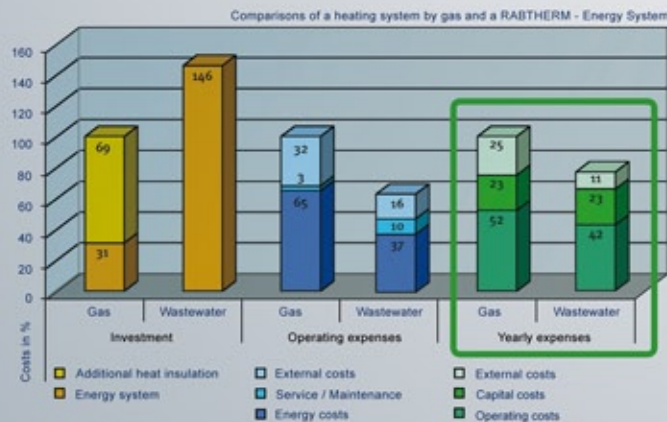


## Costs

The system costs may vary according to sewer and local prevailing circumstances. As an average one can assume 2900 \$ for heating and domestic hot water supply of one apartment. Annual maintenance costs of the heat exchanger are minimal, maintenance of heating system components can reach 2 % of the investment costs.

Contracting is becoming a most attractive form of financing.



## Encouragement / State fundig

Financial encouragement can be reached by the fact that this new technology is environmentally friendly and leads to lower energy costs compared to fossil fuels:

- Project implementation of RABTHERM-systems allows for claiming financial encouragement or funding
- Attractive or encouraged loans (CO<sub>2</sub> -loans)
- Bonus for complying with energy and thermal insulation standards
- CO<sub>2</sub> trading
- Exemption of future environmental protection fees

## Contact



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## Energy from waste water

The regenerative energy source for heating and cooling



- CO<sub>2</sub> -reduction
- renewable
- wide-spread energy source
- sought-after by joint proprietors
- no fine dust



## Basic Idea

The last big "heat leak" in the building envelope can be sealed with the patented system of RABTHERM. Wastewater leaves the buildings with up to 77°F (25°C), and even in strong winters temperatures in the sewers seldom fall below 54-59°F (12-15°C). With heat exchangers integrated in the sewer this heat can be extracted. This type of energy recovery is therefore extremely environmentally friendly.

Depending on the system of electricity generation used to drive the heat pump, output of CO<sub>2</sub> can be reduced by 30 to 85 percent. RABTHERM-systems considerably participate to energy savings and environmental protection. Total heat in sewer lines exceeds the sum of solar, wood and biomass energy potential.

Wastewater is a constant renewable energy source at a high temperature level, which can be exploited at the sites where it originates – with the aid of heat exchangers locally installed in the sewers. RABTHERM heat exchangers can be implemented in existing sewers or can be integrated in new pipe elements.

## Application

Extracting heat from wastewater and increasing the temperature level by use of heat pumps for:

- Heating, drying
- Hot water, process water

Additionally, with the respective design of the heat pump, the energy can be transferred in the opposite direction, using wastewater as a heat sink for:

- Cooling water, air conditioning

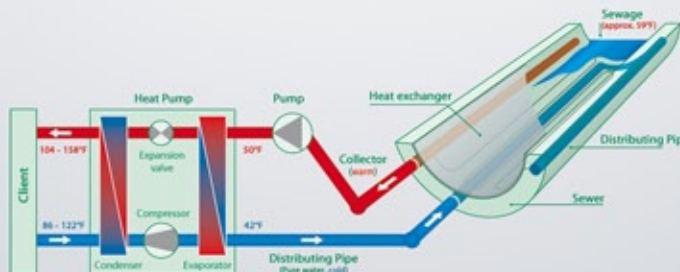
## Market

Buildings with high heating and/or cooling demand, such as:

- Public and administration buildings, schools, sports facilities, swimming pools
- commercial and industrial facilities, shopping malls
- Condominiums

## Product and Technology

The heat exchanger cools down the wastewater by 3.5°F (2°C) (max. 1°F (0.5°C) as a 24 hour average). The energy is transferred with water pipes to the boiler rooms. Here the heat pumps raises the temperature for heating and hot water purposes to max. 150°F (65°C) and eventually feed into district heating systems.



Centerpiece is the heat exchanger in variable shape, designed for maximum heat transfer performance. All components to be installed in the sewer are made of stainless steel and are protected against the detrimental fouling effects by a patented method.

## Customer Value

Compared with conventional energy sources, Rabtherm systems provide advantages such as:

- Independence from foreign, fossil energy sources
- Primary energy cost reduction: 20-30 %
- CO<sub>2</sub> reduction: 30-85 %
- Fine dust: none
- Return on investment: 1 to 6 years

## Basics

Criteria for optimum performance of RABTHERM - Systems:

- Main sewer (min. diameter)
  - installation in existing sewer > 800
  - installation in new sewer > 400
- Wastewater flow (dry weather flow) min. 12 l/s
- Wastewater temperature (winter) min. 47°F (8°C)
- Installed heating power min. 60 kW
- Distance boiler room - sewer max. 200 m

## Performance

Heat extraction capacity of heat exchangers depends on:

- Wastewater flow
- Sewer slope
- Fouling
- Wastewater temperature

Specific heat extraction may vary from 2 to 6 kW per 1 m<sup>2</sup> of heat exchanger surface.

