Do you have waste water in your production which cannot be disposed of into the public sewer system? How do you manage this waste water? Often this wastewater is disposed of with specialised waste management companies. This is a straightforward procedure not disturbing the day to day business in the production. However; here big saving possibilities are hidden.

When processing this water in-house 70 % of the occurring cost can be saved. When processing 2,000 m³ industrial wastewater in-house instead of disposing of the water with waste management companies one can save in ten years more than € 1,000,000.00. These savings justify investment in water processing equipment in almost every case.

But which process for the treatment of the wastewater is the right one?
On the market several different technologies are available, all of them offering pros and cons. The variety of possibilities makes the proper selection of the right process difficult.

Which processes are available?
The most common processes for the treatment of industrial wastewater are chemical-physical treatment plants, membrane plants and vacuum distillation systems.

Which is the right process?
In some cases there is only one processing possibility. It can be determined by amount of wastewater and
degree of pollution. If mostly inorganic pollution membrane filtration plants can be exclude since processing would be too costly.

If the water contains latex, paint or proteins vacuum distillation is not applicable. Fig. 2 shows that there is a extensive area where all three processes are an option. In this area the different processes have to be compared carefully.

Which are the important criteria to select the process?
First of all the general requirements have to be fixed. The most important criterion is the quality requirement to the treated water. This criterion is the basis for analysis of all following criteria.

Certainly the most important criteria are costs. Not only investment, but also operation costs have to be considered. What sense does a low investment make, if high operation costs are eating up this advantage within shortly?

Process flexibility is a very important factor as well. How does the processing plant react if waste water quality varies or even changes composition totally within shortly? What happens if alternative process chemicals are applied in the production process?

Finally reliability has to be looked at. How complicated is the operation of the system? In how far can the operators themselves react in case of malfunction?

Zero liquid discharge – is it feasible?
Nowadays many companies focus on sustainability to save valuable resources. Self imposed environmental standards are often higher then required by the respective authorities. This certainly includes
responsible dealing with valuable fresh water resources. If the aim is zero liquid discharge production facilities and/or if very pure rinsing waters are required, vacuum distillation is the best choice. Distillate quality is high enough to allow recycling without or with simple post treatment only. Distillate is normally almost free of oil and heavy metals. Only if quality requirements to rinsing water are very high post treatment with ion exchangers is necessary.

When using other processes like chemical-physical treatment or membrane filtration the quality of the treated water is below fresh water quality. Thus it is more feasible to dispose of the treated water into the public sewer system and process fresh water to the required quality for the production process.

When investigating investment and operating costs of vacuum distillation systems in the area of 100 to 30,000 m³ wastewater per year with a pollution degree lower 8 % one can see the feasibility advantages of vacuum distillation technology. Investment costs are higher compared to other processes; however operation costs are unbeatable. Chemical-physical treatment has very high chemical consumption figures and operation is time consuming and demanding, especially if the wastewater composition is complex. Consumption figures of membrane filtration plants are moderate; however retentate amount is rather high leading to high disposal cost. Fig. 3 shows that higher investment costs of vacuum distillation systems are compensated quickly by lower operation cost.

In terms of flexibility and reliability vacuum distillation systems are setting benchmarks. Modern systems adapt to varying process water compositions automatically. If for instance designed for the processing of spent coolant emulsions small and simple modifications allow processing of galvanic rinsing water instead. Smart maintenance concepts and intelligent process visualisations improve system availability and ease operation. In so far modern vacuum distillation systems as reliable as the specialised waste management company picking up the wastewater frequently.

Fig. 3: Comparison of operation costs for process water treatment systems

Fig. 4: Comparison of life cycle costs of process water treatment systems
Summary:
Fig. 2 explains process selection depending on wastewater volume and degree of pollution. In the area where several processes are possible vacuum distillation proves to be the most feasible and environment friendly process. In other areas it is recommendable to think about combination of several processes (for example membrane filtration plus vacuum distillation for the processing of retentate.)