



# Modern production plant with Bio-Diesel

## The multi-feedstock process in Australia

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Figure 1: Production plant for Bio-Diesel fuel

Bio-Diesel fuels has been an environment-friendly alternative to fossil fuel for some years. By esterification or transesterification, fuel for Diesel engines can be manufactured from vegetable oil, with the right technology also from waste cooking oil and animal fat. The requirements on the technology used for the plant and the process used are however substantial if a real quality product is to be obtained for usage in lorries and cars with efficient usage of raw materials.

In Australia, the ›Australian Bio-Diesel Standard‹ was introduced in 2003 as a product standard and as a requirement for government support for the renewable bio-fuel. This standard is based on the strict European standard for Bio-Diesel, EN 14214 ›Automotive Fuels – Fatty and Methyl Ester (FAME) for Diesel Engines – Requirements and Test Methods‹.

With this new standard the Australian government gave the green light for the usage of biological fuels – ethanol and Bio-Diesel. Government vehicles in Canberra have been refuelled with a mixture of ethanol and petrol since 1.1.2006. In August 2006 the government announced the Ethanol Distribution Programme. This programme involves the provision of \$A 17.2 million to petrol station operators who are prepared to fit pistons for fuel mixing (petrol/ethanol). \$A 100 million are available from the Renewable Energy Development Initiative (REDI). With this sum it is planned to stimulate further research and development projects related to obtaining bio-fuels – e.g. the production of Diesel from algae or obtaining ethanol from biomass.

Even if the Australian government is still reticent in its support to the manufacture of fuels from plant matter, as the figures stated show, private investment in this sector has already increased significantly. Low cost bio-fuels are particularly interesting for agriculture, transport and mining. The gap compared to other industrial regions, such as the USA, Japan and Europe, is made clear by a few figures. In the financial year 2005/06 (1.7 to 30.6), the production and consumption of ethanol reached 41 million litres and of Bio-Diesel only 16 million litres. This figures compare to a consumption of 19.1 billion litres of petrol and 15.9 billion litres of Diesel of fossil origin.

While there is government funding for the addition of bio-ethanol, the situation for Bio-Diesel is complex. With the so-called Fuel Tax Act 2006 the government removed all the price advantages of Bio-Diesel for customers for this environment-friendly fuel, e.g. transport businesses, farmers and mining companies, as of 1.7.06. In this way the government wanted to establish approximately the same competitive conditions as for the providers of conventional Diesel. In addition, at the start of 2007 the prices of raw materials such as fat, canola and imported palm oil, increased drastically. To explain: canola (Canadian oil, low acid) is the term used for the special, so-called zero-zero rapeseed developed in Canada and cultivated in the whole of North America. Canola is now generally understood as a term for rapeseed in many parts of America and Australia.

Reductions in production and even plant closures resulted from these government decisions. In 2006/07 production capacity of 390 million litres per year was available. Plants for a further 210 million litres per year capacity are under construction. This situation clearly shows that this branch of industry has not lost its investment optimism despite unfavourable conditions. It is assumed that the upward trend in prices for the raw materials will diminish in 2008.

One of the investors in modern Bio-Diesel production down under is the company Bio-Diesel Producers Limited, which together with ANZ Investment Bank in Barnawartha, has invested in a new Bio-Diesel plant 300 km north of Melbourne with an annual capacity of 50,000 tonnes (around 57 million litres of Bio-Diesel) (Figure 1).

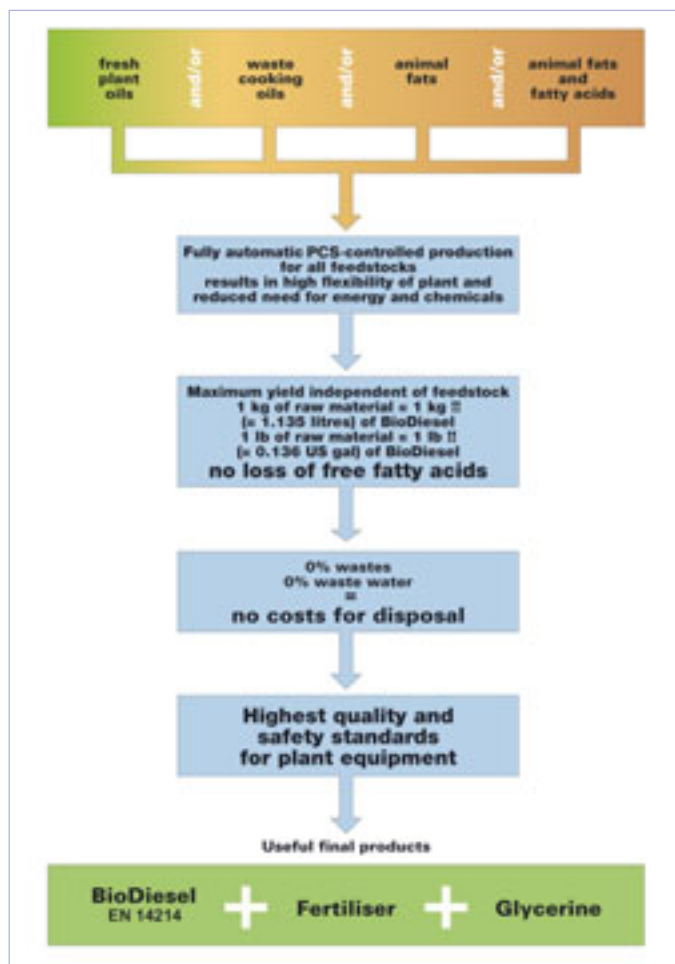


Figure 2: Multi-feedstock process

During the selection of the technology provider, the investor decided for the Austrian technology and systems engineering company BDI – Bio-Diesel International and its multi-feedstock technology. A key issue for reaching this decision was that the technology from BDI makes it possible for the company operating the plant to use a wide range of raw materials. Using the process stated, vegetable oils, waste cooking oil, and also animal fat can be used as raw materials to manufacture fuel compliant with the standards. The operating company makes full use of this flexibility – both animal fat and waste cooking oil are used as raw materials for the plant.

With the plant erected the plant manufacturer met not only the high requirements on the quality of the end product, but also the demanding conditions from the building authorities that in Australia relate to both the overall project as well as to the individual technical components. On December 06th, 2007 the plant produced the first Bio-Diesel, and was then run-up in steps and finally handed over to the operating company at the start of 2008. →

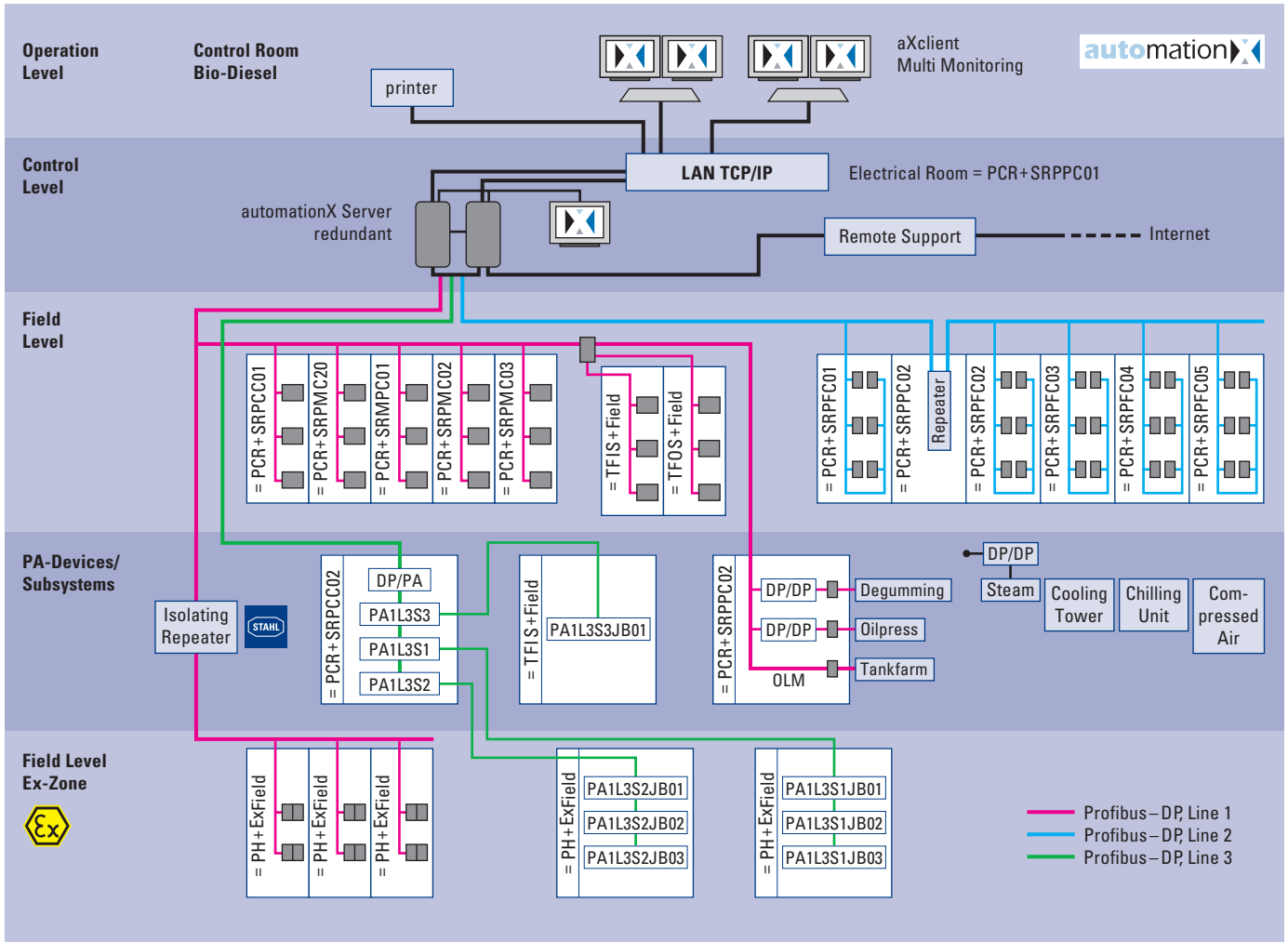


Figure 3: Process control system automationX

Technologically, the patented BDI process, multi-feedstock technology, is employed; with this process it is possible to use difficult to process raw materials with an elevated fatty acid content (Figure 2). During this process the raw materials are converted into Bio-Diesel in chemical reaction stages.

Explosion protection also plays a key role in this process, as for reasons related to the process, methanol is also processed in the plant. The entire process in the plant is controlled and monitored from a central control room. The automation system used for the project, called AutomationX, is a PC-based automation system from the company of the same name, which like BDI is based in Grambach near Graz (Figure 3 and 7). Along with simple operation, complete monitoring and fully automatic control of all production processes play a central role. The statistics, accounting, trending, alarm journals, maintenance information etc. round off the range of features.

Bio-Diesel plants in Europe are classified in zone 2 for explosion protection with the exception of a few areas. In Australia, the plant had to be designed and erected for zone 1 due to the requirements that apply there.

A key challenge proved to be that proven systems and components normally used by BDI in its projects were not available to the SA or IEC standards allowed in Australia. The majority of the proven components were and are not available in SA ex. As a result it was decided to convince the main suppliers for the instrumentation and control system to have their equipment and components approved in accordance with the IECEx-Scheme. Apart from the fact that these types of approvals involve significant effort, the time available was a real hurdle for the plant manufacturer and its main suppliers, also including R. STAHL which supplies the remote I/O system IS1 for BDI projects.



In the little time available, R. STAHL undertook and achieved the task of having the entire remote I/O system IS1 incl. the related enclosures and fittings approved for usage in Australia (Figure 4).

The adaptation of the IS1 system's zone 2 solution, as normally used, to the requirements of a zone 1 installation was not difficult due to the modular system concept. It was only necessary to replace the CPU&Power Module CPM with the zone 1 version. For communication with the remote I/O field stations in zone 1, the intrinsically safe version of the Profibus DP is used. The 'intrinsic safety' of the Profibus segment is ensured by a fieldbus isolating repeater 9185 that is installed in the safe area.

Valve blocks with series 8640 solenoid valves were also integrated into the IS1 field stations (Figure 5) along with the system components. The individual valves in each valve block can also be replaced during operation if necessary, i.e. without needing to depressurize the entire valve block. In addition, integrated non-return valves in the exhaust air ducts ensure that exhaust air from the process flowing back does not reach the pneumatic valve and unintentional switching is therefore prevented.

The IS1 system digital outputs are wired internally to the individual intrinsically safe solenoid valves in the factory at R. STAHL. The function tests prior to delivery ensure freedom from faults and also minimize the possible errors during the installation of the field installation. Auxiliary air supply and exhaust air outlet were also preinstalled in the stations, such that on site it was only necessary to connect the external supply to the stations.

The manufacturer Bürkert also had the range of solenoid valves used approved for IECEx while the project was underway and marked the valves accordingly (Figure 6).

The remote I/O stations have passed the extensive, strict official tests in Australia without problems and, like the overall plant, are in the meantime in continuous operation.



Figure 4: IECEx type plate of IS1 field station

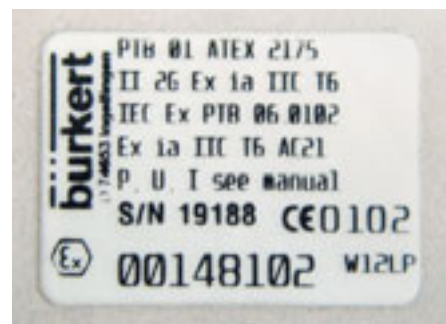


Figure 6: IECEx type plate for a solenoid valve manufactured by Bürkert



Figure 5: field station with integrated valve blocks

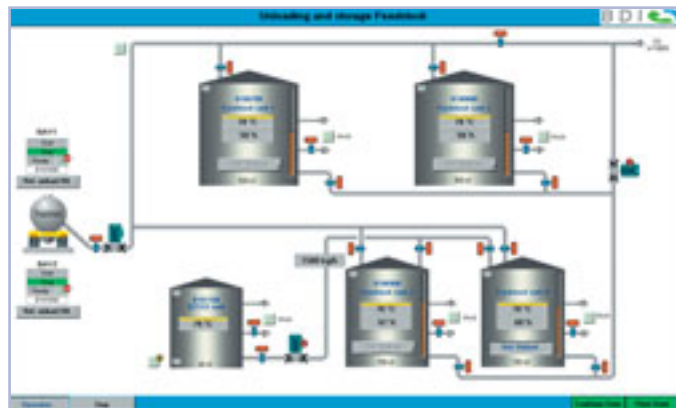


Figure 7: automation process diagram (example)

