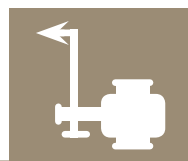


Heat pumps: Reducing energy costs in hotels



Heat pumps... reducing electricity consumption and lower operating costs in hotels



In an economic environment where reducing electricity consumption and lower operating costs are crucial priorities, the use of energy-efficient technologies is becoming critical.

This also applies to all the sectors of the economy, including the hospitality industry, where the supply of hot water represents one of the biggest end uses of electricity. It is estimated that the amount of sanitary hot water used by each hotel guest per day ranges from 90 to 160 litres. Peak demand can be as high as 45 litres per guest.

Hot water demand in a hotel depends on a variety of factors, including:

- Number of rooms
- The occupancy rate
- The range of amenities
- The star rating of the hotel.

Hotels account for 7% of the distribution of sanitary hot water in the commercial sector in South Africa.

In addition to guest rooms, it is also necessary to provide hot water for restaurants, kitchens, laundries and swimming pools. It is critical to ensure that a hotel has hot water available whenever it is needed. It is, however, important to cater for peak demand of hot water - the maximum consumption that can occur during a specific period of time due to usage in all rooms together. Depending on the type of hotel, this could be during in the morning or evening.

Auxiliary services such as kitchens and laundries normally have a steady demand - scheduling laundry operation to off-peak periods can reduce pressure during peak periods

The peak demand of 45 litres per guest could increase based on the status of the hotel and the amenities provided.





Heat pumps are an ideal choice for the provision of hot water in hotels since they are flexible and can be scaled up to meet varying needs as well as expansion plans.

The costs incurred in replacing existing energy-intensive systems - such as geysers and in-line elements called calorifiers - can be broken up into the initial capital investment and the daily operating costs.

Factors that impact system size and costs, include:

- The average ambient air and municipal water temperature in your area
- The humidity levels in your region
- The plumbing configuration of the hotel
- The temperature at which water is delivered to your guests
- Importantly, capability to meet peak hot water demand - system sizing is critical to ensure guest satisfaction.

Usually, storage capacities are built to cater for 75% of the hot water needs and a heating system that can produce hot water for the remaining period of peak demand. Once peak demand has been met, the system can fill up the storage tank to get ready to cater to the next peak.

There should always be a balance between the recovery rate of a heat pump and storage capacity. A higher recovery rate means quicker regeneration and smaller storage needs.

Heat pumps can save up to 67% of energy consumption. How does this energy-efficient technology work?

Heat pumps use the reverse cycle of a refrigeration plant to heat water. In effect, it transfers heat from a source such as water or air to the water to be heated. (In general, it is the very large commercial units that use water as a heat source). This fact sheet, however, focuses on air sourced units.

As in other refrigeration equipment, heat pumps employ:

- An evaporator
- A compressor
- A condenser
- Refrigerant gas
- An expansion valve within a closed circuit.

Heat pumps in commercial settings - such as hotels - are typically mounted at ground level.

Latent heat is given off when the refrigerant gas is liquefied through the condenser and transferred to the surrounding water together with further sensible heat loss, effectively raising the temperature of the water to 65°C. In some circumstances even higher temperatures can be attained. Generally there is no need for a hot water booster pump to achieve this result.

It may seem strange that an electro-mechanical device with moving parts - an electric motor driving a compressor - can be a more energy-efficient method of heating water than a typical resistance element geyser. In fact, a heat pump can be up to three times more efficient - for every kWh of electricity supplied to the heat pump, more than three kWh of thermal energy in the form of hot water is produced. A thermostat will keep the hot water at a constant temperature between 55 and 65°C with 60°C being the most commonly used setting.

The many other benefits of heat pumps

Apart from being energy-efficient and reducing energy costs, these include:

- Using the cooling system of a heat pump, which can be utilised and simultaneously cools a building, or a specific area of a building. This is especially useful in hotels where cool air can be channeled to guest rooms, kitchens, conference areas and foyers, thereby reducing electricity use and saving on costs of separate stand-alone air conditioning system. By effective planning and using both the hot and cold sides of an installation and capital, amortisation can occur over a short period.
- Reducing your hotel's maintenance costs.
- Reducing your hotel's carbon footprint because no combustible gas is burnt during the heating process.
- Ensuring a longer lifespan for the boiler tank due to a lack of chemical interaction between the element, and other metals such as copper used in the plumbing process.
- Reducing the risk of burns in hotel showers because water heated in a heat pump seldom exceeds 65°C.
- Although initial equipment and installation costs are higher than those of gas or electric element geyser systems, these are offset by lower operating costs. In South Africa, a typical payback period on a commercial system would be three to five years at current electricity costs - as electricity costs increase this time frame will become shorter.
- Systems can vary in size from small to very large commercial applications with heating and storage capacities for thousands of litres of water.
- Although bulkier than traditional boilers, heat pumps can usually be accommodated in existing spaces and do not always require additional buildings to house them.
- Establishments in the hospitality industry that depend on standby generators can use heat pumps during power outages to produce hot water as they are more efficient than directly heating water with gas.

Heat pumps are internationally recognised as eco-friendly, contributing to a lowering of greenhouse gas emissions by between 200 and 400%.

Which electricity source is required for installations?

The majority of large commercial heat pumps use three-phase electricity supply.

Do heat pumps need servicing?

Yes.

Talk to your technology supplier about your heat pump's maintenance requirements.

Are heat pumps noisy?

This depends on the size and design of your system. The compressor and air being blown through the evaporator radiator produced as it flows through the unit are sources of noise.

Air noise is marginally higher than ambient background noise and is usually not distracting, especially as heat pumps will be located far away from your guest rooms. In very large systems the noise level could cause a distraction and, therefore, need to be housed appropriately.

Case study

One of the world's most iconic hotels, the Belmond Mount Nelson in Cape Town, replaced an outdated, 30-year-old, 2,000 litre 'resistive' geyser in the Oasis Wing of the hotel with a modular heat pump.

"The old geyser was not in a good condition because the elements were faulty. The biggest problem, however, was the huge amount of electricity it consumed. The geyser in a residential home is 3kW; ours was 96kW and it switched on and off when it felt like it. In other words, when a guest turned on a tap and closed it, the geyser switched on and off," explains Rob Fiander, Chief Engineer at the hotel.

"We chose a modular system because I am able to take part of the system out in the low season when we don't have to run all 30 rooms in the Oasis Wing. With a modular system, I can decrease or increase the hotel's water heating requirements; I can run 20 rooms or 10," said Fiander.

The heat pump retrofit in the Oasis Wing achieves an energy-saving of 5 to 6% per month.

“Like every business in South Africa, we went through pretty rough times. With the price of electricity going up to an unrealistic value, as everywhere else in the world, we made a decision to find ways to reduce operating costs. Electricity, gas, services and utilities come off the bottom line and we didn't want to get rid of our excellent staff; we pay them well to provide a good service to our guests, so we had to find other ways to save,” explained Fiander.

Late in 2014 the Belmond Mount Nelson commissioned a “thermo cube” to be installed in the hotel's Taunton Wing, which is a one cubic meter insulated tank of water heated by a heat pump. Spiralled inside the tank are two large surface stainless steel pipes to assist with heat transfer.

“The great advantage of this is the elimination or reduction of Legionella; as the chlorinated cold water enters, it heats within minutes and is delivered to the faucet. Two 1,000 litre resistive boilers were decommissioned, leaving one installed for volume. The resistive, energy-intensive elements have been shut down; a saving of R3,000 to R7,000 per month is possible in our summer months,” commented Fiander.

Eskom Energy Advisors are on standby to assist you:

Eskom's national Advisory Service offers information on manufacturers and suppliers of energy-efficient electro-technologies such as VSDs. The team can also advise businesses on:

- Reducing energy usage
- Doing walk-through energy assessments to identify energy usage patterns, energy needs, areas of energy wastage and energy-saving opportunities
- Improving the energy efficiency of operations and electrical systems and processes
- Prioritising maintenance as an important contributor to reducing energy usage
- Finding SANAS approved energy savings Measurement & Verification Authorities.

Advisors can also provide information on funding opportunities for energy efficiency projects.

Call 08600 37566, leave your name and number and an Eskom Energy Advisor will contact you, alternatively, ask for a specific advisor to contact you.

Visit www.eskom.co.za/idm for more information.

Credits:

- Belmond Mount Nelson Hotel, Cape Town
- Fact sheet: Consistent hot water supply in hotels (www.klimatech.in)
- www.engineeringtoolbox.com
- Brochure: Effective water heating: using heat pumps for households, commerce and industry (Eskom, November 2009)