

## Hot water systems



### Case Study

Application:	Hot water system consisting of an electrically heated unvented water storage cylinder feeding 15 separate hot water outlets over a 200m <sup>2</sup> area, with an existing secondary circulation pump rated at 50W.
Intervention:	High efficiency secondary circulation pump with night set-back functionality.
Installation cost:	£350
Simple payback period:	0.4 years

### Annual Savings

Electricity:	5,471kWh
Cost:	£836
Carbon:	1.6tCO <sub>2</sub> e

## HOT WATER SYSTEMS

Hot water is used in commercial buildings for a variety of applications. The most common ones are handwashing, showering and catering. Provision of hot water is a necessity for all business premises, however upgrades to the system are often overlooked. There are several different ways of producing hot water as outlined below:



## SMALL SYSTEMS

The simplest hot water system is an instantaneous electric water heater close to the point of use. This works fine for occasional use for handwashing but the flow rate is quite limited so it's often more practical to install a type that has a small integrated storage vessel. Modern units are well insulated and can be ideal when there's a need for a good water flow. They can usually serve a few hot tap outlets and so are often described as multipoint units.

Another common way to supply hot water to a few local tap outlets is to use a gas fired multipoint water heater or a gas combination boiler. Unlike good quality commercial grade gas fired multipoint water heaters, combination boilers tend not to be particularly efficient at delivering hot water but they can still be quite cost effective to operate because of the low price of gas.



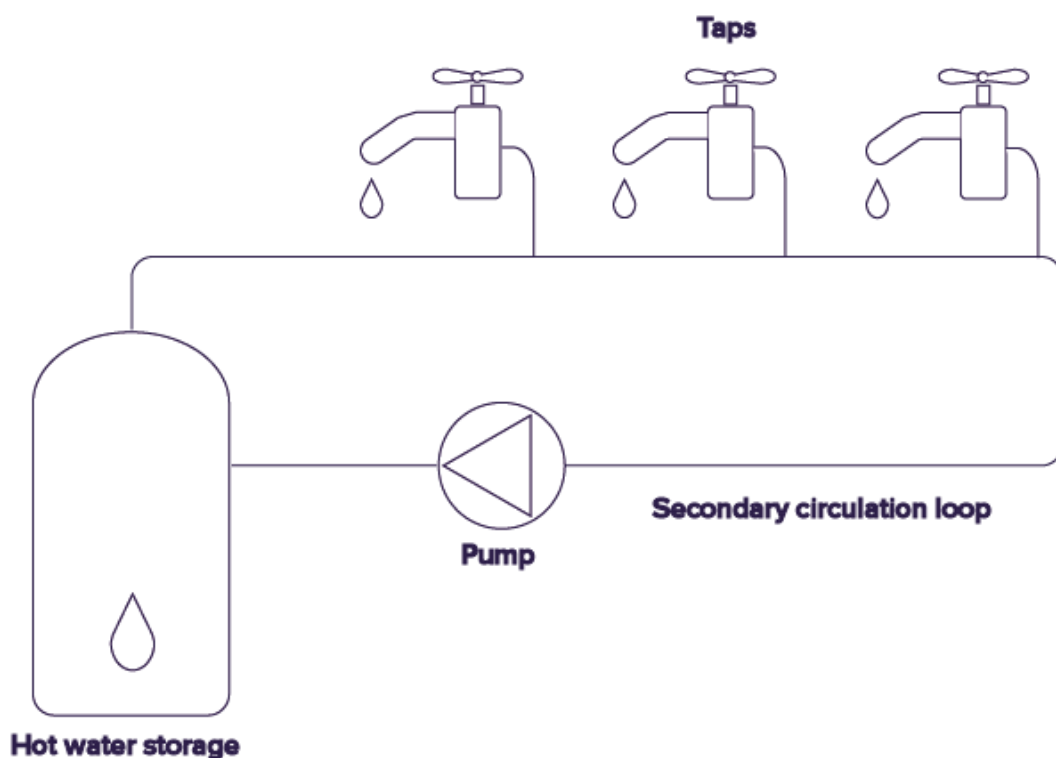
Electric multipoint water heater with integrated storage

## LARGER SYSTEMS

In buildings where there is a higher demand for hot water, it is common to find a centralised hot water storage cylinder in a plant room. Often referred to as calorifiers, these sometimes have an indirect heating coil in them which is supplied with heat from a commercial boiler, but some calorifiers are directly fired by a gas burner.

## SECONDARY CIRCULATION

Where stored hot water needs to be distributed to tap outlets that are some distance away, a circulation system is sometimes needed so that hot water reaches the tap outlets quickly. With a secondary circulation arrangement, hot water from the top of the storage cylinder is circulated through a pipework loop that runs past all of the hot taps and returns back to the cylinder. The hot taps then are tee'd into the circulation loop as shown in the diagram:





This method of hot water distribution ensures that hot water reaches the tap outlet very quickly but it can also be extremely wasteful of energy. Heat is continuously lost from the hot water storage cylinder and the circulation pipework even if it is well lagged. Furthermore, the extra pump that is required consumes electrical power. If the hot water is only being used for hand washing, a system like this may be unnecessary, and good savings can be made by using instantaneous water heaters at the point of use instead. Another simple way to save energy in this setup is to add a time-switch to the pump so that it only runs during the hours that the building is occupied. As an alternative, high efficiency secondary circulation pumps with integrated variable speed drives and night set-back functionality can be installed.



Secondary circulation system pump



High efficiency circulator



Electronic time switch

## OTHER ENERGY SAVING OPTIONS

Taps that are left running accidentally waste huge amounts of water and energy. A very effective upgrade is to fit self-closing taps or sensor taps which automatically turn off. Low flow taps are also available and can save considerable amounts of water and energy.



Self-closing tap



Sensor tap

## SOLAR THERMAL SYSTEMS

If your business uses a lot of hot water it may be worth considering a solar thermal hot water system. There are several different kinds of solar thermal system suitable for commercial premises. They use flat plate or evacuated-tube solar collectors to convert the infrared energy in sunlight to heat a fluid which is circulated from the collectors through a heat exchanger, often a finned coil inside a hot water storage cylinder. They're very efficient but need a backup heater for the winter months and have to be regularly maintained. Decerna can provide expert advice about solar thermal systems.

### EVACUATED TUBE COLLECTORS

The collector absorber plates are contained within vacuum insulated glass tubes. Heat losses are minimised through the use of vacuum insulation but these collectors are less robust than the flat plate type.



### FLAT PLATE COLLECTORS

These can be mounted on A-frames on a flat roof or integrated into a pitched roof. The absorber plate is under a glass cover and has a special coating to improve the absorption of solar energy.



## HEAT PUMPS

Heat pumps are normally associated with space heating but they can also be used as an alternative way of producing hot water. The capital costs are relatively high but if large volumes of hot water are required they can be a good option. Ground source or air to water heat pumps with a storage cylinder extract heat from the ground or air and pump it via a heat exchanger into the hot water system.

This process is very efficient compared with direct electrical heating but the temperature of the water from heat pumps is usually a little too low for sanitary hot water production and electric immersion heaters are normally required to bring the water up to a safe and hygienic temperature. See either of our factsheets on heat pumps for further details.

## HEAT RECOVERY

Some industrial equipment and processes generate large quantities of waste heat. There are various options for recovering some of this heat and it is quite common to use it to pre-heat hot water systems. Our heat recovery factsheet gives further details.

## SAFETY AND MAINTENANCE

All hot water systems need regular maintenance to ensure they operate safely and efficiently. Minor leaks or dripping overflows should be investigated immediately because they could quickly become worse or lead to a failure of the system.

Any thermostatic blending valves that are installed to prevent scalding need to be properly maintained to ensure the ongoing safety of the installation.

In systems where water is stored at temperatures between 20-45°C, there is a risk of harbouring or proliferating Legionella bacteria. Hot water systems should be set up to provide sanitary hot water at 55°C or more to avoid this possibility. However, it is imperative that a suitably qualified and experienced engineer is appointed to design modifications to hot water systems and that a competent contractor is commissioned to carry out the alterations. It is also important to ensure that documentation and plant maintenance procedures are updated after the installation takes place. The Health and Safety Executive gives detailed guidance on the control of Legionella bacteria in Approved Code of Practice L8.

## SCALE

Some areas have hard water which can cause heat exchangers to scale up and become inefficient. It may be necessary to consider some form of water conditioning such as a softener to avoid this.

## CONCLUSIONS

There are many different types of hot water system used in commercial buildings and there are several ways to save energy from simple changes like swapping regular taps to self-closing taps through to complete system redesign or the introduction of renewable energy.

## ABOUT US

Decerna provides a wide range of consultancy and development services, to ensure that the right decisions are made, to support our customers in the whole journey, from initial concept through to implementation of low carbon systems and infrastructure. Please get in touch to find out how we can help your organisation to de-carbonise.

[www.decerna.co.uk](http://www.decerna.co.uk)

[info@decerna.co.uk](mailto:info@decerna.co.uk)

+44 (0)1670 613 270

Disclaimer: The information in this document is provided in good faith, and every effort has been made to ensure that it is accurate at the time of publication. However, Decerna gives no warranty as to the accuracy or completeness of the information contained in this document, and disclaims any liability for any inaccuracy or omission.

January 2023