Opportunity for energy efficiency –
Smart engineering of pump systems in chemical processes

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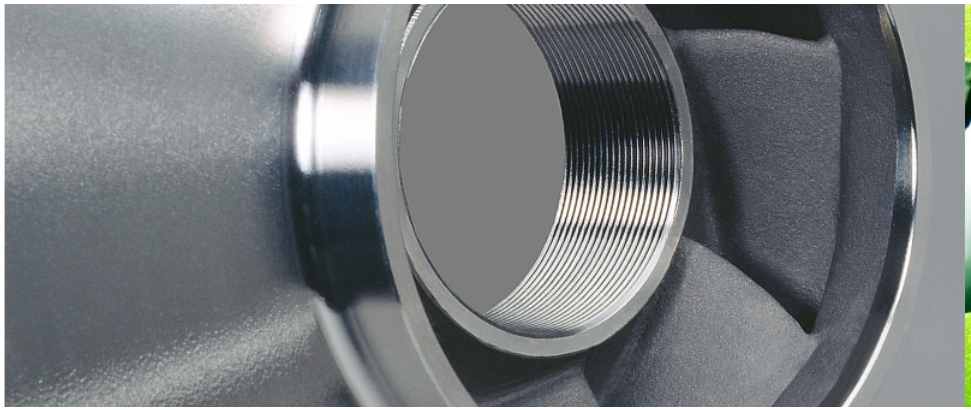


cleaner pumps, cleaner planet™

Energy recovery and energy efficiency both help to make European industry more competitive

Energy recovery and energy efficiency have both become major strategic issues in many industries. Recognising its importance and the widely shared consensus that climate change is man-made, a large number of companies have started to do something about it.

- European companies are reducing their carbon footprint
- European companies are saving on CO_2 emission certificates
- European companies are spending less money on energy

➡ Technically, energy can neither be lost, nor can it be recovered. Energy can only be converted from one form to another, such as thermal, mechanical, kinetic, electrical or potential energy.

In chemical plants, potential energy is solely created to produce chemicals – but never to store energy

Drive energy used to transport fluids is converted into either potential energy or heat (pipe friction losses). In chemical plants, heat can be “recovered”, but potential energy cannot – because it wouldn’t be produced:

Pumped storage hydroelectric (PSH) plants

At night, when energy is not needed, it is used to pump water into water storage reservoirs. During the day, when energy is needed, the water is used to generate electricity. Potential energy is created as a means of storing energy.

➡ **Turbines** or **Pumps as Turbines** can be an option to recover potential energy.

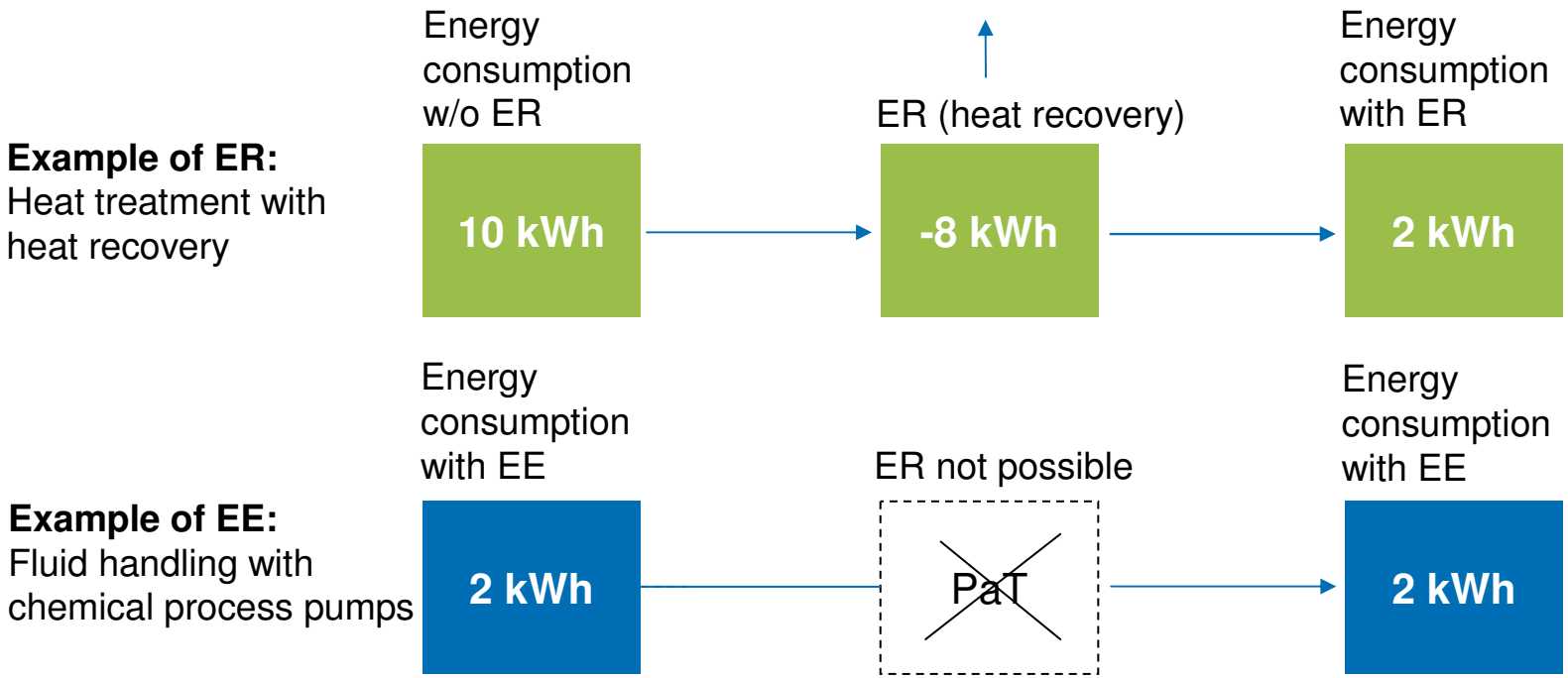
Chemical process plants: pumped storage chemical-electric (PSC) plants?

In the chemical industry, electrical energy is consumed when needed to pump chemical fluids. Otherwise, they would not be pumped at all. Potential energy is required in chemical processes for many reasons, but never to store energy.

➡ **Turbines** or **Pumps as Turbines** cannot be an option to recover potential energy!

In chemical process pump systems, energy efficiency is an opportunity because energy recovery is not possible

Energy recovery (ER) vs. energy efficiency (EE)



In chemical process pump systems, safety is vital when pumping hazardous fluids

Safety

Chemical manufacturing processes require maximum reliability of each piece of equipment. Processes for treating liquids such as bromine, phosgene, TDI, MDI or chlorine often require pump systems fitted with monitoring and/or protection devices.

➡ Legal requirements are not only rigorous, but often specifically defined for each process and each fluid (ATEX Directive, etc.).

Energy efficiency

If safety is assured, energy consumption in chemical processes can be optimised. Environmental challenges can best be met by using clean and energy efficient technologies. Chemical companies gain considerable competitive advantages if they use energy efficient pumps in their processes.

➡ Efficiency requirements are not only rigorous, but generally depend on each pump technology and each pump material required (magnetic drive pumps, etc.).

The fluids to be pumped determine technology and material, and both influence the pump's safety and energy efficiency

Pump		Materials (depend on concentration, temperature, solids content, etc.)			
		Metal (stainless steel, alloys, etc.)	PFA-lined with a cast iron casing	PTFE or PVDF solid plastics	Ceramic-lined with a cast iron casing
Technologies	Magnetic drive pumps	**Acids, alkalis, solvents, heating-cooling circuits, etc.: liquid sulfur, caustic soda, …**	**Highly concentrated acids at high temperatures etc.: bromine, …**	**Highly concentrated acids at high temperatures etc.: hydrochloric acid, …**	
	Double mechanical seal pumps	**Slurries, granulates, liquids containing solids, etc.: toluene diisocyanate (TDI) …**	**Acids, alkalis containing solids, risk of dry running, etc.: sodium chloride, …**		**Acids with abrasive solids, etc.: methylenedianiline (MDA), aniline, …**
	Other pump technologies				

To optimise both safety and efficiency, the complexity of pumping chemicals requires smart engineering

In chemical processes, the complexity of pumping fluids is manifold:

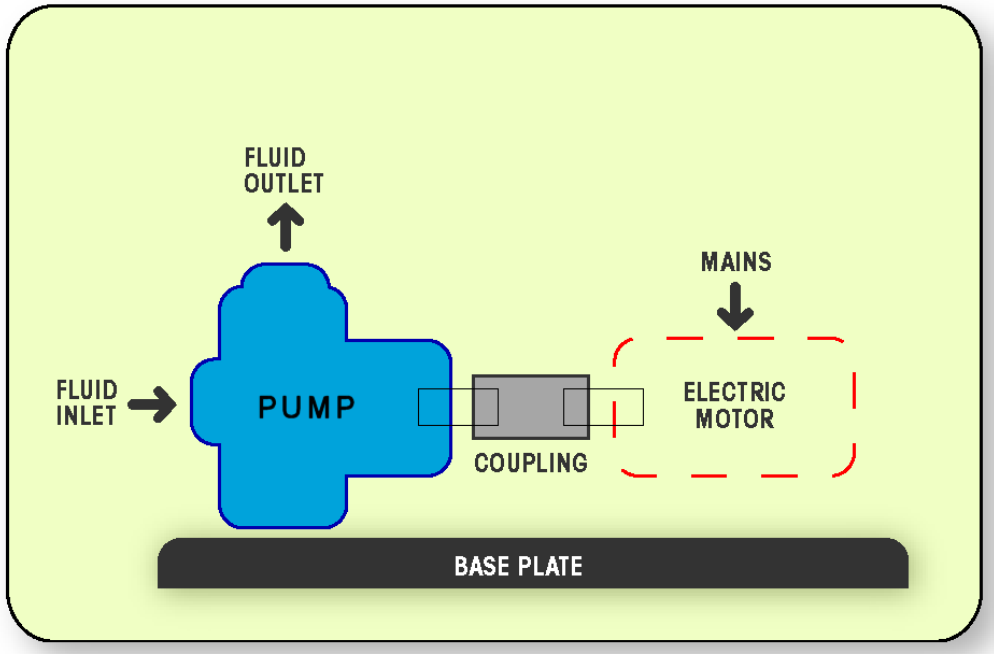
- The huge variety of different fluids, such as acids, alkalis, solvents, slurries, etc. requires expertise about which technology and which material are best suited to each fluid
- Each fluid is either highly corrosive, abrasive, toxic, explosive, hazardous, dangerous or all of these together
- Each fluid may contain gas and smaller or larger amounts of solids, has varying temperatures, densities and viscosities, may crystallise under certain conditions or all of these together
- In chemical pumping processes, leakage may result in severe environmental harm and human fatalities and has to be avoided at all costs – without compromising on energy efficiency

➡ Each fluid needs the right selection of technology, material, impeller, containment shell, motor, VSD control and pump, as well as system planning.

Each has different implications for safety and energy efficiency of the final process!

Engineering solely focused on the pump; preferred pump suppliers offer potential savings of up to 5%

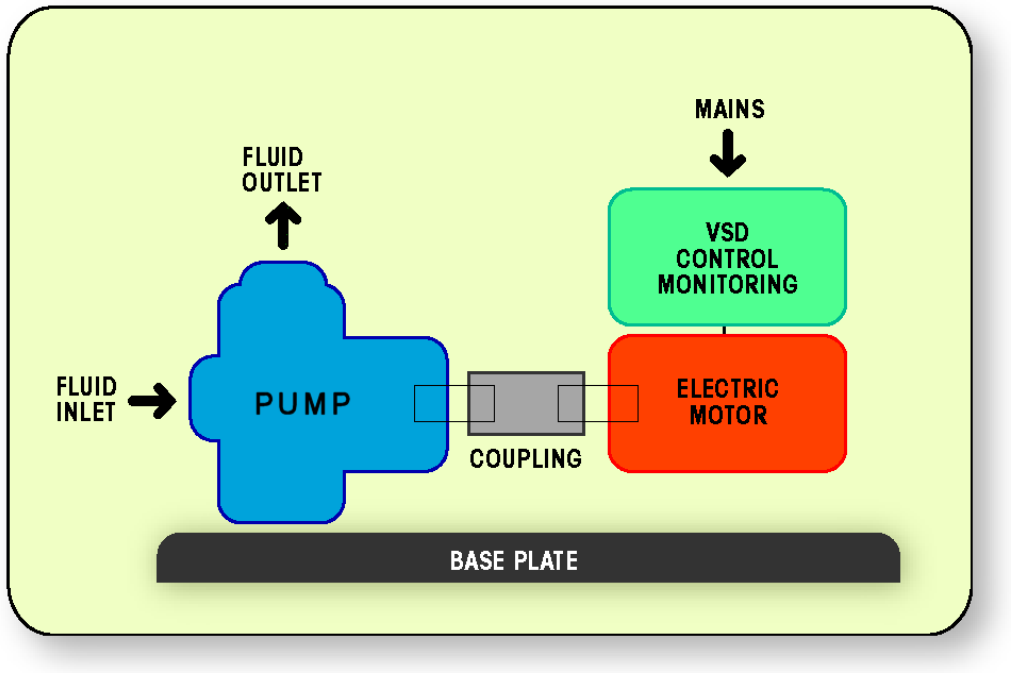
- Impeller: trimmed vs. standardised
- Containment shell: zero losses vs. eddy current losses w. temperature monitoring



Source: "ECOPUMP" Initiative – European Pump Industry Energy Commitment

Engineering also focused around the pump; preferred pump suppliers offer potential savings of up to 10%

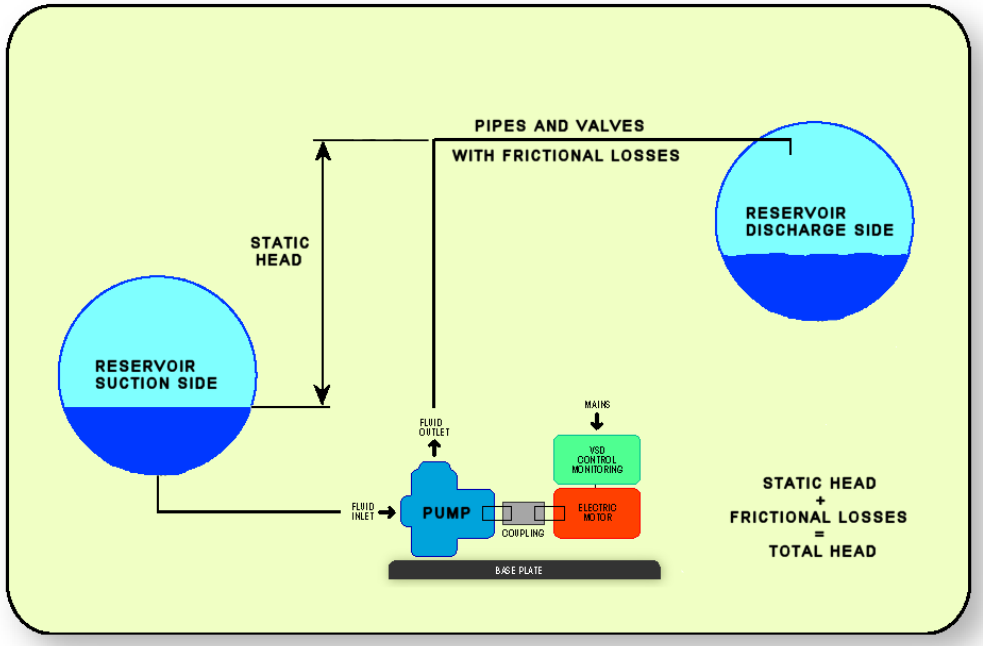
- Electric motor: IE2, IE3 or IE4
- VSD control: valve throttling vs. speed variation (to operate different duty points)



Source: "ECOPUMP" Initiative – European Pump Industry Energy Commitment

Engineering focused on the entire system; preferred pump suppliers offer potential savings of up to 20%

- System planning: optimal designs, flows, heads, piping diameters, load profiles, etc.
- Pump selection: optimal technologies, materials, sizes, couplings, protection, etc.



Source: CP Pumpen AG

Conclusion: smart engineering of pump systems in chemical processes is an opportunity for energy efficiency!

- In chemical process pump systems, energy recovery can be replaced with energy efficiency – saving potential energy in chemical plants in the first place is better than recovering it.

- Both safety and energy efficiency are of crucial importance in the chemical industry – they need to be understood as two complementary characteristics, and not as being mutually exclusive. Chemical manufacturers don't have to compromise on energy efficiency to meet their stringent safety and quality requirements.

- Smart engineering of chemical processes means taking into account all aspects and technical intricacies of the specific fluids to be handled and offering solutions for optimal pump selection, including technology, material, size, coupling, and protection.

CP has numerous references in the chemical industry, including both plant managers and designers

Plant managers

AJINOMOTO
DOW
NOVARTIS
AkzoNobel
Tomorrow's Answers Today
DSM
LANXESS
Energizing Chemistry
BASF
The Chemical Company
EMS
EMS-CHEMIE HOLDING AG
Lonza
Bayer
EVONIK
INDUSTRIES
degussa.
Roche
BC
BorsodChem
infraserv
höchst
Dienst. Leistung.
SANDOZ
Clariant
Exactly your chemistry.
JANSSEN
PHARMACEUTICA
Siegfried
Johnson&Johnson
SOLVAY

Plant designers

AKER KVÆRNER
FOSTER WHEELER
AkerSolutions
JACOBS
Bertrams
CHEMIEANLAGEN
Technip
DOW CORNING
Uhde
ThyssenKrupp
FLUOR
UHDENORA
A JOINT COMPANY OF UHDE & GRUPPO DE NORA

Thank you for your interest!

To learn more about how CP can help you optimise the safety and energy efficiency of your chemical process pump systems, please contact us or our local agent:

http://www.cp-pumps.com