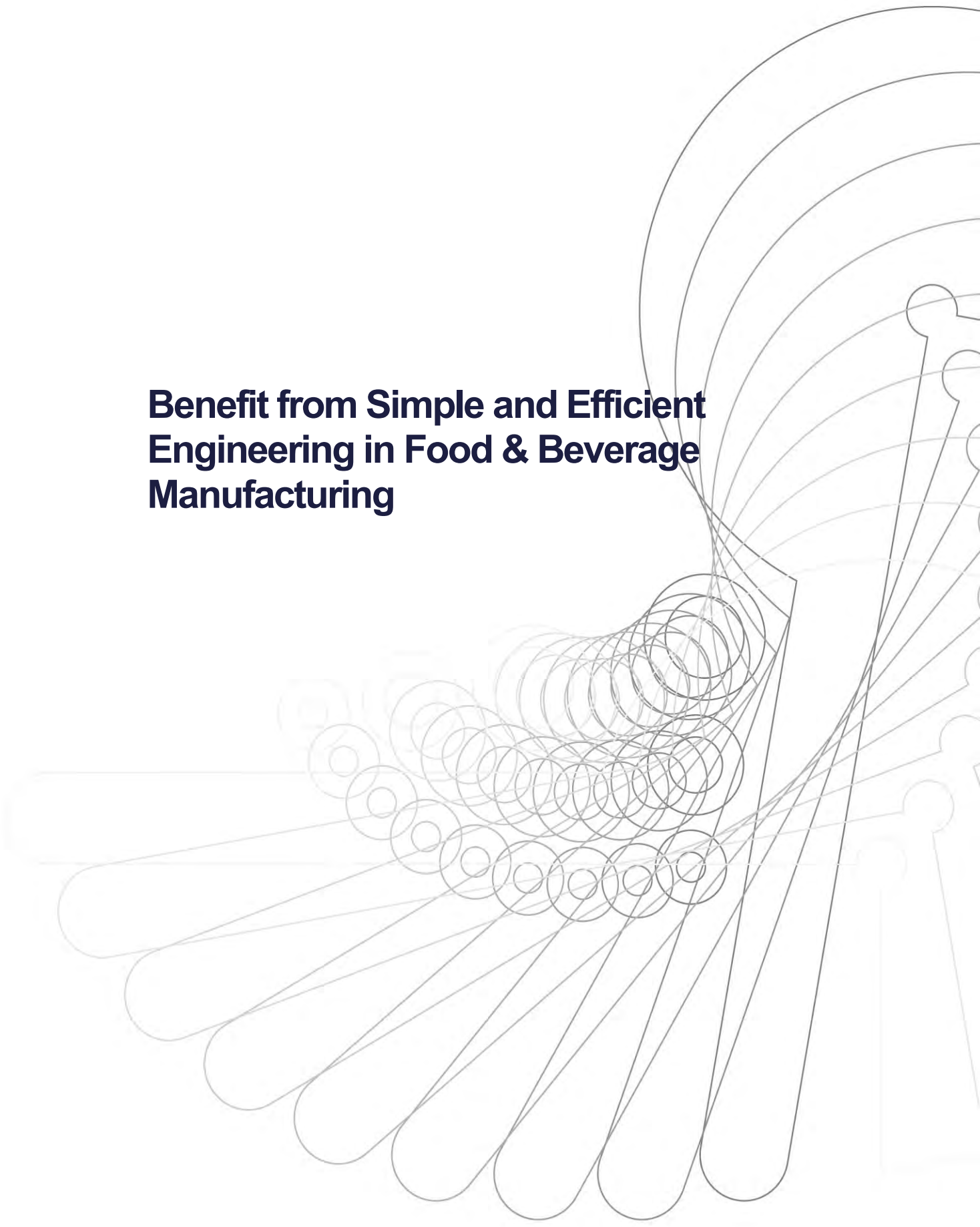
Benefit from Simple and Efficient Engineering in Food & Beverage Manufacturing



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Introduction

Each Food & Beverage Plant has its own life cycle. In the beginning there is an idea from an investor, from which flows the business plan. As soon as the product has been defined, the necessary production lines and processes, whatever they happen to be - whether the production of cheese or the filling of water - are designed by their respective specialists.

Figure 1 shows an example of a factory life cycle. Naturally, a production site can often run through these phases several times, or only in part.

The design of Manufacturing processes and Production Plants forms the basis for detailed investment planning. It is at this point the suppliers, such as Machine Manufacturers and System Integrators, are also involved.

From this moment on, engineering is a key task within the factory life cycle. For the purposes of this document, we concentrate in particular on software engineering for process and factory automation.

Figure 1: Each Food & Beverage Production Plant follows its own life cycle.

Why is Engineering so important?

ROI = Return-Of-Investment

At a minimum, Engineering has an effect on the following areas:

- Initial project costs and, thus, financial indicators such as ROI
- Subsequent costs for maintenance and upgrades and therefore indicators such as TCO

TCO = Total-Cost-of-Ownership

- Reliability of production facilities, as well as quality of processes, and thus OEE indicators
- Adherence to tight time restrictions from project management: software engineering is, as part of the final project phase, often under extreme time pressure
- Speed and flexibility when updating production processes and equipment in line with the requirements of the market

Who is responsible for the engineering?

If we look at the roles of Machine Manufacturers, System Integrators and Manufacturing Companies, all three protagonists carry out engineering tasks. The suppliers typically take on the key role, at least until the point when their equipment is put into operation. The staff of the production plant also develop their own engineering skills, in order to more or less cover the need for maintenance tasks, equipment optimization and upgrades etc. Their skills are sometimes supplemented with help from external service providers (System Integrators).

How does automation software make Engineering more profitable?

In the following chapters, we will demonstrate examples, where zenon – the process control system from COPA-DATA – was deployed and which demonstrate how software engineering can make a whole Production Plant more powerful and more productive.

Thanks to zenon"s universal nature, zenon communicates with the most varied hardware components, which makes it possible to select an individually defined, optimum mix of automation technologies during the design phase. This freedom of choice and design accompanies each project through all steps of the factory life cycle. In this document, we will look at four examples from the Food & Beverage industry.

Example 1: Creation of an in-house process control application – a pasteurizer with added value

Let's take a look at a brewery. We start with the following situation:

- At a flash pasteurizer in the beer filling facility, the local display shows the process parameters as real time data and recent events. In accordance with the requirements of ISO 9000, the pasteurization process must be documented and monitored more precisely.
- Only operating personnel with little experience in the development of HMI/SCADA systems are available for the project planning.
- If necessary, required software solutions can be installed on a PC in the office of the production manger.

The following requirements must be met for compliant monitoring and documentation for the flash pasteurizer:

a) Data acquisition from process parameters such as temperatures, flow levels, pressure and status information

b) Online calculation of pasteurization units

c) Alarm management

d) Storage of pasteurization and parameters for at least a year

e) Online and historical trend diagrams of parameters

By installing zenon on the PC of the production manager, the team arrives at their goal in five steps:

1. **Save costs and plan in-house instead of buying in from outside**
   Because zenon does not require any programming knowledge, even beginners can learn very quickly how to create projects by simply setting parameters. Intuitive, clear and powerful.

2. **Choose control connections**
   With zenon, the connections to the automation components are made with just a few settings. Because zenon already provides over 300 communication protocols, all that needs to be done is to select the appropriate ones.

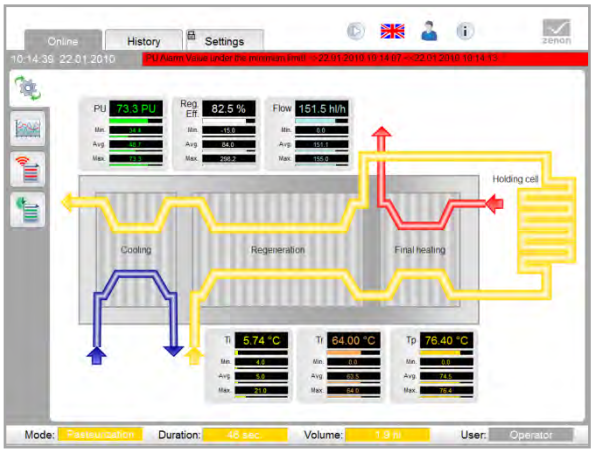

Figure 2: Historical and real time information, easily available thanks to zenon, improves control of the pasteurization process.

3. **Type in the pasteurization formula**
   Calculating the pasteurization formula need not be a ‚black art„. You simply need the math driver that already exists in zenon. Type in the formula and use the real-time calculations immediately.

4. **Complex functionality – only a few mouse clicks away**
   Requirements such as data archiving (historian), alarm management and extended trend analyses are easily activated and set up by mouse click in zenon. The display on the pasteurizer now has only a nostalgic value from now on. This is because all important events not only trigger alarms, but are also recorded in strict compliance with ISO and FDA rules and can be analyzed and clearly displayed at any time.

5. **Screens provided out of the box**
   Now only the corresponding user interface screens are still to be created. zenon makes this step very easy by providing a large number of pre-defined and adaptable screens which also include functional logic.

In less than four hours, a display that previously required constant monitoring was thus turned into an automated solution that also complies with strict standards and can make a valuable contribution to ongoing productivity.

Example 2: Maintenance of HMI software solutions on machine operating systems

In our second example, a Juice Producer is running zenon as the HMI software on the Production machines. Nevertheless, he has a great challenge to overcome:

- The machines are already out of the warranty period but the Machine Manufacturer has provided the Juice Producer with the Editor files for the zenon projects.
- The Juice Producer‟s internal operating processes require that the Automation and Maintenance teams modify the HMIs themselves.
- The cleaning procedures of the bottle washing machines have just been improved. New chemical additives were used in controlled doses. The automation systems were updated accordingly and new parameters, as well as status data are available in the HMI software.

The automation team now has the following task:

- The visualization needs to be updated to reflect the changes to the process, appropriate alarms must be configured and visible on the HMI.

With zenon, the relatively inexperienced team achieves their goal in four steps:

1. **One editor for all systems**
   The zenon development environment enables all zenon applications to be conveniently edited. It is compatible with previous versions and with hardware running Operating Systems ranging from Windows CE to Windows 7.

2. **Object orientation**
   The clear organization of project components in zenon Editor makes it possible to quickly find the required process screens. Graphical symbols such as pumps, pipelines, valves, etc. are quickly added to the screens by dragging and dropping them from the central symbol library.

3. **Real-time-ready**
   For clear process visualization, the properties of symbols are directly linked to real time status information. For example, the appearance and the color of the pump symbols automatically correspond to their real status, such as "in operation", "stopped" or "error".

4. **Alarm!**
   For process parameters that trigger an alarm under certain conditions, the desired minimum and/or maximum limit values can be set. The zenon alarm management system automatically takes these limits into account: information windows are displayed, entries in the historical and/or online alarm information list are made, etc.

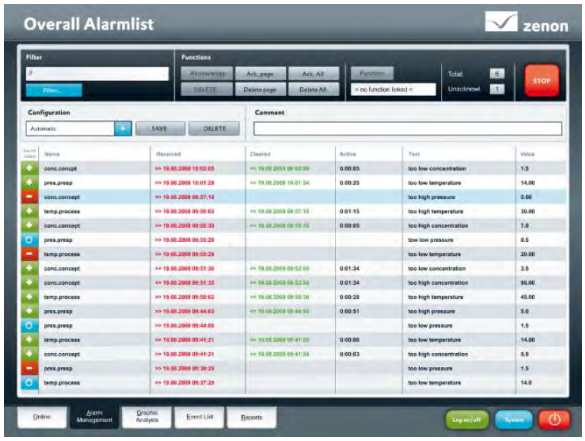

Figure 3: New process parameters are added to zenon alarm management with just a few mouse clicks.

Without costly external assistance, the Juice Producer"s team has adapted the original, supplier-developed application to reflect the new parameters.

Example 3: Automatic calculation of KPIs

KPI = Key Performance Indicator

In this example, we are examining how to increase the effectiveness of production in a milk processing plant. The initial situation is:

- The milk processing plant manually calculates its key performance indicators (including OEE) each week.
- OEE of 55% shows that there is a great deal of potential for improving production effectiveness.
- The technical management team intends to expand the existing zenon process control system in such a way that the KPIs (including OEE) are automatically calculated.

The Engineers must solve the following problems:

a) Online calculation and display of OEE indicators for the current production shift is required

b) An analysis of OEE indicators must be visible in the reporting system for each hour, shift, batch, week, etc.

The engineers find out that they are only five steps away from the solution in zenon:

1. **Collect data**
   In zenon, the data and parameters of machine programs, operating mode and status, if not already available, can be collected easily by means of data acquisition.

2. **Transform data into information in real time**
   The zenon math driver (or the straton® SCADA Logic interface) transforms the production data into meaningful information for controlling effectiveness in real time: Time and production counters, calculation formulas to calculate OEE indicators, fluctuation tendencies, etc.

3. **Present information clearly**
   Using the graphical elements in zenon, information is presented to the user very clearly: numerical values, bar graphs, trend curves or waterfall diagrams, for example, ensure data is understood quickly and clearly. Real-time information makes it possible for the Production team to react to any change quickly and appropriately.

Figure 4: Using zenon, the calculation and display of real time performance indicators is made possible without programming – simply by means of setting parameters.

4. **Archive data**
   zenon's archive server, the zenon Historian, continually adds data required for subsequent analyses to the pre-existing archive data. The length of time that recording can take place is unlimited.

5. **Prepare and individualize reports**
   In-house OEE reports are prepared using zenon's reporting technology. In doing so, time filtering is left to the users.

Thanks to zenon, the milk processing plant now has automatically calculated KPIs. It therefore eliminated the use of error-prone manual calculations and staff can now immediately react to real-time data.

Example 4: Involve employees from Production Control and Management

At a mineral water bottling company, more employees are to be included in the development of the production process and quality assurance. The initial situation:

PLMS = Packaging Line Management System

- A zenon PLMS is used for production control and management.
- The central component of the system is a PC in the office of the Packaging Manager.
- The factory is introducing the concept of a "continuous improvement process". This brings new responsibilities for Machine Operators, Performance Managers, Energy Consumption Managers, Maintenance Managers and Quality Managers.

The system is to be adapted to meet the new requirements. To achieve this:

a) The equipment operators at production level are to be given the possibility of manually entering supplementary information into the Line Management System.

b) All people involved in the area of Production Control and Management are to be given access to relevant online and historical data.

Six work stages were necessary for the modification:

Figure 5: With little engineering effort, zenon brings the right information to the right people via the network.

1. **Install an HMI panel**
   In the first stage, an HMI panel (or an industrial PC) running zenon is installed on the shop floor and subsequently connected to the PLMS℠ central PC by Ethernet.

2. **Universal communication**
   With a few settings in zenon, the client-server communication between the HMI on the shop floor and the central PC is set up.

3. **Screen creation**
   Screens that may be required for equipment operators (for example, to display the causes of downtime via the zenon Industrial Performance Analyzer) are created at the central computer using zenon and automatically aligned with the HMI.

4. **Simple networking**
   Other computers that are used by the production team can be connected via zenon network technology easily and quickly.

5. **Web server delivers uncomplicated access for all to use**
   With a zenon web server at the central PC, the whole production team is in a position to access relevant data from each networked computer without extra development work.

6. **Integrate mobile colleagues**
   zenon runs on mobile devices (PDAs, smartphones etc) and, in this way, enables employees who are moving around the production area to have access to real time performance indicators, alarms, events etc.

PDA = Personal Digital Assistant

With just a few configuration steps, a system was created that had moved from a stand-alone solution to one that now integrates all employees involved, provides information in real-time and effectively supports team members in increasing their performance.

Further examples? Share your experiences…

In this paper, we have selected four examples from a great number of situations that we have been confronted with in Food & Beverage engineering practice. What are your experiences? Which challenges have you had to overcome? Are there still challenges you have to solve? Perhaps they include:

P&ID = Piping and Instrumentation Diagram

- Standardization of in-house process visualization (user interface, P&ID symbols, functions, etc.).
- Putting equipment into operation: How much or how little knowledge is actually necessary for this?
- Using redundancy to create fail-safe systems for the packaging sector.
- Cleverly reusing software engineering work already undertaken.
- Quickly recognizing essential elements by creating applications that operate throughout the equipment.

You are very welcome to discuss your specific requirements with us, or our partners, to find new solutions and leverage the expertise we have gained.

Summary

With zenon, you can benefit from simple and efficient engineering. The five most important advantages are:

1. zenon is based on setting parameters instead of complex programming and, as a result, enables Automation novices to perform effective software engineering. This brings considerable **cost optimizations** when developing and maintaining process control applications.

2. Because no programming is required, zenon also avoids the risks of bringing complex errors to a system when developing applications. This leads to secure, reliable equipment automation and thus to **increased availability of equipment**.

3. The basic principles of the zenon development environment – usability, object orientation, reusability, openness, and out-of-the-box functionality – deliver **reduced engineering time.**

4. Ever new challenges in the Food & Beverage market, such as new products or packaging, determine the dynamics of Production Plants. zenon applications are simple to expand, in terms of functionality as well as equipment. zenon therefore provides **Food & Beverage Plants with** essential **flexibility**.

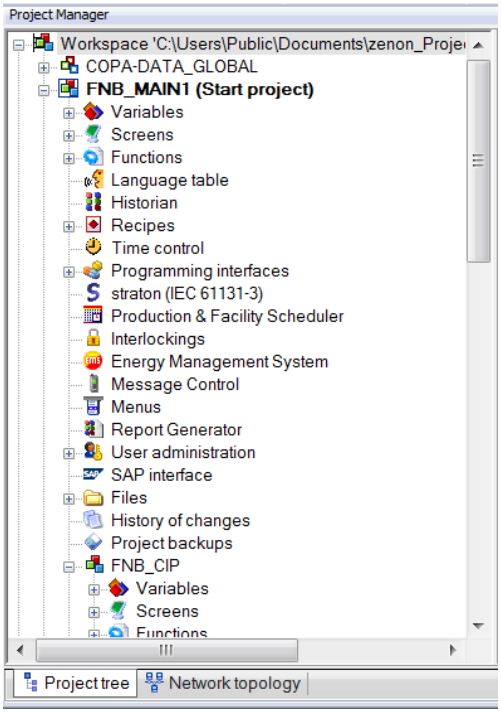

Figure 6: The zenon Editor Project Manager makes the learning curve shallower by intuitively structuring the project components.

5. **Continuous improvement** of processes in Food & Beverage factory requires agile engineering in order to continuously increase effectiveness and quality whilst simultaneously reducing consumption. zenon makes it possible to quickly and cost-effectively update the automation solution used for control and analysis of production processes.

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