



## Eco Support: Consistent Electronics Ease Biodiesel Production

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*Ecology is not only a subject that is talked about: despite some – mainly economic – problems, specific eco projects are successfully realized. The example of a biodiesel production shows that the right technology eases many a task. The chances of increasing ones economic share in the global eco market can be substantially improved by selecting suppliers with a very broad positioning. Since January 2007, every liter of petrol has to contain 1.2 percent biofuel. By 2010, this value is even to be increased to 3.6. Already for some time, five percent biodiesel are for instance admixed with mineral oil diesel – according to the EU, this value should amount to 10 percent. The development of alternative fuels is thus increasingly gaining importance, which is reflected by the consistent construction of respective process-technical systems*

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In the Kaufungen-Papierfabrik district near Kassel, two production plants for biodiesel are installed. While the single-line plant of the forwarding company Ulrich produces approx. 35,000 annual tons, the double-line plant of the BioD company has been supplying roughly 50,000 annual tons since mid-2006. A large share of the Ulrich plant is used for the forwarding company's own consumption, whereas BioD supplies biodiesel to the free market.

Both plants largely use either rape oil, which is delivered by road tankers from oil mills, or used-up frying fat from restaurants, which is collected by specialized companies. After all, biodiesel is nothing else than methyl ester, for example consisting of rape oil, methanol and a mixture of a potassium hydroxide and methanol. Any mixture of these three substances generates a chemical reaction. The result is biodiesel and glycerin.

### Reduced "biodiversity" eases construction and installation

The decisive factor is a continuous flow of the entire process. As opposed to other system concepts with centrifuges, the Kassel plants utilize gravity for the individual separation processes. Moreover, central control parts are generally delivered as an autonomous system for biodiesel plants. "For installation of the electro-technical components, it was therefore important to us to minimize the "biodiversity", which is frequently seen in process-technical systems, at least for the central electro-technology", reports Manfred Bietendorf, managing director of the automation expert s.a.b. (website: <http://www.sab-kassel.com>) near Kassel. This is underlined by the following examples:



Figure.2. Manfred Bietendorf (le), managing director of the electro-technical company s.a.b., is satisfied: "Procuring the complete electro-technical equipment from a single source accelerates all processes – from planning to installation down to service. I really appreciate that."



Figure1A and figure 1B. In the Kassel biodiesel production plant, all important sensor and actuator signals are transmitted to the central control station via Profibus.



Installed as infeed main switch in the centrally arranged control cabinets, the expert uses the compact Sentron 3VL circuit breakers by Siemens, which are available for the power range from 16 to 1,600 A. In the double-line plant, the size up to 800 A ensures safety, while the variant up to 630 A was selected for the single-line plant as its capacity may still be expanded in the future.

The practitioner particularly opted for these low-voltage switching devices due to their direct connectability to Profibus via a plug-in, a so-called COM-10 module. "For us, Profibus is obligatory and we employ it in all plants constructed by us", explains Manfred Bietendorf.

Due to the modular design of this molded-case circuit breaker, it can be individually adapted to the respective requirements. With the help of an additional rotary door-coupling drive, the switch actuation can be routed to the outside through the cabinet door. This way, the entire plant can be de-energized. If the plant was to be switched off via the control station, also a Profibus-actuated motor drive with spring energy store could be retrofitted to the switch. Manfred Bietendorf summarizes: "In my opinion, this modularity of the 3VL perfectly meets our practical requirements."

### Totally Integrated Automation for a consistent drive concept

With Totally Integrated Automation, in short TIA, Siemens offers a consistent platform for the electro-technical realization of customized automation solutions, which is also evident with the Kassel biodiesel plant. For the pump drives and agitators, s.a.b. uses Sirius 3RW30 soft starters by Siemens. Their advantages compared to a conventional solution not only include a reduced mechanical load during start-up, but also aspects of price. Three contactors, one seven-wire line and one timing relay can be saved per drive compared to start-delta circuits. As these soft starters are also extremely cost-favorable, such a solution is even reasonable for simple drives.

The devices are available up to power ratings of 55 kW. Exceeding this, the 3RW4 range masters up to 1,200 kW. Thanks to the consistent optimization of the power sections in hybrid technology, the devices are extremely compact. Up to a control cabinet temperature of 60 °C, they even allow for side-by-side installation. For example, the resource pumps at the loading and unloading stations of the biodiesel plant with 13 kW are driven by these devices. And also the roughly six meter long agitators inside the mixers merely require a constant speed, which is why the soft starter solution proved to be perfect for this application.

To the methanol dryer, for example, two vacuum pumps with 27 kW each are installed. Only one pump runs at a time while the second one guarantees a possible reserve operation for safety reasons. To prevent damage to the vacuum pumps, soft starters ensure a smooth operation also here. Approximately ten of these devices are installed in the biodiesel plant. Manfred Bietendorf explains: "One of the advantages during commissioning is that the start-up time and voltage as well as the ramp-down time can be comfortably set at the device via three potentiometers." Particularly the ramp-down time considerably reduces impacts in the pipeline system compared to direct circuits.

### Rugged technology with ease of handling

Smaller pumps operating at variable speed are controlled via Micromaster MM440 frequency converters by Siemens in the Kassel plant. These devices are available from 0.12 to 200 kW and are characterized by their outstanding ruggedness, thanks to which they even smoothly deal with regenerative feedback effects from the motor. Furthermore, they are equipped with a wide-voltage range for mains with 50 and 60 Hz. "The quick-start function available in the FC software guides the operator through the 13 most important parameters, making these devices extremely user-friendly", praises Manfred Bietendorf.

In the described plant, one frequency converter per two redundantly dimensioned pumps each is installed. This already



Figure 3. The Sentron 3VL molded-case circuit breaker is available up to 1,600 A. Thanks to its modular design, it can be easily adapted to individual requirements.



Figure 4. As a "material-sparing" alternative to conventional star-delta circuits, soft starters offer valuable services for pumps and agitators. In addition, the 3RW30, the most basic starters of the Sirius range by Siemens, are comparable to standard feeders in terms of prices.

shows that these devices are considered extremely safe by the fitter. Which pumps are to be "active" is controlled by the Simatic S7-317 PLC in the control station via Sirius 3RT contactors by Siemens. For this purpose, the contactors are connected via contactor relays to the explosion-proof distributed I/O ET200S isp (international specialty products), which is in turn equipped with a Profibus node at the head module. "We like to employ these units as it facilitates the transparent combination of a vast number of sensors and actuators in confined spaces", Manfred Bietendorf justifies his selection.

This compact Profibus-capable unit for the bundling of input and output signals was developed for explosion-proof areas. They are approved for Zone 1 and 2 as well as for Zone 21 and 22 and provide protection both against gas as well as dust explosions. Within the scope of Totally Integrated Automation, the stations can be very easily integrated in PCS7 and also in the Simatic S7 by Siemens.



Figure 5. For drives with varying speeds, the Micromaster MM440 by Siemens has proven a rugged "all-rounder" which offers particular ease of handling.

Up to 32 electronic single modules can be positioned on one station. This way, 256 digital or 128 analog individual signals can be detected, for example for the biodiesel plant's flow rate, level or temperature values. If, for instance, the glycerin level signals an excessive value, the pump drive for evacuation has to be started. And as the EX-proof ET200 isp can be applied in a temperature range between -20°C and +60°C, it is the ideal solution for most Ex-protection application cases.

In the course of his career, the expert has been frequently using the above-mentioned solution with one frequency converter for several drives – even up to ten on one FC: Particularly in dosing systems, this is very practical as only one component at a time can be transported onto the weigher anyway. While he previously used a combination of an individual 3RT contactor and a 3RV motor circuit breaker for such cases, Manfred Bietendorf sees major future advantages in the Sirius 3RV19 infeed system with spring-loaded technology. "This facilitates savings in terms of space, time and money", he assures.



Figure 6. The assembly of three different safety circuits via 3TK28 safety relays by Siemens ensures that an EMERGENCY-STOP does not shut down the entire plant. In the biodiesel plant, this has proven extremely practical over the course of time.

### Infeed system simplifies electrical construction and handling

The major benefit of this infeed system is that it is based on a modularly expandable three-phase busbar. The infeed can either feature a right- or left-hand design. The carriers are available for two and three load feeders, which can be elegantly installed side-by-side; the electrical contacts are then established via extension connectors. The feeders are simply plugged onto the busbar from the front and connected with the three phases via connection plugs.

All electrical connections are generally shock-proof to ensure increased protection for humans. For eased installation, the 3RV19 are offered with spring-loaded technology, which means that the lines merely need to be stripped and plugged into the right connection. This completely does away with the attachment of connector sleeves and any future re-fastening, e.g. specified for screw connections. "Such spring-loaded connections are particularly vibration-proof and failsafe", Manfred Bietendorf voices his long-standing experience.

### Increased safety through illuminated EMERGENCY-STOP

As in most machines and systems, the aspect of safety is also of utmost importance for the biodiesel production. Yet, despite his affinity with the bus technology, Manfred Bietendorf consciously abandoned the application of safe bus systems such as PROFIsafe or ASIsafe for this plant as its design merely necessitates the bridging of short paths. This can be perfectly mastered by the Sirius 3TK28 safety relay by Siemens.

For applications such as the failsafe monitoring and disconnection of machines or the failsafe disconnection of system components with key switches, up to four individual devices are necessary when installed individually. With this solution, only one 3TK2845 multi-function device does the job. Manfred Bietendorf explains: "On the sensor side, we principally always rely on a double-redundant routing in the NC to always be on the safe side." In addition, he routes the EMERGENCY-STOP buttons to an NO to immediately signal the tripped EMERGENCY-STOP to the control.

To ensure that the nearest EMERGENCY-STOP button in the plant is found as soon as possible, Siemens has been offering a practical innovation in its portfolio since November 2006. The label with the lettering "EMERGENCY-STOP" on a yellow background will in the future be illuminated via eight LEDs. The users can decide whether they prefer continuous or flashing illumination. "In some applications, this comes in unbelievably handy", Manfred Bietendorf comments.



Figure 7. Start-up time and voltage as well as ramp-down time can be comfortably set for the 3RW30 soft starters via potentiometers.

### On the safe side with system consistency

The biodiesel production plant in the Kassel district of Kaufungen-Papierfabrik has very impressively shown that a single-source strategy entails a whole series of advantages: The systems' consistency supports electrical engineering fitters on the one hand and provides the safety of comprehensible control concepts to plant operators on the other side. As Manfred Bietendorf puts it: "I am provided with competent answers on any subject by the device manufacturer at all times – even on a Sunday if need be."

To him, such a type of service is of utmost importance as he himself has to provide fast and uncomplicated support in his role as a plant engineer. Of course, this request is also taken a step ahead when the plants are delivered worldwide, as an example in the USA showed. There, the subjects of service, reliability and respective releases such as UL and CSA approval are paramount issues. "This is when the importance of a broad portfolio and integrated systems as offered by Siemens with Totally Integrated Automation really shows its value."

## Temperature Transmitters Offer Reliable Results in the Harshest Conditions

For efficient process control, accurate and reliable temperature measurement is essential. And, when it comes to temperature measurement in the field, **Endress+Hauser's** (Germany) iTemp TMT162 transmitter delivers reliable results, time after time.

Reliable and robust, the TMT162 field transmitter offers the maximum in functional safety with EMC immunity to NAMUR NE 21 (insensitive to motors and generators), signal on alarm functions to NAMUR NE 43 and basic requirements to NAMUR NE 89 (providing information on sensor input corrosion and excess ambient temperature). In addition, the TMT162 is ATEX certified (Ex ia, Ex d, Ex nA) for hazardous area use and stainless steel housing is available as an option, offering excellent protection in harsh environments.

The TMT162 features a brilliant rear-illuminated display: measured values can be easily read from a distance or in difficult conditions, day or night. Set-up is quick and easy and can be done online, so there is no need to disconnect the measuring point when re-programming. What's more, with its dual sensor input, the TMT162 also offers options such as sensor backup, sensor drift recognition, average and discrepancy values and automatic sensor switching.

Using the free ReadWin software, individual linearisation curves can be generated and configured into the transmitter to increase accuracy. These linearisation curves have between two and 100 sampling points and can be entered as either a resistance figure, a difference in temperature or a milliamp figure against a given temperature. In addition, to further increase measuring point reliability, Callender van Dussen constants can also be programmed into the transmitter to effectively remove sensor error in the temperature loop.

The TMT162 also offers safe process guidance via presettable fault conditioning. It is possible to set three stages (0, 2, 5 seconds) over which the actual analogue output value is 'frozen' before a fault condition is recognised and an alarm is raised. With a presettable fault signal between 21.6 and 23mA, the TMT162 can be easily connected to any of a number of process control systems for maximum versatility.

Offering SIL2 classification and first-rate specifications, the TMT162 temperature transmitter clearly demonstrates what it was designed to do: perform critical temperature measurements in the life sciences, chemical, petrochemical, power and oil & gas industries. HART and FOUNDATION Fieldbus compatible, it's also easily retrofitted into existing systems.

