

Heat recovery from warm wastewater

Warm wastewater either discharged or treated in effluent plants, is a by-product of many processes including beverage, food processing, dairies, abattoirs, chemical processing, and pulp and paper industries. Hot wastewater is found in abundance at textile dye houses, laundries and tanneries as a part of their processes. Most of the time, wastewater is sent out to the effluent treatment plant, without recovering the heat due to perhaps low temperatures or particles and fibres it may contain.

Finding the right heat transfer equipment that can handle fibres at the same time provide close approach temperatures for heat recovery is not easy. Fibres require minimum contact points to avoid blockage, and at the same time, heat recovery needs efficient heat transfer. Here the Alfa Laval WideGap plate heat exchangers play a perfect role.

The heat stored in wastewater generated by burning fossil fuels such as natural gas, LPG, fuel oil, or coal. Sometimes, steam may have been used to indirectly heat the water, used in various processes and then discharged from the plant. Throwing away this heat is a loss in plant profitability, time and can have severe environmental effects.

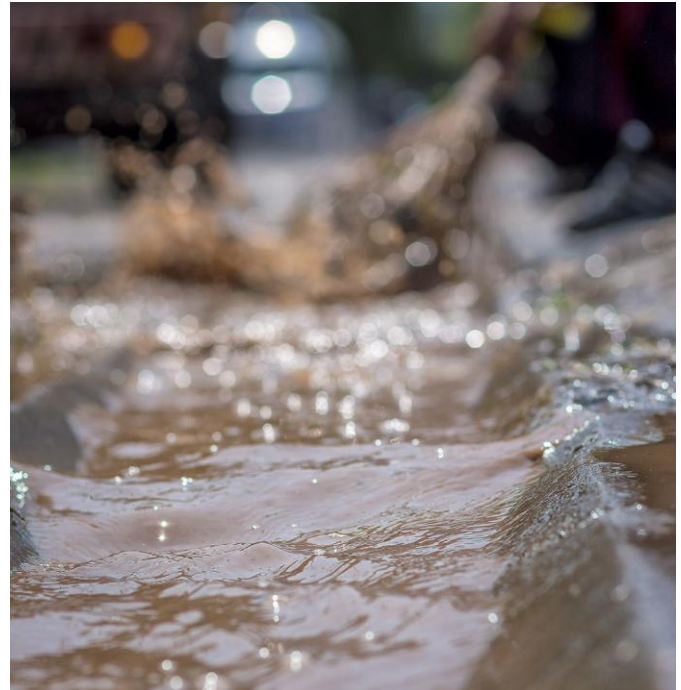
A single degree Celsius in cubic metre (m³) of warm waste water holds 1,000 kCal of heat. Dividing by 860 results in 1.2 kW of energy that should be recovered, saving 2.9 euro per day (1.2 kW x 24 hr x 0.10 euro/h).

Fact: Specific heat of water is 1 kCal/kgK or 4.172 kJ/kgK

Example:

A plant with average wastewater of 20 m³/hr at 50°C can save 51,100 euro per month, by cooling it down to 20°C, preheating incoming cold water at 15°C up to 45°C. This preheated water can be groundwater or ambient mains water, usable for steam or hot water boiler make up. If unused immediately, the preheated water can be saved in a tank for various needs at 45°C.

- Preheating hot water boiler feed
- Preheating steam boiler feed
- Hot water for cleaning
- Hot water for bathing and showers
- Heating of office or production facilities
- Use in production processes
- Supply to district heating network



Warm waste water	20 m ³ /hr	50°C → 20°C
Clean incoming water	20 m ³ /hr	45°C ← 15°C*

* Incoming groundwater or mains water for Europe assumed at 15°C.

Savings in this application is 600,000 kCal/hr or 700 kW:

700 kW x 8,760 hrs per year x 0.10 euro/kWh = 613,200 euro per year.

Even if saving is a total of one month in the year, this equates to 51,100 euro per month!

Daily saving is 1,710 euro per day, 71 euro per hour, every hour.

Energy Hunter – Utilities

Heat recovery equipment

Shell-and-tube heat exchangers for wastewater applications are less prone to blockage but not so ideal for heat recovery, as their approach temperature is limited at best to 10°C due to their non counter-current flow behaviour. Standard plate heat exchangers provide excellent efficiency with up to 1°C approach temperature but can block with fibres. Alfa Laval WideGap gasketed plate heat exchangers fall right in between with ideal efficiency and blockage free operation.

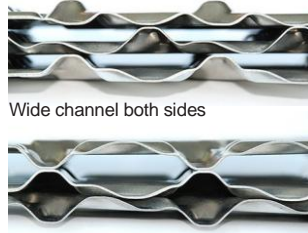
With a channel gap of 11 mm Alfa Laval WideGap plate technology provides a rectangular channel flow path without contact points, for wastewater containing particles, debris, fibres and do not require fine pre-filtration below 5 mm. In other words, anything under 5 mm will pass through the channels without causing blockages.

While the fibrous wastewater flows in the wide channels, Alfa Laval offers technology such that the clean water can flow through narrow channels for maximum turbulence.

The Alfa Laval WideGap gasketed plate heat exchanger can be operated a long time without the need for manual maintenance with periodic back flushing when needed.



Conventional plate heat exchanger

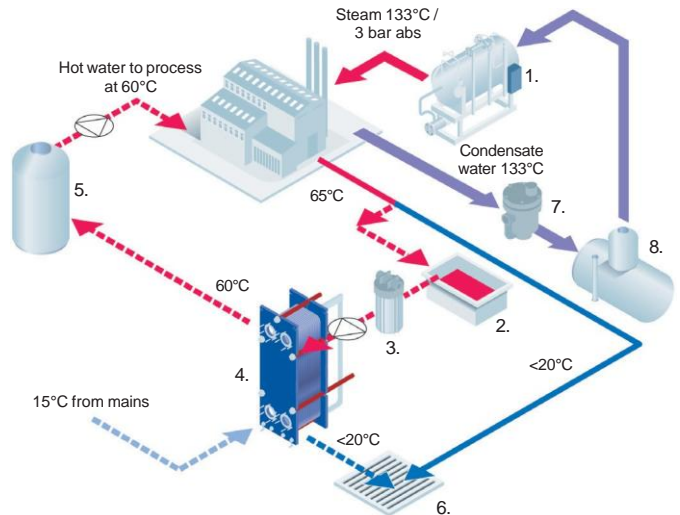


Wide channel both sides

Wastewater wide, clean water narrow channels

Productivity savings

Many processes use steam to generate hot water for process requirements. The time it takes to heat the water to the required temperature is a loss in operational time for plant capacity. By having hot water ready at the desired temperature means faster batch processes and an increase in plant capacity.



1. Steam boiler
2. Collection tank
3. Pre-filter <math>< 5\text{ mm}</math>
4. WideGap plate heat exchanger
5. Hot water storage tank
6. Drain/effluent treatment
7. Steam trap
8. Condensate tank 104°C

Effluent from the plant under 20°C can be separately sent directly to drain without mixing with the valuable hotter water using a two-way solenoid valve giving direction when the effluent temperature is too low for the recovery. The savings are not only in unnecessary cooling the temperature of the effluent but reduce pumping costs of effluent through the plate heat exchanger.

Simple sedimentation filter with 5 mm perforation mesh can be recommended to keep out particles larger than 5 mm to enter the gasketed plate heat exchanger channels.

▼ PRACTICAL TIPS

Back flushing is a handy way of cleaning a gasketed plate heat exchanger without opening the unit. With suitable diameter connections installed on the inlet and outlet of the wastewater to the gasketed plate heat exchanger, manual or automatic back flushing can be done. When to back flush can be followed by monitoring the pressure drop across the gasketed plate heat exchanger.



Port filter is an Alfa Laval original equipment supply shipped with the unit installed at the inlet of the wastewater. The perforations diameter of 5 mm is suitable as anything under 5 mm will enter and leave the widegap gasketed plate heat exchanger.

