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## AUTOMATION TECHNOLOGY IN BIOGAS PLANTS

HIGH-EFFICIENCY SOLUTIONS FROM ROCKWELL AUTOMATION®

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# BIOGAS ENERGY

ONE OF THE MOST PROMISING ALTERNATIVES TO FOSSIL FUELS



Energy production is one of the biggest topics of our time. More and more the focus is on its environmental compatibility. This is a great opportunity for producers of renewable energy. Because, with biogas, the future is getting closer.

Renewable energies are becoming more and more important as a result of the ongoing issue of climate change. Biogas is one of the most promising alternatives to conventional fossil fuels, and this is reflected in the growing demand for plant machinery to produce what is recognised as an ecologically sustainable source of energy. This is especially true in Germany, which tops the list of installations – it already has

about 4000 biogas facilities in operation. Germany is also home to the largest number of biogas system construction companies, who are beginning to see good prospects for international expansion. After all, the renewable energies trend is growing on a global scale.

Alongside globalisation, a further tendency that favours German machine builders is the trend towards larger biogas facilities. The market today is interested in the big multi-megawatt machines as well as in small, individual systems operating on farms. The larger machines are more sophisticated, with a higher level of more complex automation as well as more stringent safety requirements. The experience of German plant construction firms in this area gives a competitive edge, and are currently also able to handle the challenges of building very large facilities than their competitors.

Manufacturers of biogas systems have a world market open to them. And German system manufacturers have the advantage: thanks to their advanced know-how they are also able to deliver large installations.

Large biogas plants involve additional process technologies, because – unlike small systems on farms – the gas tends not to be converted to electricity and heat in the same place they are used. Instead, it is produced where the agricultural raw materials are available, and then transported to urban areas where it is consumed. Process technologies clean the biogas first, then transport it through pipelines and feed it into the natural gas network.

Rockwell Automation® knows and understands these developments in the biogas market. It has developed solutions that allow machine builders to capitalise on the business opportunities offered by today's trend towards renewable energy.

## The key elements to Biogas Energy

The process of producing energy from biomass is extremely complex. Controlling the sequences taking place in a biogas installation requires automation technology. Rockwell Automation can provide the components needed to control operation, from under one roof.



### Understanding

A biogas installation must have the right development concept. Optimally, the operation will run by connecting control, communication and display within an integrated architecture.



### Collection of waste

Animal and plant biomass is used as the basis for producing energy. It is fed into the fermenter, which receives a controlled supply of it.



### Processing

The controlled fermentation process takes place in the fermenter. Micro-organisms break down the biomass to produce methane-containing gas.



### Waste to energy

After it is cleaned, the gas is fed to a cogeneration unit. This is where the controlled conversion into heat and electricity takes place.



### Use

Buildings in the vicinity of the biogas system can be heated with the heat produced. The electricity is fed into the energy consumers electricity grid or used directly in situ.



## Energy from Biogas

Let's take a closer look at biogas production processes to identify the areas that can be optimised by automation. The process starts with the collection of plant- or animal-based biomass in a pit, then transferring it to a heated fermenter that is waterproof, gas proof, and opaque.

Once the biomass has been fed into the fermenter, it is homogenised using a controlled stirring system. At the same time, various bacteria start to act at a specific temperature that has to be kept within a narrow tolerance. During the controlled fermentation process, the biomass is decomposed by micro-organisms, a process that produces gas containing methane. Once the ingredients of the gas have been documented, it is cleaned of sulfur and other pollutants and

fed into a combustion engine which, together with a generator, forms a combined heat and power generation unit. This is where the gas undergoes controlled conversion into heat and electricity.

When the biogas is fed directly into the natural gas network, a process that is poised to gain importance in the future, the procedure is tightly integrated with utility companies requirements in terms of gas quality. The plant systems have to be sure that the gas is purified to high standards – particularly in terms of eliminating all traces of sulfur. As a result, the facilities have to include additional control and documentation functionality as an integral part of the sophisticated and complex plant and control technology.

The operation of biogas systems is today based on a tried and tested technique. Thousands of installations are proof of the efficiency and safety of the technology used. A key role in this is played by the automation of the processes. Rockwell Automation has the right solutions.



## Need for Efficient Automation

Each individual process step in a biogas plant system needs to be intensively monitored and controlled. Human observation of processes is clearly insufficient, because there are a number of variables that humans cannot perceive.

For example, a pH value cannot be seen, felt, or smelt. It must undergo high-precision measurement and immediate operator reaction if necessary. Motors also need to be driven by control mechanisms so that they can be started automatically if need be and not be dependent on human intervention. In biogas facilities, the whole process should be able to function reliably with or without supervision. This is why automation technology plays such a crucial role – not least from the safety perspective, because it minimises the risk of human error.

## Hardware and Software for Production

A biogas plant will run optimally on an integrated architecture that combines control, communication, and visualisation functions. This type of architecture requires a control system that includes programming software covering the entire production process as well as information networks to facilitate control, configuration, and data sharing. The system can be complemented with equipment for continuously displaying all plant functions and parameters – this makes monitoring quicker and easier.





### Rockwell Automation Components

Rockwell Automation's solution for biogas systems consists of a scaleable hardware platform along with equally scaleable software comprising the programming software RSLogix™ 5000 and the visualisation program FactoryTalk®View. The integration is managed by a common industrial protocol called NetLinx, which includes three networks – EtherNet/IP, DeviceNet and ControlNet.

### The Big Challenge: Flexibility

Rockwell Automation provides the components necessary for regulating and controlling a biogas facility, allowing customers to save time by sourcing them from a single supplier. For customers planning a broader automation project, Rockwell Automation can help design a framework for a scaleable solution and implement products within it.

The advantage for customers here is that they can work with Rockwell Automation on both small and large projects, so that they benefit from knowledge transfer and leverage their own experience. Projects are always tailored to the needs of the customer, who is supplied with the exact quantity and type of products necessary for the solution – no more and no less. Rockwell Automation also places a lot of importance on end-to-end consistency between all the technical processes. This is particularly important in communications, as it helps the various plant machinery components 'talk' to each other – and speak the same language. The advantage here is that all of the system information can be centrally collected, displayed, and archived. The customer benefits from the fact that Rockwell Automation is not only recognised as a specialist in certain types of components, but covers the entire automation spectrum from A to Z as well.

The biogas market is full of future-looking trends and developments. Rockwell Automation analyses them and converts them into optimum solutions for installation manufacturers. With its scaleable hardware and software solutions, the company can help provide the elements needed for an efficient biogas system from under one roof. The installation manufacturer therefore enjoys the utmost flexibility. Because the service provided by Rockwell Automation extends from the supply of components to knowledge transfer.



## Working Together to find Solutions

Rockwell Automation has well-qualified staff with universal skills in problem solving within biogas facilities. Automation specialists, with comprehensive practical experience, are also available from related areas with similar processes such as food production, where ingredients are combined to form a product while observing certain conditions and complying with a requirement for detailed documentation.

Rockwell Automation's modules have been proven many times over in practical implementations. When executing each individual biogas project, there is such a variety of modules that customers can check the 'building blocks' available and identify the right elements for their automation solution. This helps engineers from biogas machine builders select the exact functionality they need for each phase or task.

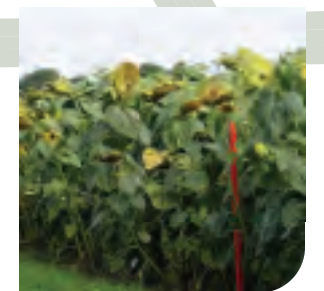
Whatever the required performance levels are, the right automation modules are available. The same applies for automating pre-production technologies, such as processing the biomass raw material, as well as for downstream process steps such as gas cleaning or combustion in a heat and power generation unit.



Together with the flexible hardware, the relevant software solutions also provide economy. The engineering services from the automation specialists are therefore very scaleable.

It is clear from these examples that the automation of biogas systems can be tailored to suit customer's requirement. A fundamental part of this flexibility is Rockwell Automation's Integrated Architecture™, which offers unique functionality and scalability for customised solutions that help to meet customer needs. The system comes with a library of templates for process functions, which can easily be adapted to customer-specific needs or used for system extensions.

Rockwell Automation's FactoryTalk, an integrated production and information software suite, is at the heart of a control and monitoring function. It allows supervisors and maintenance staff to access production data directly. No time-consuming and costly programming or integration work is needed to run it, because its centralised structure with a common 'address book' means the data remains in the machines producing it.





### Benefits

The implementation of solutions from Rockwell Automation's innovative product range pays off for biogas companies in terms of the efficiency and safety of energy production. This is true for a farmer producing just 100kW on one machine as well as for an energy group with a large-scale facility generating several megawatts of electricity, heat and/or gas. Whatever the performance requirements, sequential control, drive control and process control are always managed by a single programmable logic controller (PLC), and FactoryTalk View provides continual visibility into all the facility's functions and parameters.

This visualisation makes it easier for staff to operate the equipment and to monitor critical parameters so that they stay within the relevant thresholds. The system offers additional functions such as alarms, storage of historical data, and data transfer to an external database. Customers can choose whether to operate these functions directly on the biogas equipment or remotely via a router or modem.

### German Initiative goes Global

Biogas facilities are a big success story in Germany – and German manufacturers have an edge that they want to maintain and expand in international markets. And they are finding it quite a bit easier with Rockwell Automation as their system provider. Why? Because the group has worldwide presence and offers a comprehensive range of services that help provide the best conditions for biogas equipment manufacturers to achieve international success – especially with trends such as large-scale facilities and feeding biogas directly into natural gas networks.

