# How to tap the energy savings in greywater

**By Erwin Schwartz**

Many operators of offices, hospitals, hotels, large condos, and other buildings are aware of the need to save money and reduce their environmental impact, through better water management. The result has been the growth of ways to reduce water consumption, ranging from low-flow showerheads to landscaping that requires minimal watering.

Building operators are also aware of a similar need to reduce energy costs, and here too there has been a growth in development and installation of cost-management measures. Saving energy has its environmental benefits as well, such as reducing greenhouse gas emissions.

However, organizations may be missing out on the opportunities that are literally flowing away from them, through the heat energy available to them through the water they dispose of.

Wastewater (or greywater) may have been heated through hot-water tanks, dishwashers, laundry facilities, industrial processes, or simply from passing through a heated building. The heat in this water is a potentially valuable resource. Rather than being used, however, this heat is wasted as the water is sent into the municipal sewer system.

**New developments in heat-recovery systems**

Several trends are forcing building operators to take a closer look at greywater heat as a resource:

**1.** The need to protect the organization's financial interests from sudden energy cost increases, by using alternative sources of energy - such as heat that would otherwise be wasted.

**2.** The need to manage greenhouse gas emissions, through reduced use of fossil fuels - and the interests of many companies in gaining LEED certification for their buildings.

**3.** Corporate leadership is looking more closely at energy management, partly through applying the international energy management standard ISO 50001.

Improvements in systems that help building operators recover heat from the greywater produced by their buildings, include:

• A smaller physical footprint, with less need for large spaces for changing out tubes after they become fouled.

• Greater reliability, for more trouble-free operation.

• Better information systems that can quantify the savings gained through greywater heat recovery.

For example, consider a relatively small hotel, with 100 rooms, that has its own laundry facility and restaurant. Documented evidence indicates that a well-designed heat recovery system, installed for the hotel's greywater, would save approximately $232,000 over a 15 year period. For a larger building, such as a residential condominium tower, or 300-room hotel, the savings would likely be over $500,000 for the same timeframe. This can be done by having the building's greywater circulated next to incoming cold water before it goes to the central boiler.

Recovery of heat energy in greywater is particularly important in water-intensive industries, such as pulp and paper plants, dairies and breweries. However, heat recovery is also important in sectors that process sludges, including municipal wastewater treatment facilities (WWTFs).

Another reason for increased use of heat recovery exchangers is due to recent energy cost increases and the introduction of pasteurization and anaerobic thermophilic digestion processes, as part of sludge digestion in municipal WWTPs.

Heat exchangers can also be used to support cooling, which would include reducing the load on air conditioning systems, and helping cool computing equipment such as servers. They can be used to recover energy (heating and cooling) from the huge amount of municipal sewage that flows below the street near the building.

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*DDI heat exchanger installed in a narrow hatch in Niagara.*

Many industrial processes also produce sludges that may contain considerable heat, which represents a valuable resource that should not be wasted.

**Three approaches to system design**

There are three main configurations for heat exchange systems:

**1. Tube-in-Tube.** As the name implies, this technology includes one tube inserted inside another, with the hot liquid (or sludge) in the inner tube. Heat gets transferred to the cooler incoming liquid in the outer tube. This design is not very efficient, due to the low heat transfer compared to other technologies. Another disadvantage is that, in some jurisdictions, double-walled tubing is required for the inner tube, to reduce the danger of cross-contamination. The air space between the two walls inhibits heat transfer.

**2. Spiral design.** The hot liquid runs through a series of narrow spirals. This design requires small gaps of perhaps two centimetres for the tubes, limiting the amount of solids and sludges that can be pumped through, to avoid plugging.

**3. Rectangular.** This design uses rectangular channels, placed in direct contact with each other, with hot and cold channels alternating. Because there is no space between the hot and cold channels, this design maximizes the amount of heat transfer. It allows for thick double walls in the channels for the greywater market, minimizing chances that corrosion or erosion will cause leaks that could contaminate one flow with the other.

The rectangular technology provides for a very large gap against plugging, and the controlled width of the channel provides for a fast flow, which prevents baking to the surface. It also allows for easy cleaning, provided there are doors or cleaning ports at both ends of the unit that can open for inspection and maintenance.

*Six heat exchangers in the City of Tulsa, Oklahoma. Two are used as direct-sludge-to-sludge heat recovery; two used as hot water to preheated sludge; two used as cold water cooling the processed hot sludge.*

**Conclusion**

It is important to choose a system that can reliably manage any risk of contaminating the incoming flow with the outgoing flow. In some jurisdictions, this is particularly important if there is a chance that the greywater could inadvertently be mistaken for potable water.

Specify a system that fits into the geographic footprint available. Some systems require an open space that is longer than the pipes in the recovery unit, so that the pipes can be changed if they leak, corrode or become fouled.

Systems should be low-maintenance and, particularly in the case of sludges, designed to avoid plugging (due to small gaps) or baking (due to slow flows) that can reduce efficiencies and require shutdown until repairs can be made.

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