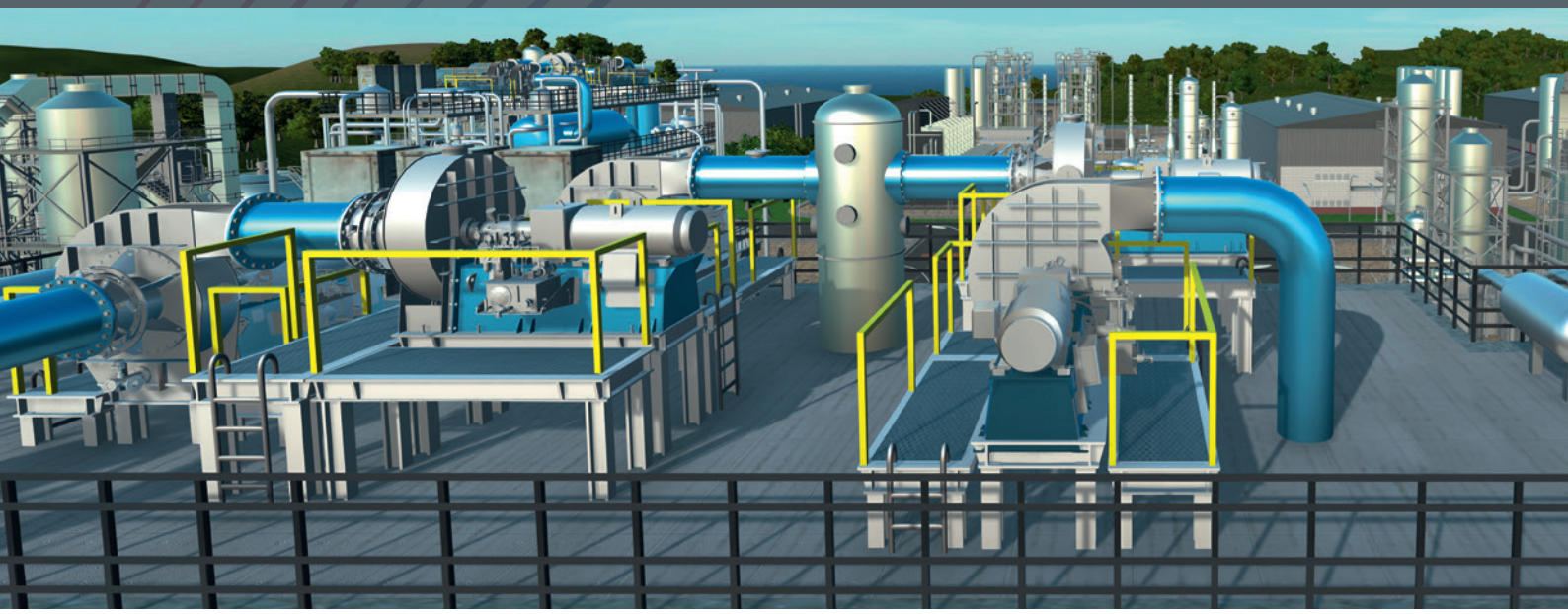
PILLER
Blowers & Compressors

PILLER INDUSTRIAL HEAT PUMP

WE ARE WORKING ON THERMAL ENERGY



CONTENTS

HEAT RECOVERY IN THE PROCESS INDUSTRY: ENERGY EFFICIENCY AS A SUCCESS FACTOR

Waste heat from thermal separation and other industrial processes is often released unused into the environment through cooling towers or condensers. At the same time, there is an extremely high demand for process steam. PILLER has the solution: The PILLER Industrial Heat Pump which enables users to recover surplus heat and to supply steam. The PILLER Industrial Heat Pump shifts the waste heat streams to a usable temperature through compression of process vapor or generated steam. Thereby allowing this energy to be reintroduced into the process or elsewhere in the plant.

SIGNIFICANT ENERGY SAVINGS, HUGE REDUCTION IN CO_2 EMISSIONS

The PILLER Industrial Heat Pump is ideal for use in energy-intensive process industries with high steam demand. It can be used wherever thermal separation processes take place, such as in the manufacture of products in the petrochemical, chemical, pharmaceutical, basic materials manufacturing, paper and food industries.

Your benefits through efficient production with a PILLER Industrial Heat Pump:

Cost-effectiveness – savings through energy efficiency
- Significant reduction of energy costs through heat recovery in the form of steam and its compression
- Minimized cooling water consumption and reduced electricity costs as a result
- Amortization period of less than 3 years

Sustainability – climate and resource protection
- Reduction of CO_2 emissions
- Reduced use of fossil fuels

Integration in existing systems – flexible and easy retrofitting
- No special requirements regarding installation site
- Easy to set up even in limited space conditions

HOW YOU BENEFIT FROM THE PILLER INDUSTRIAL HEAT PUMP:

over **75%** saving in energy

up to **90%** saving in energy costs

over **60%** reduction in CO_2 emissions

PILLER INDUSTRIAL HEAT PUMP – VAPOR COMPRESSION OR STEAM GENERATION

YOUR PROCESS – OUR SOLUTION: WASTE HEAT RECOVERY MADE BY PILLER

In contrast to conventional heat pumps, that use chemical refrigerants, the PILLER heat pump uses the existing process fluids, either the vapor from the process or water.

If vapors are compressed directly and then used for heating, the basic principle corresponds to classic mechanical vapor compression (MVR) process (fig. 1, left). In addition to being used for process heating, the compressed vapor can also be used in another process or for the generation of steam or hot water.

If it is not a gaseous waste heat stream or if the vapor cannot be compressed, the innovative heat pump cycle with evaporator can be used. For this, PILLER uses water as a working fluid in order to generate steam in the evaporator at a low pressure and temperature (fig. 1, right). The High Performance Blowers by PILLER bring the steam to the pressure and temperature to drive the process or heating system needs.

The advantages are clear: higher energy efficiency due to the reuse of waste heat, reduced use of fossil fuels, lower CO_2 emissions and reduced energy costs – thanks to retrofitting your process.

Until now, vapor from chemical processes and thermal separation is often condensed leaving the energy in these streams unused. With a heat pump, waste heat can be brought back to a usable pressure and temperature. PILLER offers industrial Heat Pumps that enable the requirements of the process industry for heating steam and increased temperature to be met. The secret is High Performance Blowers for vapor compression. PILLER now offers a solution that is one of a kind in the market – the PILLER Industrial Heat Pump.

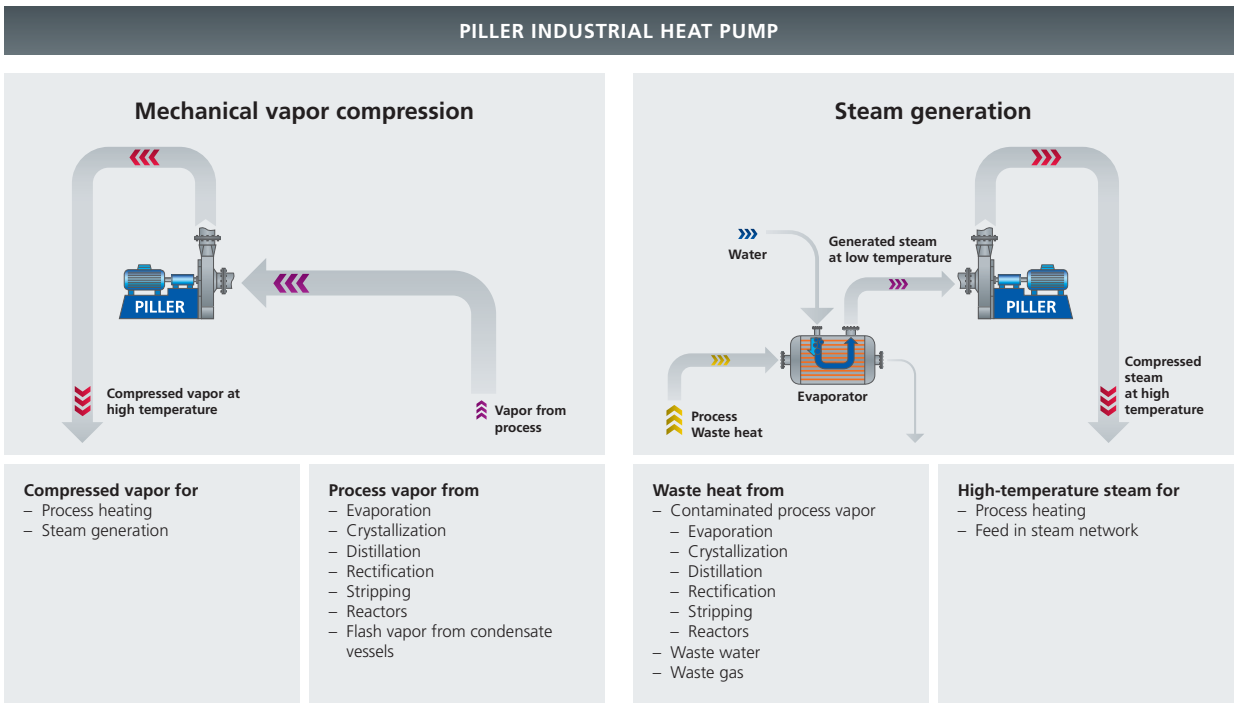


Fig. 1: PILLER Industrial Heat Pump – mechanical vapor compression and steam generation

THE STARTING POINT: THERMAL SEPARATION PROCESS

We examine a thermal separation process that needs steam in order to break down an incoming feed into fractions. In this case, a mixture of lower boiling point components is collected as a gaseous product – the overhead vapor. When the vapor evaporates, it absorbs almost all of the heat that is supplied by heating steam. Following this process, the overhead product is condensed. The reasons for condensing of the overhead vapor is to maintain the pressure level, and recover the overhead stream as a liquid or intermediate product, or to return it into the process as the reflux.

ENERGY CONSUMPTION IN THE INITIAL STATE – HIGH DEMAND FOR HEATING STEAM

In the conventional process (fig. 2), a boiler produces the required steam by burning fossil fuels with the need of additional electrical energy. Due to heat losses from the boiler system only 80 % of the fossil energy input ends up in the steam.

The supplied heat is routed out to a cooling water circuit through condensing of the overhead vapor. In addition to high heat losses into the environment, the cooling system uses costly electricity for the operation of cooling water pumps and fans in the cooling towers.

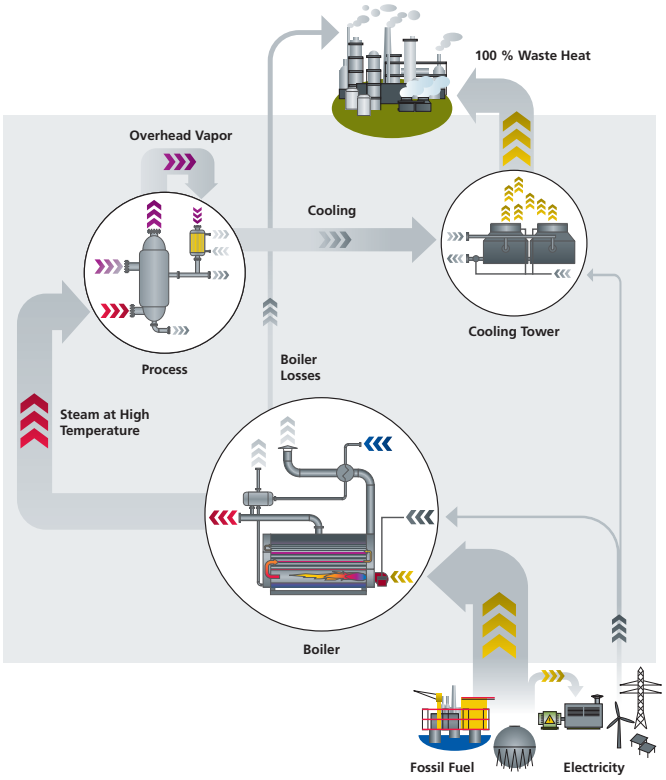


Fig. 2: Sankey-Diagram of the conventional system without heat recovery

RETROFITTING UNITS – MORE ENERGY EFFICIENCY AND COST REDUCTION

Retrofitting a process with a PILLER Industrial Heat Pump with steam generation (fig. 3), on the other hand, enables waste heat at low temperature to be brought back to a usable temperature while preserving the heat of vaporization. Heat recovery using a PILLER Industrial Heat Pump with previous steam generation and subsequent compression is always the perfect solution if direct vapor compression is not possible.

The comparison of the conventional (fig. 2) and the retrofitted system (fig. 3) shows how efficient the PILLER Industrial Heat Pump supplies process heat. With low electricity input the heat remains in the system and saves high amounts of fossil fuel.

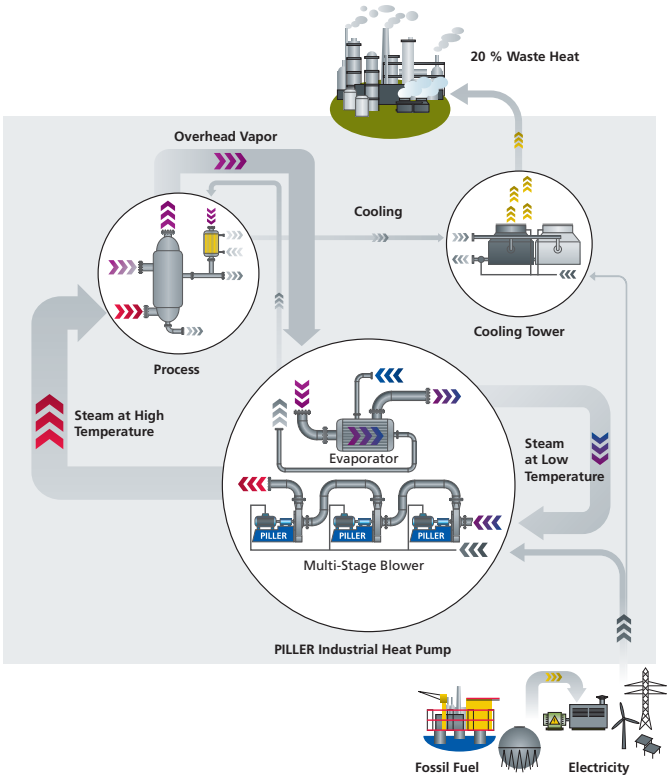


Fig. 3: Sankey-Diagram of the retrofitted system with the PILLER Industrial Heat Pump

INDIVIDUAL AND CUSTOMIZED COMPONENTS

The components for the retrofit will be designed specifically for your process depending on the process data you specify. This way, you receive the most efficient and economical solution for your application. Our experienced engineers support you in the implementation of your project as well as in the commissioning of your retrofitted unit. All with superior MADE BY PILLER quality.

THE PILLER EVAPORATOR FOR STEAM GENERATION

The basis for steam generation with the PILLER Industrial Heat Pump is the evaporator. The PILLER Evaporator is designed to optimally convert waste heat from your unit and provide the necessary heating steam for your processes.

How the PILLER Evaporator works:
During the overhead vapor phase transition, energy is released. The Evaporator uses this to evaporate water at a low pressure or temperature. The heat is transferred to the water. In addition to process-related conditions, this form of heat transfer has a major advantage: Compared to other fluids, water has a very high heat of vaporization. In contrast to other refrigerants – like those used in heat pumps – water is also environmentally friendly, safe, inexpensive and widely available.

Fig. 4: The PILLER Evaporator evaporates water at low pressure

THE PILLER HIGH PERFORMANCE BLOWER FOR VAPOR COMPRESSION

The key element of the PILLER Industrial Heat Pump is the compression with the PILLER High Performance Blowers (fig. 5). The design of the individual blowers and their interconnection in a multi-stage system (fig. 6) are perfectly adapted in order to achieve the needed compression of the working fluid. With your retrofitted process, vapor can now be compressed while preserving energy and feeding it at the lowest cost into your processes. A multi-stage system also enables the integration of additional heat sources into intermediate stages. More and more companies are successfully relying this solution with up to eight stages.

Fig. 5: PILLER High Performance Blower

Fig. 6: Multi-stage system in operation

THE PILLER INDUSTRIAL HEAT PUMP: ALWAYS A WIN

HOW YOU BENEFIT FROM THE PILLER INDUSTRIAL HEAT PUMP:

- Significantly improved energy efficiency through heat recovery
- Extreme reductions in energy consumption and costs
- Amortization period of less than 3 years
- Improved climate protection and resource conservation thanks to reduced use of fossil fuels and lower CO_2 emissions
- Simple integration into existing systems: retrofitting without great effort and easy installation even in limited space conditions

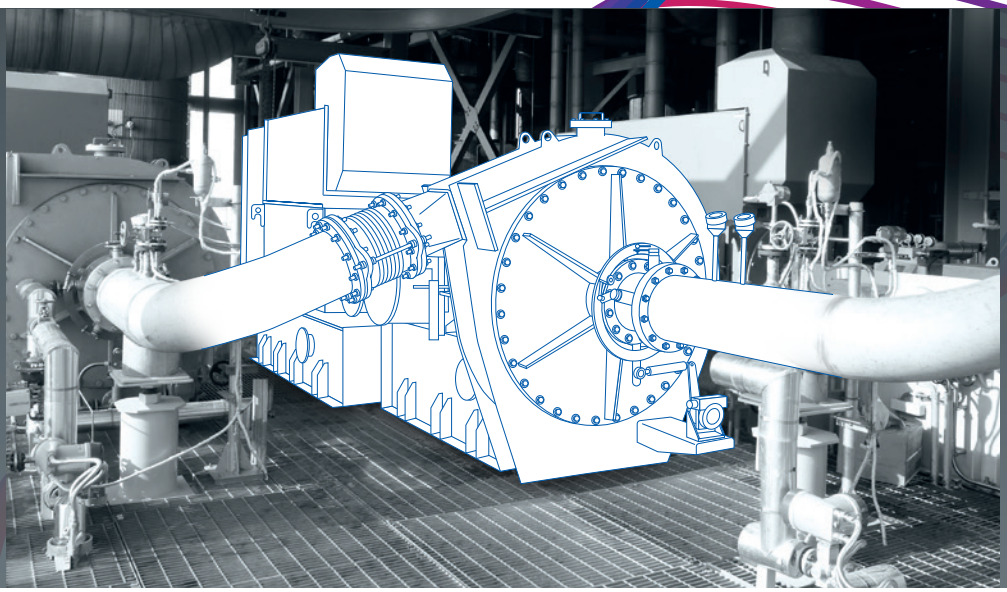


Fig. 7: Process-specific blower design

OUR SERVICES AT A GLANCE

Feasibility and economic viability studies

Analysis of your individual process for technical feasibility and economic viability; a listing of important parameters and requirements:

- Energy Balance of process streams
- Process parameters of the waste heat streams and the heat supply
- Material composition of the waste heat streams
- Integration options in existing heating networks
- Space requirements and other framework conditions for the installation of necessary technology

Joint definition of project aims in relation to feasibility – as a sound basis for decision-making.

Pre-engineering – solution suggestions

- Development of solution proposals as decision aid (technical and economic)
- Recommendation of a concept as a jointly development solution

Basic engineering – design planning

- Start of basic engineering after positive investment decision
- Review of all pre-engineering results
- Detailed elaboration of the most technically and economically advantageous solution
- Determination of all expected costs and revenues

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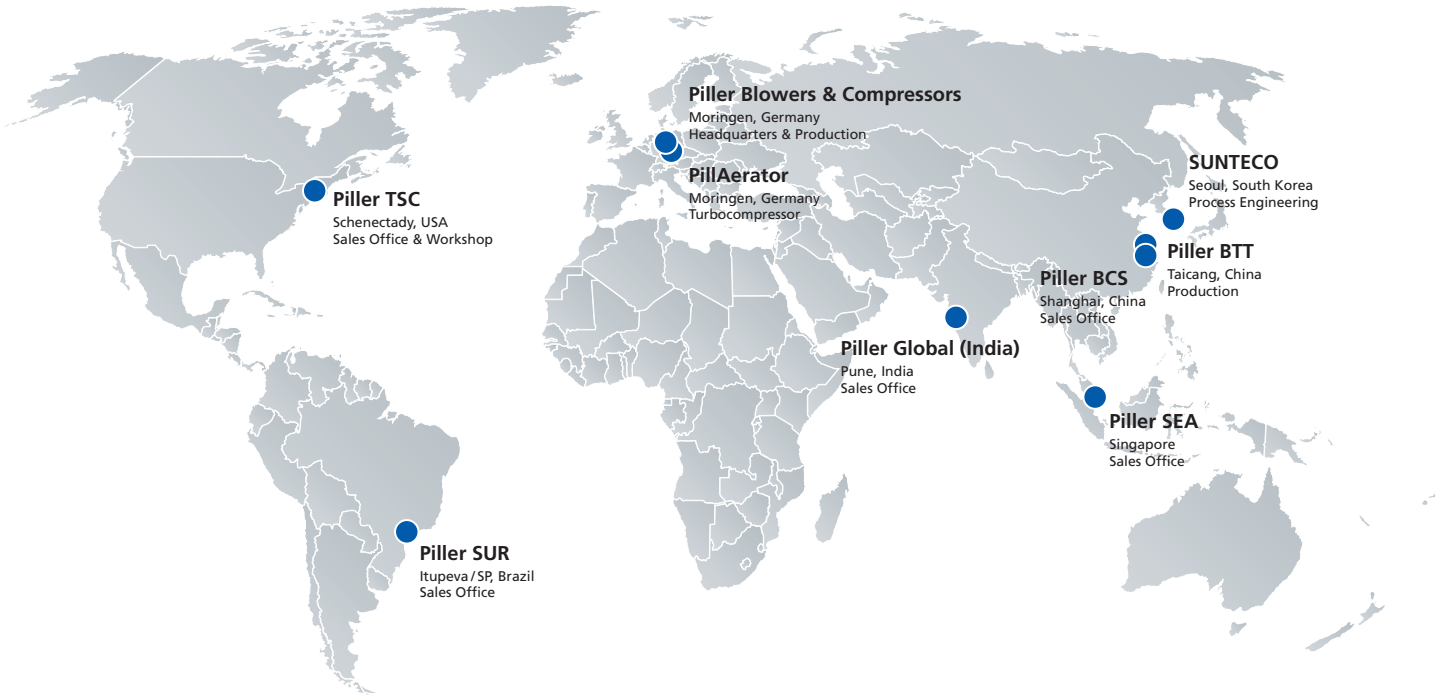

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