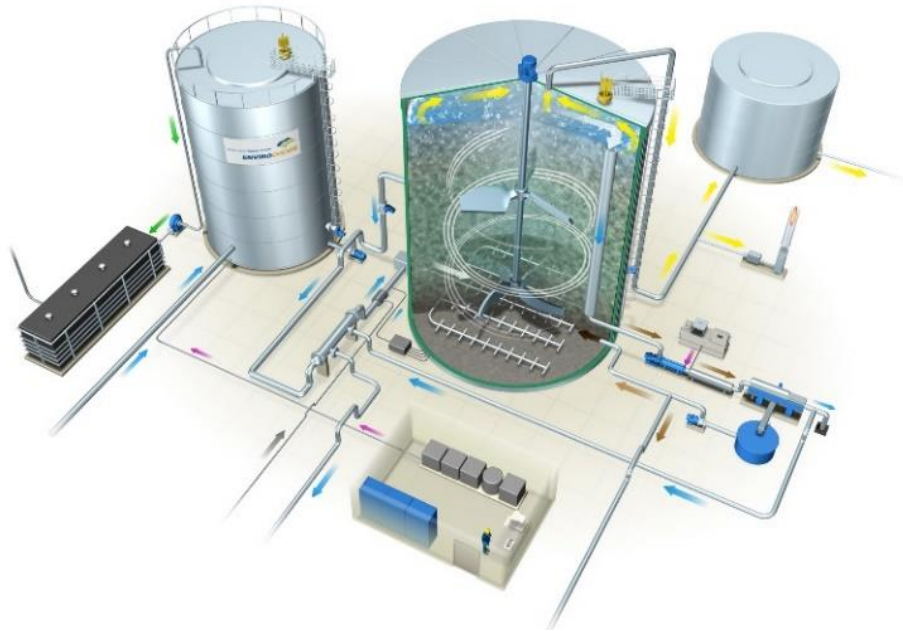


## Biomar AWR process graduates with flying colours



Schematic representation of EnviroChemie's Biomar AWR process for producing energy from dairy wastewater.

**A pioneering wastewater purification process with biogas production has been in use at Norrmejerier dairies in Sweden for over 15 years. The trailblazing company has been achieving positive results for many years.**

**Goodbye whey – parting is such sweet sorrow (usually).** As, whoever produces cheese, also produces whey or whey permeate as a waste product. And waste disposal is an expensive business. This is not the case at Norrmejerier dairies in Umea, Sweden where an innovative wastewater treatment and energy recovery process has been running for over 15 years which utilises a technologically sophisticated combination of organic wastewater purification, whey disposal and biogas production.

The Norrmejerier dairies have thus become trailblazers in their sector in terms of ecologically sustainable operational management with an exemplary overall energy balance.

This model combination of processes is not only a flagship project of the Swedish Ministry of the Environment, but has also received support from the EU - in line with the Kyoto Protocol. It is not without reason that this forward-looking Swedish dairy is the focus of a great deal of attention from the international technical community and can currently boast many visitors from specialist groups.

Management at Norrmejerier dairies have been revelling in the steadily increasing profit margins from the outset: "The Biomar process has passed the 'moose test' with flying colours. Due to the

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unexpectedly high overall performance of the system, the investment has paid off more quickly than originally expected,” says Tony Bäckström, former head of the project.

What successfully started more than 15 years ago as a pilot project with the EnviroChemie anaerobic/aerobic Biomar AKB process (the first of its kind in Europe) has today convinced the upper echelons of the international dairy sector with a high-performance whey treatment process which has undergone further optimisation and an unsurpassed biogas yield. The ripper the cheese when it leaves the ripening chamber in Umea, the more sophisticated the process-integrated wastewater and whey treatment process. By upgrading the Biomar AKB process to the Biomar AWR (Anaerobic Whey Reactor) process which had been specifically developed for whey/whey permeate, Norrmejerier also achieved a significant increase in capacity and almost doubled biogas production. While high whey disposal costs were previously partially offset by marketing whey drinks and cattle feed, the whey/whey permeate is today producing energy at every level: as an energy substrate for the production of biogas and therefore for energy recovery, and as a long-term means of reducing costs through a significant decrease in energy costs thanks to reduced excess quantities of sludge. And that all adds to the bottom line – in spades.

“This completely automated process allows us to produce up to 10,000 m<sup>3</sup> of high-quality biogas every day. That is 40% more than we originally calculated,” explains Project Manager Tony Bäckström. “This means we are converting over 90% of the energy in the whey into biogas.”

### **Whey: don't throw it a-'whey' – it's a win-win scenario**

Whey or whey permeate, once the poor relation, is now welcomed with open arms in at factories in Umea: extra supplies of whey permeate from the company's other plants in northern Sweden are maximising the already high biogas production and, in turn, significantly minimising operating costs, primary energy requirements and thus environmentally damaging CO<sub>2</sub> emissions.

The sweet whey or its ultra-filtered permeate gained during the cheese-making process is a high-energy by-product. The chemical oxygen demand (COD) is used as the unit of measurement for the energy content. The COD is a measure of the oxygen consumption during the oxidative reaction of all the organic compounds found in the whey. These are converted into biogas by anaerobic bacteria in a chain reaction which consists of 60-70% usable methane in terms of energy. In order to be able to make this biological conversion process technically usable, the bacteria are stabilised in reactors (gas-tight steel or concrete tanks).

The Biomar process produces approximately 22.5 m<sup>3</sup> of biogas per ton of raw whey or whey permeate, the equivalent of 150 kWh of energy.

**Biogas: Tomorrow's clean energy source** Before the gas produced can be fed back into the dairy's energy cycle, it must be treated, i.e. dried and desulphurised, to protect the parts of the plant utilising the gas from sulphuric acid corrosion. To produce hot water, steam or electricity, it can then be transferred to a biogas boiler, a steam generator or a combined heat and power unit for use. This significantly reduces operating costs and improves the CO<sub>2</sub> balance. The production of biogas is accompanied by a reduction in the greenhouse gas carbon dioxide as the utilisation of biogas means that expensive fossil fuels such as natural gas, fuel oil or coal can be avoided.

The Biomar AWR process for whey treatment and biogas production at Norrmejerier: the sustainable, added-value technology of the future

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The fact that not everything that leaves the Norrmejerier dairies is cheese is demonstrated by the new anaerobic AWR process with a high-performance sludge separator for recovering sludge, specially designed for treating whey.

“Many European dairies are turning what was a problem of disposal into a unprecedented source of energy,” says Thomas Weißer, Director of the Biomar division at EnviroChemie. “Operating costs fall right from the start. In fact, nothing can beat the energy efficiency of the Biomar AWR process.”

Approximately 300 m<sup>3</sup> of whey or whey permeate is generated every day at Norrmejerier by the cheese-making process. This is fed into the biological treatment plant together with a small proportion of highly polluted wastewater generated during production. Following fat separation, slightly polluted wastewater bypasses the plant and enters the sewage system.

The fat present in the wastewater, largely due to rinsing processes, was previously then separated from the wastewater. But with the conversion to the AWR process, this is now a welcome co-substrate in the fermentation process. An organic biological filter removes any smells generated by the process.

### The Biomar® AWR whey treatment plant consists of the following stages:

- pretreatment
- conditioning in the plant
- anaerobic methanation of the organic ingredients
- separation and recirculation of the biological methane bacteria required for this

### The Biomar® whey reactor: further optimised for the dairy industry

Biomar anaerobic technology is well established in many sectors throughout the world. EnviroChemie has now developed the process further for the dairy industry with a specially designed methane reactor which was adapted specifically for treating whey.



*The biological wastewater treatment plant at Norrmejerier in Sweden*

### The significant characteristics and technical features are:

- high process stability due to targeted processing
- extremely high COD conversion
- low excess sludge production
- no or minimal chemicals required
- use of controlled distribution system with optimised flow
- use of EC detection system which allows the quality of the biomass in the reactor to be checked
- extremely high biogas rate
- high-performance sludge separator
- product quality to DIN EN ISO 9001
- highly automated process
- closed, odourless system
- energy production

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### Complete energy management system

Every detail of the Norrmejerier dairies' company-wide energy concept has been thought through from start to finish. As the production process in dairies generates relatively warm wastewater, a further potential saving in both ecological and economic terms was spotted in the wastewater flow at Umea: a heat pump gains additional energy from the flow of purified wastewater before it is forwarded to the communal sewage plant at a relatively cool 12 °C.



*The biological wastewater treatment plant at Norrmejerier in Sweden*

### Summary

The high overall ecological and economic balance of the Biomar AWR process offers a convincing solution with a solid foundation in the excellent above-average results from the pilot project at the Norrmejerier dairies in Sweden. Specifically, the intelligent process technology combination of biological wastewater purification, whey disposal, and the production of biogas provides the dairy industry with a clear, long-term economic benefit and significantly increased energy efficiency.

The Biomar LSD process (Liquid Solid Digestion), which utilises other energy-rich 'wastes', is a variant on the Biomar AWR process. Fat, flotates, returned product from the trade, and organic sludge from the company's own wastewater plant are typical co-substrates.

The principle of energy recovery and thus the reduction of primary fuel consumption meets sustainability requirements in full and helps to future-proof the company.

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