KASAG

Renewable energies
Concepts
Heat exchanger
solutions

Experts for energy recovery

We make waste-heat to your profit

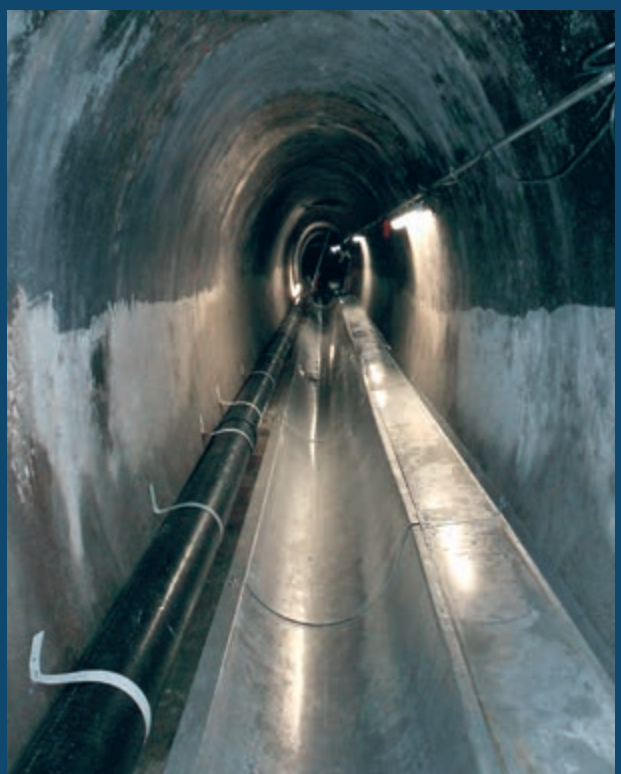
Renewable energies for future generations

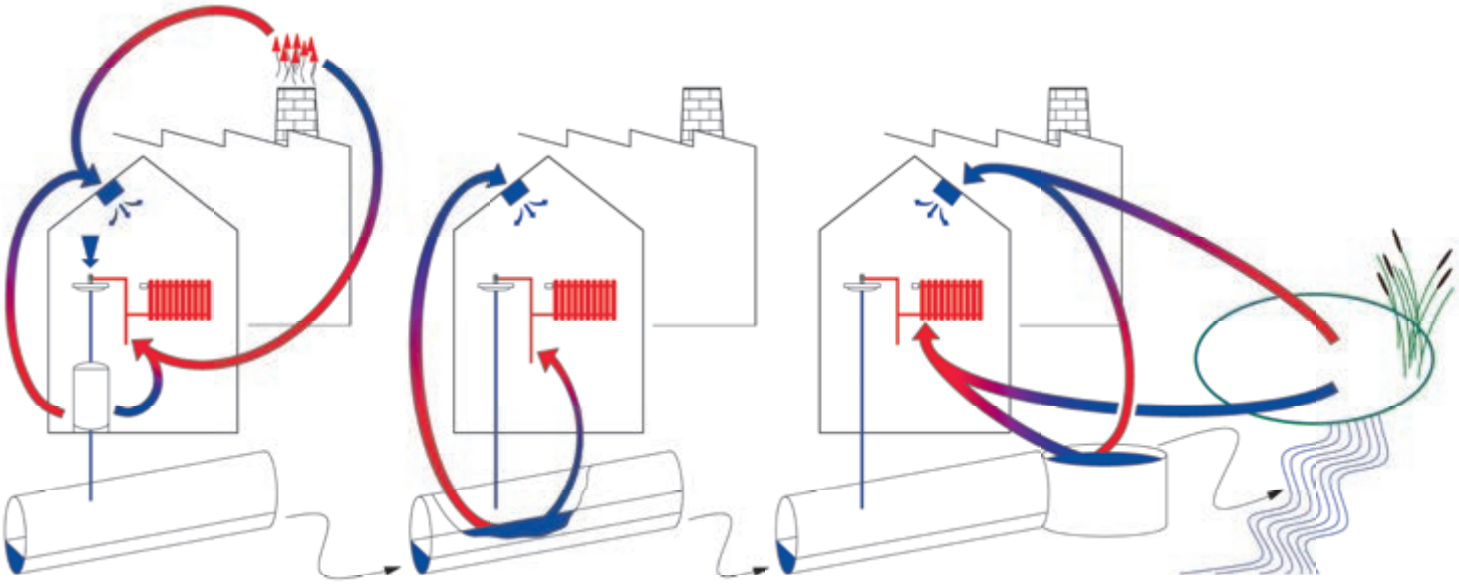
Wasted energy and global warming are harmful to nature and the environment and place our future at risk. You have a significant role to play. You are ensuring sustainability by selecting KASAG Swiss AG as your partner in the conception, design, engineering and construction of heat exchanger equipment for energy recovery from waste heat.

You can contribute to energy recovery with innovative concepts and heat exchanger solutions, by making water, waste water, process fluids and vapour at source in buildings, industry, in the sewage system on the way to the sewage plant and in surface water available for thermal recovery through heat exchange. In addition to their ecological aspects, investments in the field of renewable energy also makes sense economically.

Heat exchangers for clean liquids such as drinking water do not pose any major technical challenge. However, potential energy recovery is usually to be found in liquids and vapours (air saturated with water vapor) which have been contaminated or which contain solids and / or fats. Potential areas of use include multi-family homes, residential or municipal buildings, hotels, thermal baths, swimming pools as well as a wide range of energy intensive industries, such as foodstuffs, chemicals and pharmaceuticals.

In order for a project for energy recovery from renewable sources to be feasible, a wide range of parameters must be taken into account. KASAG will be glad to draw up a tailor-made concept with an optimal heat engineering design for you – on the basis of your overall system.





All around significant energy potentials

Heat recovery in buildings and industry

The use of a potential energy source at its place of origin is the best way to ensure optimal results. Guaranteeing the heat transfer within the heat exchanger is therefore the deciding criterion, and requires individual solutions. Intermittent waste water flows in buildings are collected in a retention volume and their energy is used for heating and cooling by means of a heat exchanger. Continuous waste water flows and/or process heat requires no retention volume.

Water, waste water, exhaust air (vapour) and industrial process liquid store significant amounts of potential energy, which can be put to use through the application of innovative concepts and heat exchangers specifically adjusted to these requirements. In addition to fluids, vapour also has a very high energy recovery potential compared to normal exhaust air.

Such energy systems can be used both heating and for cooling.

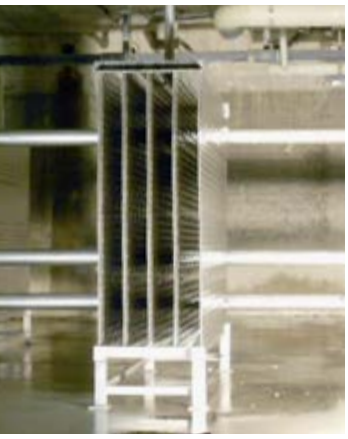
Waste heat use in waste water channels, sewers

Waste water in sewers, when combined with heat pumps and chillers, forms an ideal source of energy for heating and cooling buildings. Experience has shown that the minimum requirements for such equipment are as follows:
– A waste water flow of approximately 10 l / s
– A waste water temperature level of approximately 10 °C
– An output requirement of 100 kW or above (approximately 50 kW for heating and cooling).

There are a range of possibilities in which this thermal energy can be used as the waste water flows through the sewers to the sewage plant. The waste water can even be used several times in succession as a source of energy. New inflows, confluence in larger collectors or thermal flows from cooling systems have usually a marginal impact on the temperature of the waste water.

Innovative cities have developed energy plans on the basis of which they can determine whether a sewer pipe suitable for energy recovery passes through their vicinity (maximum distance approximately 300 m).

“Clever KASAG concepts and heat exchanger systems for energy recovery at the place of origin, in the sewers on the way to the sewage plant or in surface water allow you to provide both heating and cooling.”




Energy use in sewage plants and from surface water

Sewage plants and surface water have a massive energy potential. At a wastewater treatment plant with a 90 million litre daily waste water capacity, a reduction of 1 °C in the waste water temperature by means of heat exchangers will generate approximately 4.3 MW. The potential of surface water is comparatively even greater.

The water temperatures of surface water and rivers have steadily increased due to man's activity - namely, as a result of inflows from sewage plants. This has a serious impact on fauna and flora. Extracting heat from the treated water at the sewage plant or from surface water and rivers reduces the water temperature, and hence also has a positive effect on the overall ecosystem.

Do you have any questions?

Should you have any general questions regarding renewable energies, our experts will be glad to assist you::

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www.kasag.com/en/renewable-energies-systems-plants-heat-exchangers

"Pure gold in the form of energy is flowing through the sewers beneath our feet, and this can be extracted without any physical exertion whatsoever."

CO_2 reduction, profitability
Water, waste water, surface water and industrial processes store significant amounts of energy, which can be accessed through the use of special heat exchangers. Renewable energy sources of this kind are highly significant. Compared to traditional heating and hot water generation using oil and gas, this technology can reduce CO_2 emissions by up to 60%. As a result of increasing energy prices, investments in de-centralised energy recovery systems also make economic sense.

Pressure Equipment Directive, CE Conformity
Directive 2014 / 68 / EU relating to pressure equipment (the Pressure Equipment Directive, PED) regulates compliance with basic safety requirements for heat exchangers.

CE marking is an administrative logo indicating the free movement of industrial products in accordance with EU directives within the internal European market.

KASAG have all necessary quality management systems and worldwide approvals.

For technical exclusivity worldwide

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ISO 9001 / ISO 3834-2
PED (EN13445 / AD-2000)
ASME (U-Stamp)
China Stamp (A1)
TP TC 032/2013 (EAC)

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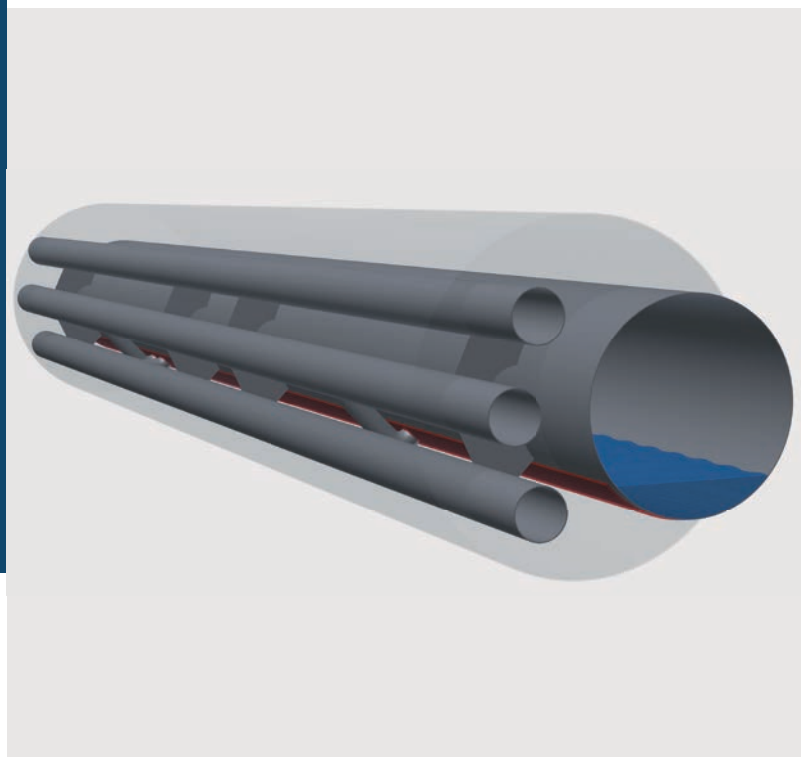
Renewable energies

Sewage-pipe heat exchanger

KASAGGravitytube

The waste water in the main pipe is used as a source of energy. Heat can be extracted as well as discharged by means of a special double jacket. The amount of waste water and the natural incline determine the waste water level in the main pipe. The sewage pipe heat exchanger is suitable for energy recovery in completely new or replaced sections of waste water channels.



Technical data

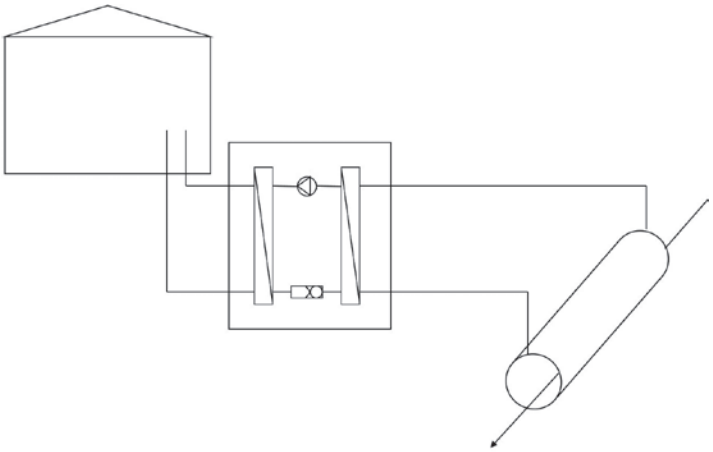
Material	Stainless steel 1.4404, 1.4571
Jacket	insulated, PE jacket
Segment lengths	2 – 6 metres
Application	Suitable for heating and cooling
Area of use	Wastewater (industrial, municipal)
Installation places	Underground or laid in the open air

Heat exchanger performance (heating)

Main pipe diameter	
200 mm	0.6 kW / m
400 mm	1.1 kW / m
600 mm	1.6 kW / m
800 mm	2.1 kW / m
1200 mm	3.2 kW / m

Assumptions

Waste water temperature	13 °C
Inlet temperature	6 °C
Wetted surfaces	120 ° of the circumference



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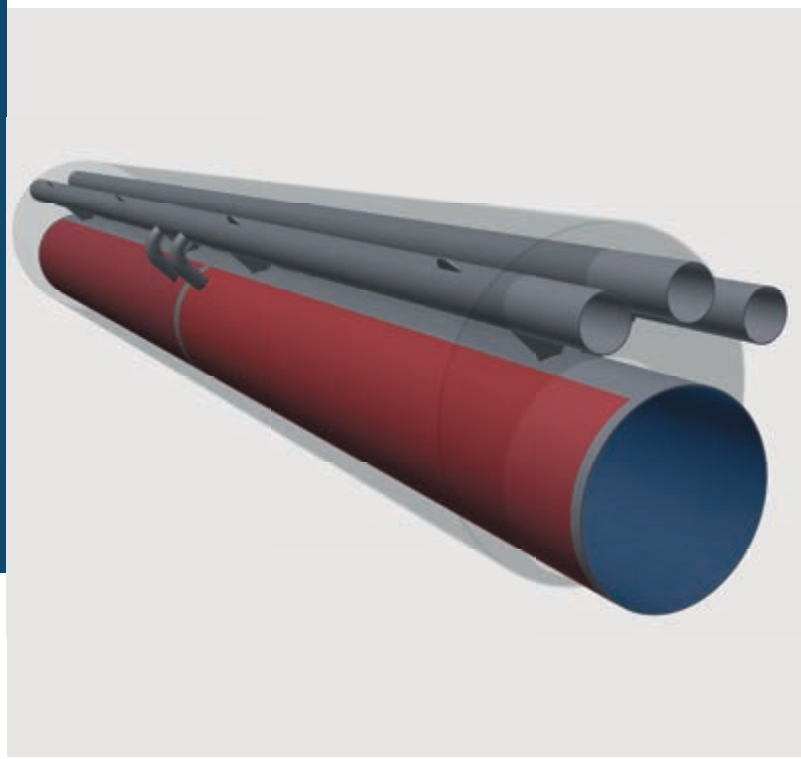
Pressure-pipe heat exchanger

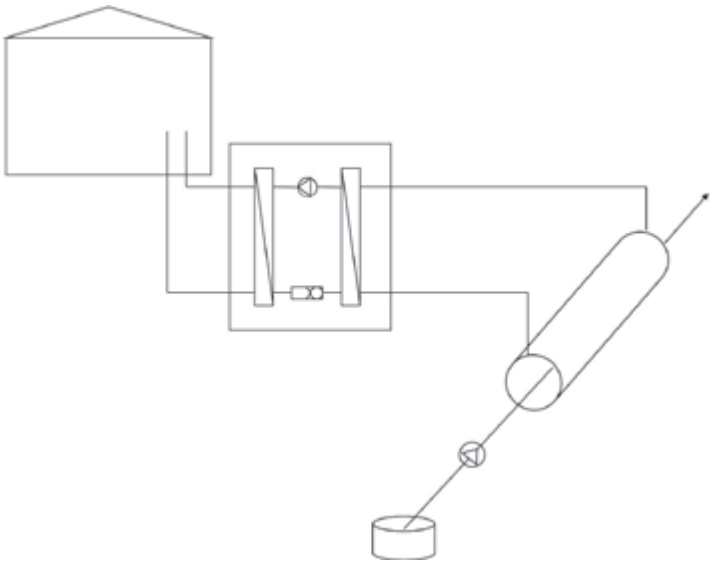
KASAGPressurepipe

The waste water flows through the main pipe and is used as a source of energy. Heat is extracted or discharged by means of a special double jacket around the entire circumference of the pipe. The main pipe is laid out according to the pressure rating in accordance with PED (EN13445 / AD-2000). The pressure pipe heat exchanger is suitable for energy recovery in new pressure pipes or as a replacement for existing pipes.



Technical data

Material	Stainless steel 1.4404, 1.4571
Jacket	insulated, PE mantle
Segment lengths	2–6 metres
Application	Suitable for heating and cooling
Area of use	Waste water, drinking water, liquids of all kinds containing solids
Installation places	Underground or laid in the open air



Heat exchanger performance (heating)

Main pipe diameter	
200 mm	1.6 kW / m
400 mm	3.2 kW / m
600 mm	4.8 kW / m
800 mm	6.3 kW / m

Assumptions

Temperature at source	13 °C
Inlet temperature	6 °C

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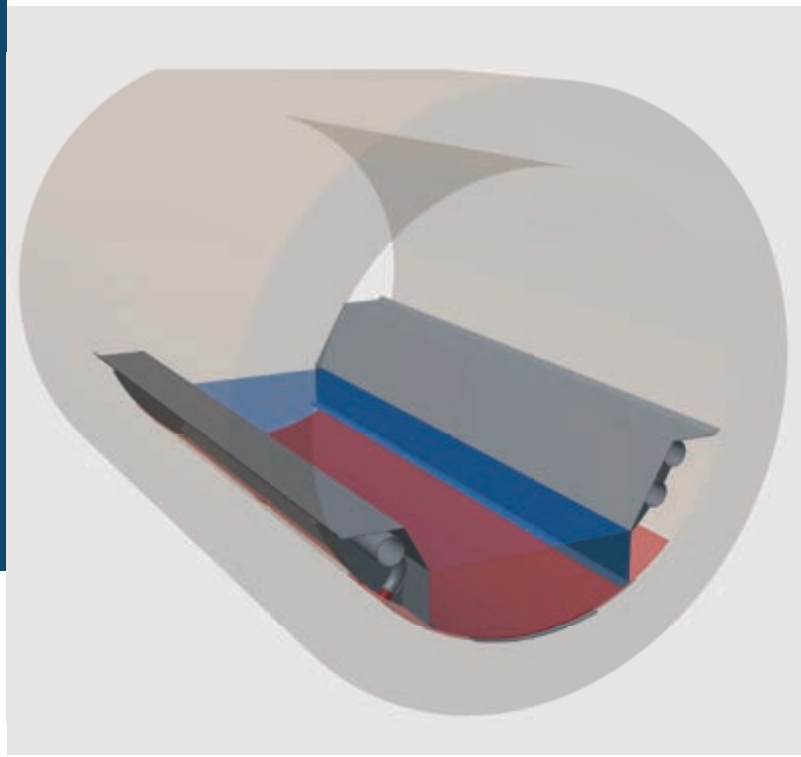
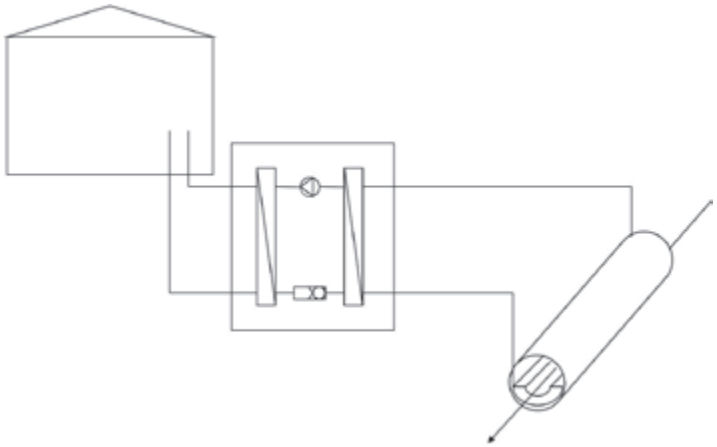
Renewable energies

Sewer heat exchangers

KASAGSewer

The waste water in the sawage channel is used as a source of energy. The heat exchanger elements can be retrofitted in existing sewers or installed in new sewers. Heat is extracted or discharged via the heat exchanger surfaces over which the water flows. Sewer heat exchangers are suitable for energy recovery in sawage channels with a wide variety of cross-section geometries. Their modular structure allows individual solutions for different applications. In order to minimise installation times, pre-assembled heat exchanger elements are used.





Technical data

Material	Stainless steel 1.4404, 1.4571
Material pipes	Stainless steel 1.4404, 1.4571 or PE
Segment lengths	1 – 3 metres
Application	Suitable for heating and cooling
Area of use	Waste water
Installation places	for existing or new waste water channels

Heat exchanger performance (heating)

Tube diameter	
1200 mm	3.2 kW / m
1400 mm	3.7 kW / m
1600 mm	4.2 kW / m
1800 mm	4.8 kW / m
2000 mm	5.3 kW / m

Assumptions

Waste water temperature	13 °C
Inlet temperature	6 °C
Wetted surfaces	120° of the circumference

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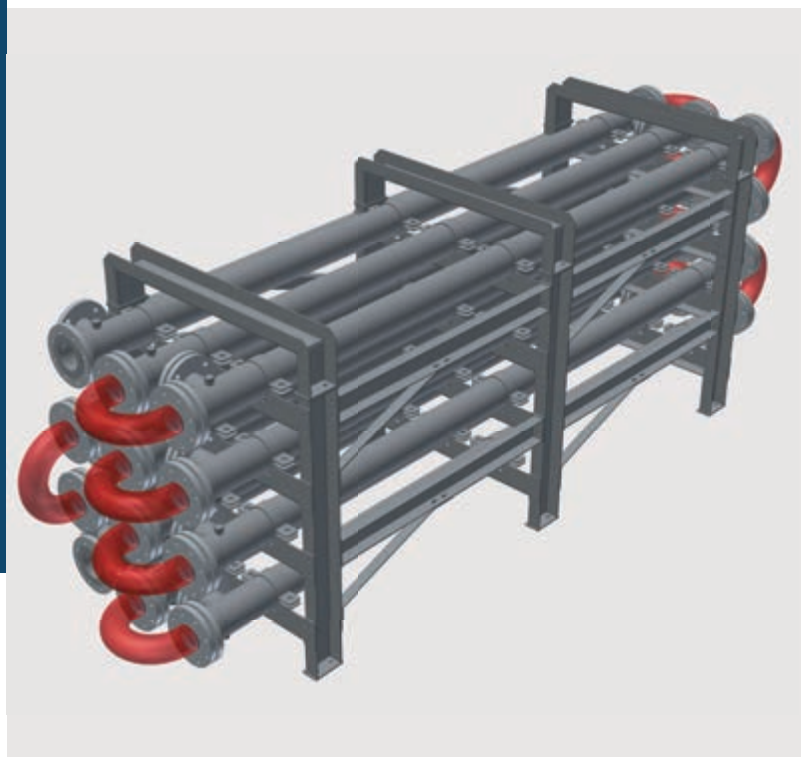
Double-pipe heat exchanger

KASAGDouble

Waste water flows in the inner tube of the double pipe heat exchanger and is used as a source of energy, by extracting or discharging heat. The intermediate circuit runs between the inner and outer pipe. Special pipes are used instead of conventional piping in order to optimise performance and for high solid content levels in the waste water. The double pipe heat exchanger is particularly suitable for grey and black water in buildings, sewage pipes and in wastewater treatment plants.



Technical data

Material	Stainless steel 1.4307, 1.4404, 1.4571
Pipe length	3 or 6 meters
Application	Suitable for heating and cooling
Area of use	Waste water (industrial and municipal), liquids of all kinds containing solids
Installation places	Indoors or outdoors

Heat exchanger performance (heating)

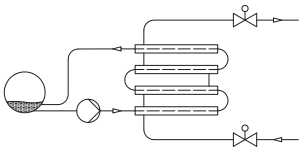
Pipe diameter	
DN32	400 W / m
DN40	460 W / m
DN50	600 W / m
DN65	720 W / m
DN80	840 W / m

Assumptions

Waste water temperature	13 °C
Inlet temperature	6 °C

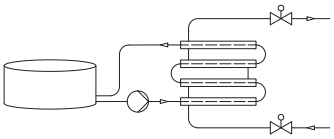
Energy use in wastewater channel

Example of use of waste water heat from a channel with no sieving



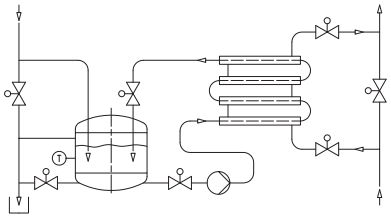
Energy use in wastewater treatment plants

Example of use of waste water heat in wastewater treatment plant



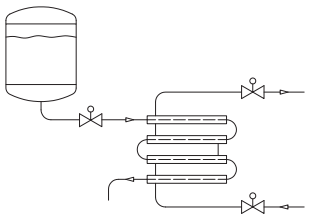
Energy use in buildings

Example in combination with collection container



Energy use in waste process heat

Example waste process heat in a dairy operation



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Renewable energies

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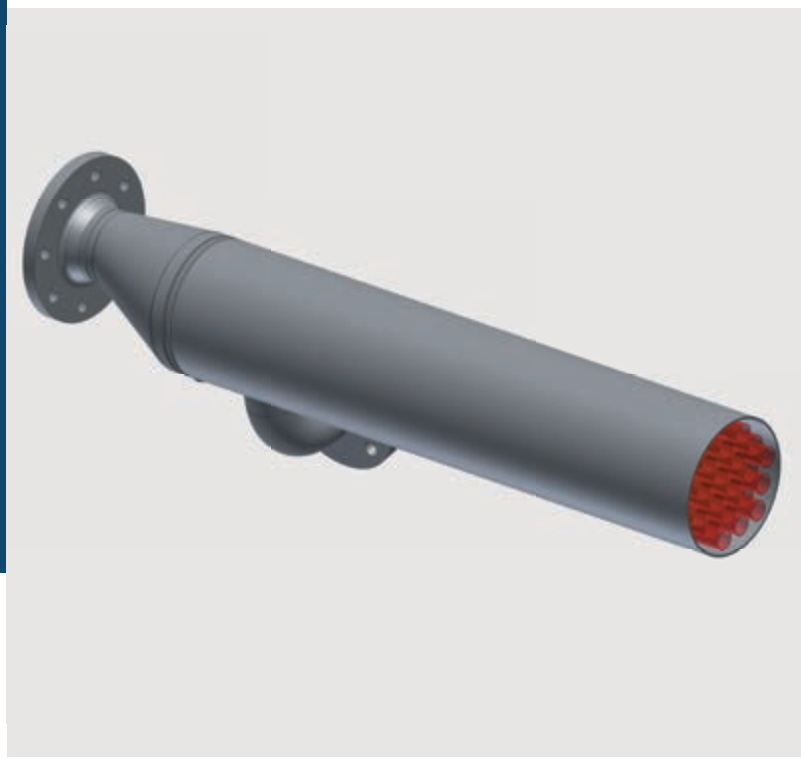
Tube-bundle heat exchangers

KASAGBundle

Process liquids, waste water or vapour (air saturated with water vapor) flow through the shell and tube and are used as a source of energy, at which heat is extracted or discharged. The intermediate circuit flows through the shell or tube area. Special pipes are used instead of conventional piping or an automated cleaning system is fitted in order to optimise performance and for high solid content levels in the water respectively oil-bearing exhaust air. The tube heat exchanger is suitable for extracting energy from water, waste water and greywater with low levels of solid content, as well as vapour, particularly in industrial operations, buildings, sewage-treatment plants and surface waters.



Technical data

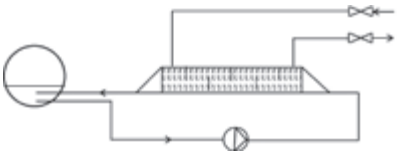
Material	Stainless steel 1.4307, 1.4404, 1.4571
Pipe length	3 or 6 meters
Application	Suitable for heating and cooling
Area of use	Waste water (industrial and municipal), liquids of all kinds containing solids
Installation site	Indoors or outdoors

Heat exchange performance

k-value	600 – 1500 W / m²K

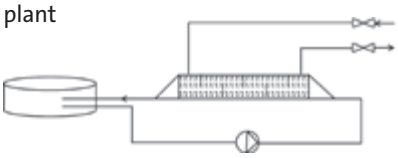
Energy use in wastewater channel

Example of use of wastewater heat from a channel with no sieving



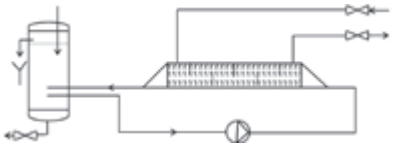
Energy use in wastewater treatment plant, surface waters

Example of use of waste water heat in wastewater treatment plant



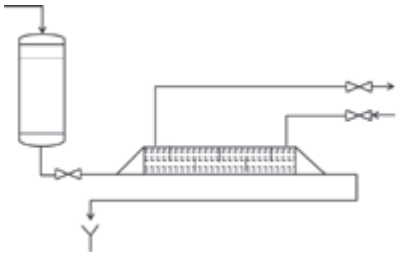
Energy use in buildings

Example in combination with collection container



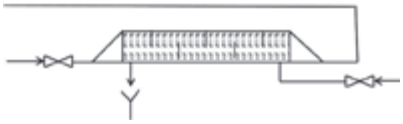
Energy use in waste process heat

Example waste process heat in a dairy operation



Energy use of vapour, exhaust air

Example of vapour condensation



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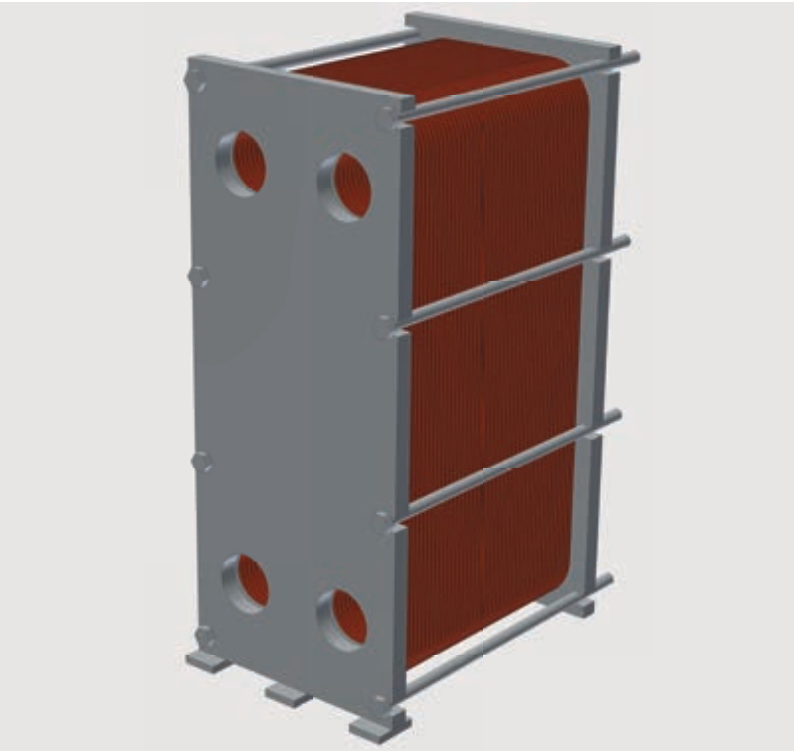
Renewable energies

Plate heat exchanger

KASAGPlate

Water, purified waste water, sea water and process water can be used as sources of energy. The intermediate circuit flows on one side of the heat exchanger, while the source flows over the other side. Cleaning can be performed manually. For simpler handling however, the unit can also be fitted with a cleaning system. The plate heat exchanger is suitable for the reuse of energy from liquids with low levels of solid content in industrial applications, buildings and in wastewater treatment plants.



Technical data

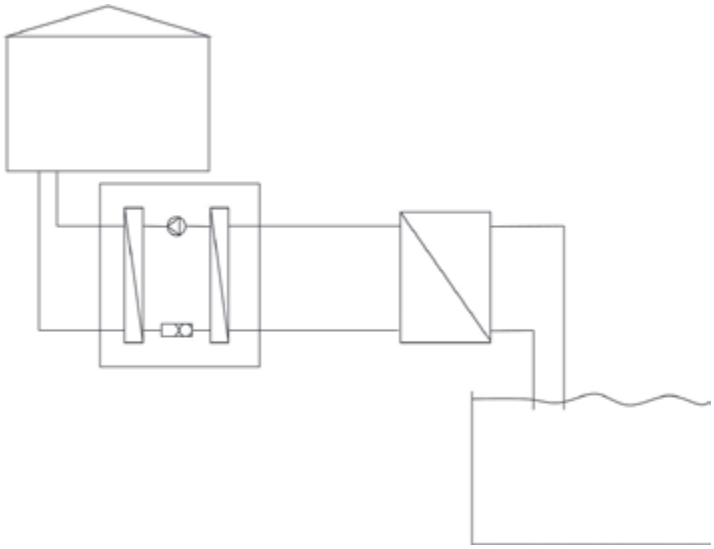
Material	Stainless steel 1.4404, 1.4571
Application	Suitable for heating and cooling
Areas of use	Water, purified waste water, seawater, process water

Heat exchange performance

Heat exchanger surfaces	3–4 kW / m²

Assumptions

Waste water temperature	10 °C
Inlet temperature	4 °C



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Renewable energies

Basin heat exchanger

KASAGPool

Waste water and process water can be used as sources of energy. The heat exchanger element is submerged in the liquid. Heat exchange occurs over the vertical surfaces by means of free convection. Pool heat exchangers are suitable for energy recovery from basins of any kind. The modular structure enables bespoke, scalable solutions for different applications. For example, as a source of energy in the retention basins at thermal baths. In order to shorten installation times, the heat exchanger registers and the piping are supplied pre-assembled.

Technical data

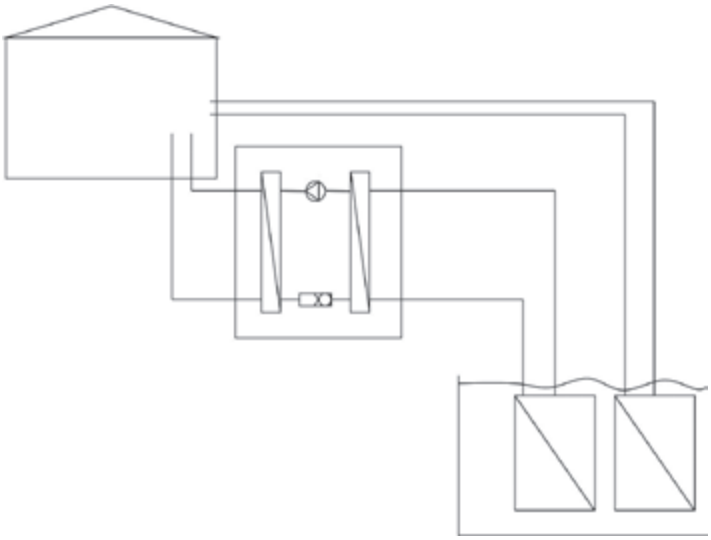
Material	Stainless steel 1.4404, 1.4571
Material Pipes	Stainless steel 1.4404, 1.4571 or PE
Application	Suitable for heating and cooling
Area of use	Process water, waste water, drinking water, liquids of all kinds which contain solids
Installation places	in clarifiers, retention basins, sedimentation tanks, etc.

Heat exchange performance

Heat exchanger surfaces	approximately 2.14 kW / m²

Assumptions

Waste water temperature	13 °C
Inlet temperature	6 °C



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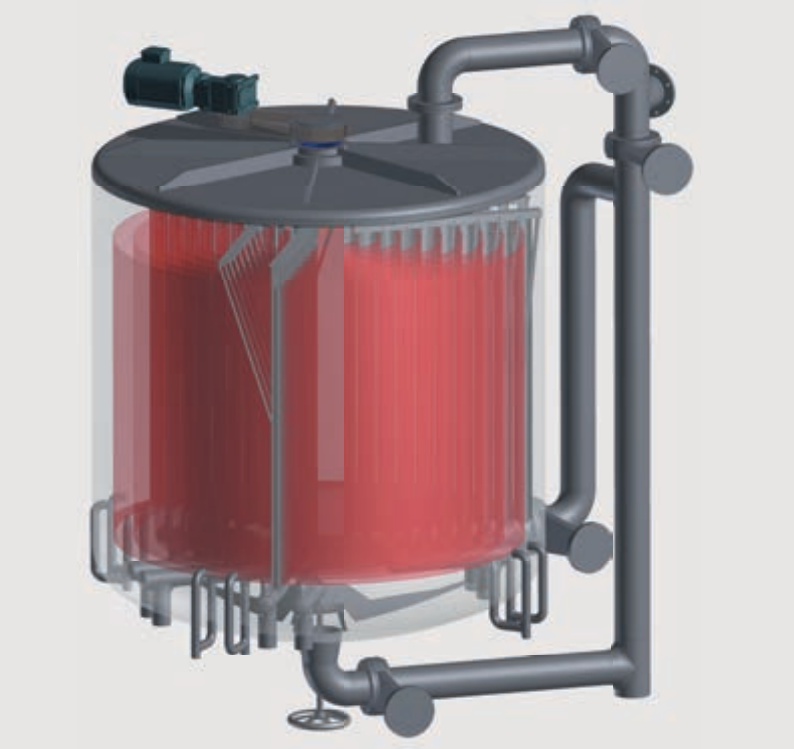
Heat exchanger with automated cleaning

KASAGClean

The waste water flows continuously or in surges – through a coarse filter where necessary – and is retained in a retention volume in the form of a container or basin. Here, it will be used as a source of energy. The retention container incorporates a cylindrical or flat heat exchanger with or without automated cleaning. In operation heat is extracted or discharged. Heat exchangers with automated cleaning are particularly suited for use in residential or municipal buildings, waste water treatment plants, hotels, thermal baths, swimming pools and in industry.



Technical data

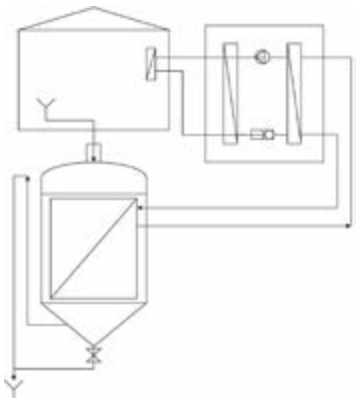
Material	Stainless steel 1.4307, 1.4404, 1.4571
Container volume	Min. 500 litres
Application	Suitable for heating and cooling
Area of use	Greywater, process water, liquids containing solids
Installation places	Indoors or outdoors

Heat exchange performance

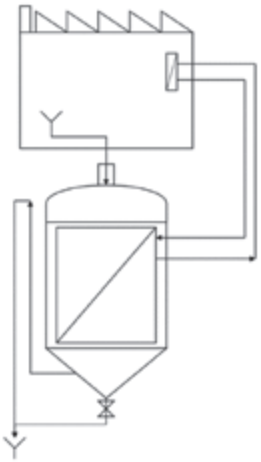
The wide range of potential capabilities of heat exchangers with automated cleaning means that it is impossible to provide general performance figures. KASAG Swiss AG will require the following information in order to provide an initial assessment:

– Waste water (quantity and timing)
– Waste water temperature
– Intended use of the energy generated

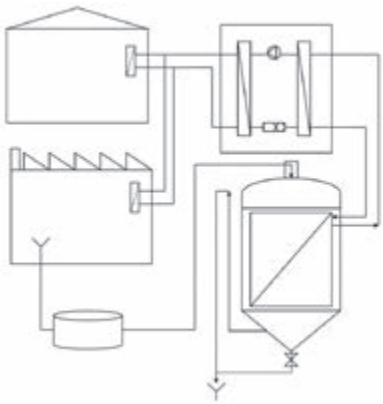
For example: Greywater from hotel operations for hot water and heating



For example: Waste water from commercial operations for lifting the temperature of process water



For example: Process water from industrial operations for heating and cooling



We make waste-heat to your profit.

Cylindrical heat exchanger with automated cleaning

KASAGClean (C)

KASAG Swiss AG offers cylindrical heat exchangers in 3 different designs and with 4 different control systems.

Dimensions, design

Diameter max. of element	Volume of container	Heat exchanger surface area
Ø 606 mm	~ 565 litres	~ 3.51 m²
Ø 806 mm	~ 1005 litres	~ 8.86 m²
Ø 1006 mm	~ 1570 litres	~ 16.04 m²
Ø 1208 mm	~ 2260 litres	~ 24.90 m²
Ø 1408 mm	~ 3078 litres	~ 35.45 m²
Ø 1608 mm	~ 4021 litres	~ 47.84 m²
Ø 1808 mm	~ 5089 litres	~ 62.06 m²
Ø 2010 mm	~ 6288 litres	~ 78.12 m²
Ø 2210 mm	~ 7602 litres	~ 95.86 m²
Ø 2410 mm	~ 9047 litres	~ 115.44 m²

Without automated cleaning
Heat exchanger (manual cleaning): Bottom and dished cover welded, container opening for inspection / cleaning, manually actuated valves.

With automated cleaning
Heat exchanger cleanable: Bolted dished cover, bottom welded, cleaning system including HE-CD3 control system, electrically actuated valve.

With automated cleaning and bottom discharge
Heat exchanger cleanable: Bolted dished cover and bottom, cleaning system with bottom discharge tool and outlet, HE-CD1 control system, electrically actuated valves.

Control system
HE-CD1: SPS with touchpanel for optimal cleaning speed, valve control and temperature display.
HE-CD2: Logo panel with function buttons, frequency converter for optimal cleaning speed, valve control and temperature display.
HE-CD3: Logo panel with function buttons, with valve control and temperature display.
HE-CD4: Logo panel with function buttons, with valve control.

Flat heat exchanger with automated cleaning

KASAGClean (F)

The Height H x Width W x Length L dimensions must be defined on a project-specific basis. Designs and control systems are the same as for **KASAG**Clean (C).

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Experts in energy and nutrient recovery

We make biomasses and waste to your profit

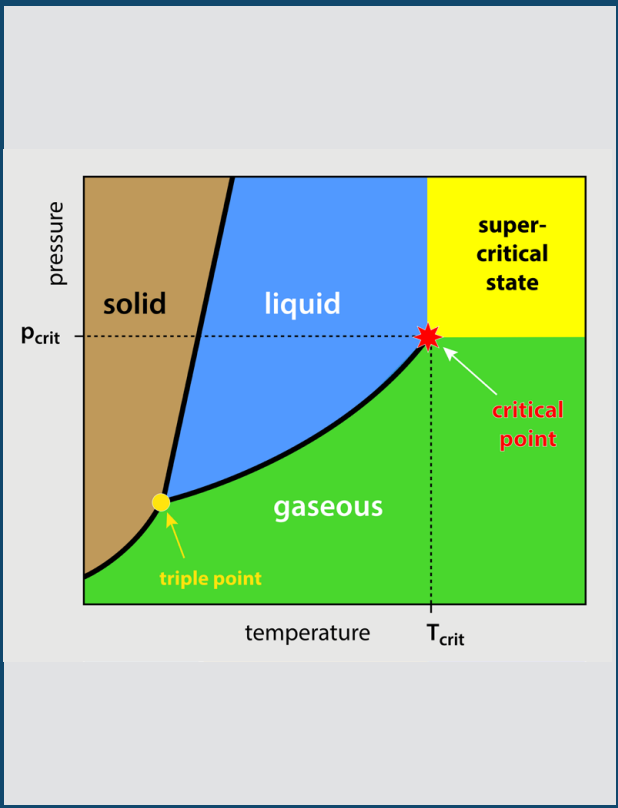
Renewable energies for future generations

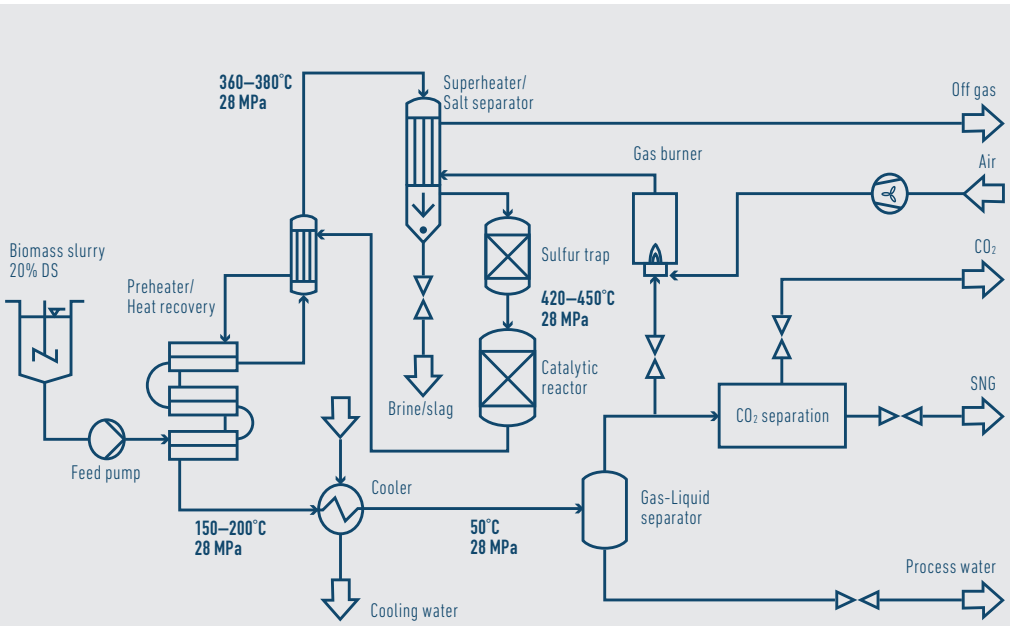
In the light of the increasing scarcity of fossil resources, the phasing out of nuclear power, as well as political and social demands relating to climate change, new and economically viable concepts in environmental protection, waste disposal and energy production are required.

Catalytic hydrothermal high-pressure gasification (HTG) (supercritical) allows energy and nutrients to be recovered during the disposal and conversion of aqueous biomass and waste. It is based on years of research at the Paul Scherrer Institute (PSI) in Switzerland and is a patented process. This innovative method allows biomass and waste to be converted into biomethane within just a few minutes.

Since 2010, KASAG has been involved in the development and construction of apparatuses and plants for the industrial use of catalytic hydrothermal high-pressure gasification (HTG). With KASAG as your partner in the conception, design, engineering and construction of plants and operation, you ensure sustainable innovative solutions and remain a step ahead.

Using this process, biomass components in the feed are converted into biogas/methane, and nutrients, such as phosphorus and nitrogen in the form of ammonium salts and minerals, are recovered. If the main aim is waste disposal, the yield in terms of biogas/methane, nutrients and clean process water makes a valuable contribution to reducing disposal costs and generate a profit. The biogas produced with this method can easily be refined into biomethane for feeding into the public gas network or converted directly into electricity in a combined heat and power plant. The nutrients recovered are processed further in accordance with their intended use (e.g. as fertiliser).





For the disposal and conversion of biomass and waste

Method

Aqueous biomass and waste with a dry matter content of 10% to a maximum of 30% can be disposed directly and used as energy. Traditional processes require energy-intensive steps, such as removal of water from the feeds and drying them. With catalytic hydrothermal high-pressure gasification this is not necessary, as the water does not change state in the supercritical range, i.e. is not converted into steam. The pumpability of the feed is a prerequisite.

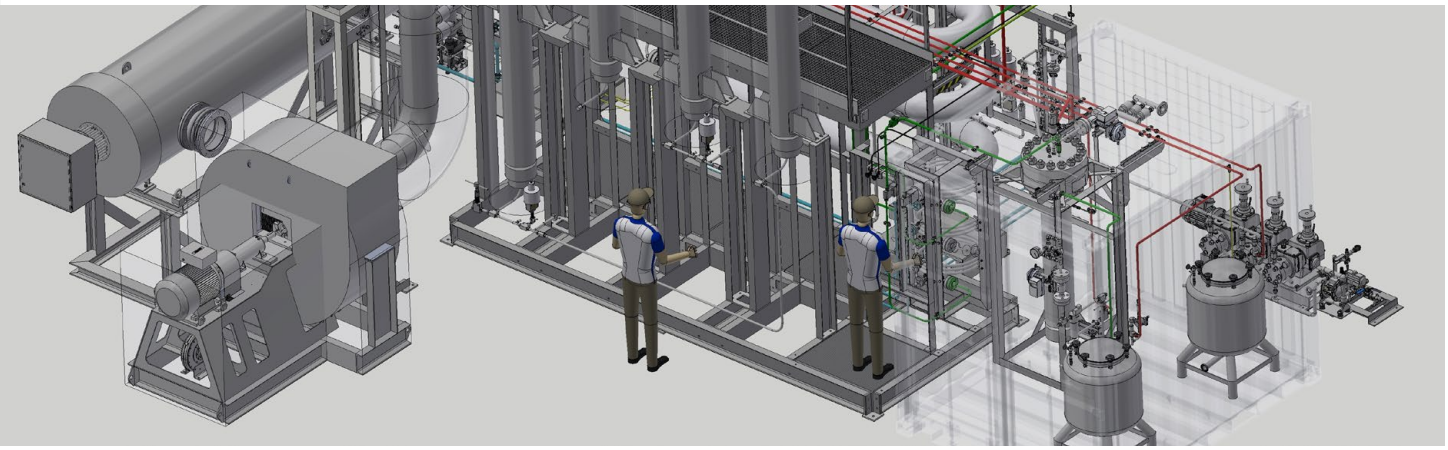
In this process, aqueous organic and non-organic residues are disposed and converted into biogas/methane using catalytic high-pressure digestion, and reusable residues, such as phosphorus, are returned to the circular economy. The patented method of the Paul Scherrer Institute (PSI) contributes to global environmental protection in the field of renewable energies.

Applications

The process offers solutions for feeds from private and public organisations, forestry and agricultural firms, waste disposal firms, waste recyclers and energy producers that have access to biomass inputs derived from animal and plant matter, as well as organic waste from industrial plants, such as
sewage sludge, industrial wastewater, biomass residues from distilleries, biodiesel production, bioethanol process-es, "Kompogas" plants, the pulp and paper industry, food production, meat processing, agriculture, mining, oil and gas production, fracking, etc.

Approximately 0.25 kg of methane CH_4, ready for feeding into energy systems, can be obtained from one kilogram of organic dry matter. Organic components that cannot be fermented are also completely gasified during the process.

"The use and disposal of aqueous biomass or aqueous waste as energy sources, with simultaneous recovery of energy and nutrients, profits the environment."



Technology

The feed (aqueous biomass, aqueous waste with 10% to 30% maximum dry matter content) enters a first heat exchanger via a high-pressure pump. At 300–360°C and an operating pressure of 250–350 bar, the gasifiable solid components liquefy in the feed. In the subsequent salt separator, the feed is heated further to 400–450°C and the inorganic components are precipitated in brine (nutrients) and removed from the system. Nutrients such as phosphorus, ammonium salts etc. can be recovered from the brine and used for a new purpose. Biomass components are converted into methane in the supercritical range in the catalytic reactor. The feed is subsequently used for energy recovery. At the end of the process, the feed is separated in the phase separator into biogas and water. Depending on the outgoing feed, the water is so clean that, after prior analysis, it can be released into the sewage treatment plant. Part of the gas is used for generating hot air and operating the salt separator by means of a gas burner that provides the necessary process energy for the overall process.

Based on the type of feed and its mass throughput for waste disposal and/or energy and nutrient recovery, the plant is designed for the relevant intended use.

Do you have any questions?

Should you require a quote or have any general questions regarding renewable energies, our experts will be glad to assist you:

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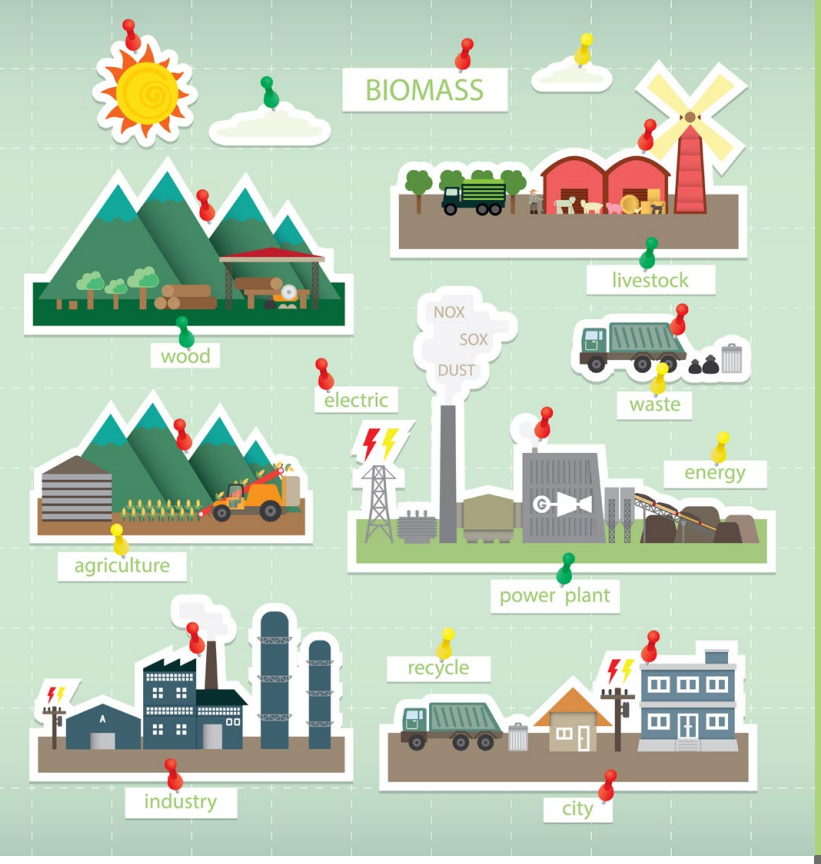

"With KASAG Swiss AG as a partner, you ensure sustainable innovative solutions and remain a step ahead."

Benefits of this outstanding technology

– Aqueous biomass and waste are separated into biogas/methane, nutrients and process water within a few minutes
– The technology is suitable for waste disposal as well as energy recovery
– The method is highly energy-efficient: efficiency levels of 60% or more
– As well as energy recovery in the form of biogas/methane, any nutrients present, such as phosphorus and other elements, can be recovered from the brine and returned to the circular economy

Trials

Would you like to try out this innovative process on your feed (aqueous biomass and aqueous waste)? You can use the Konti-C (1 kg/h) or Hydro Pilot (up to a maximum of 110 kg/h) test plants at the Paul Scherrer Institute (PSI). Just contact us.

Plant concepts for pilot and industrial plants

There are industrial plant concepts for a maximum feed of up to 1000 kg/h. For larger plants, further engineering services will be required beforehand.
Just contact us.

For technical exclusivity worldwide

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