hot water association
DEVELOPING HOT WATER

No Place Like Home

Cylinder Batteries - Tapping into the Potential of Hot Water Storage

Policy

Currently, there are a number of gaps in government policy, which negatively affect the UK's hot water storage infrastructure. Much of the focus is on the heat source such as boilers and heat pumps. However, there is little to no focus on hot water cylinders, and recognition for the vital part they play in the efficient operation of low carbon heating. There is also, currently untapped potential for them to act as domestic batteries.

The Hot Water Association (HWA) through their work, have identified a number of short-term and longer-term policy proposals.

Background

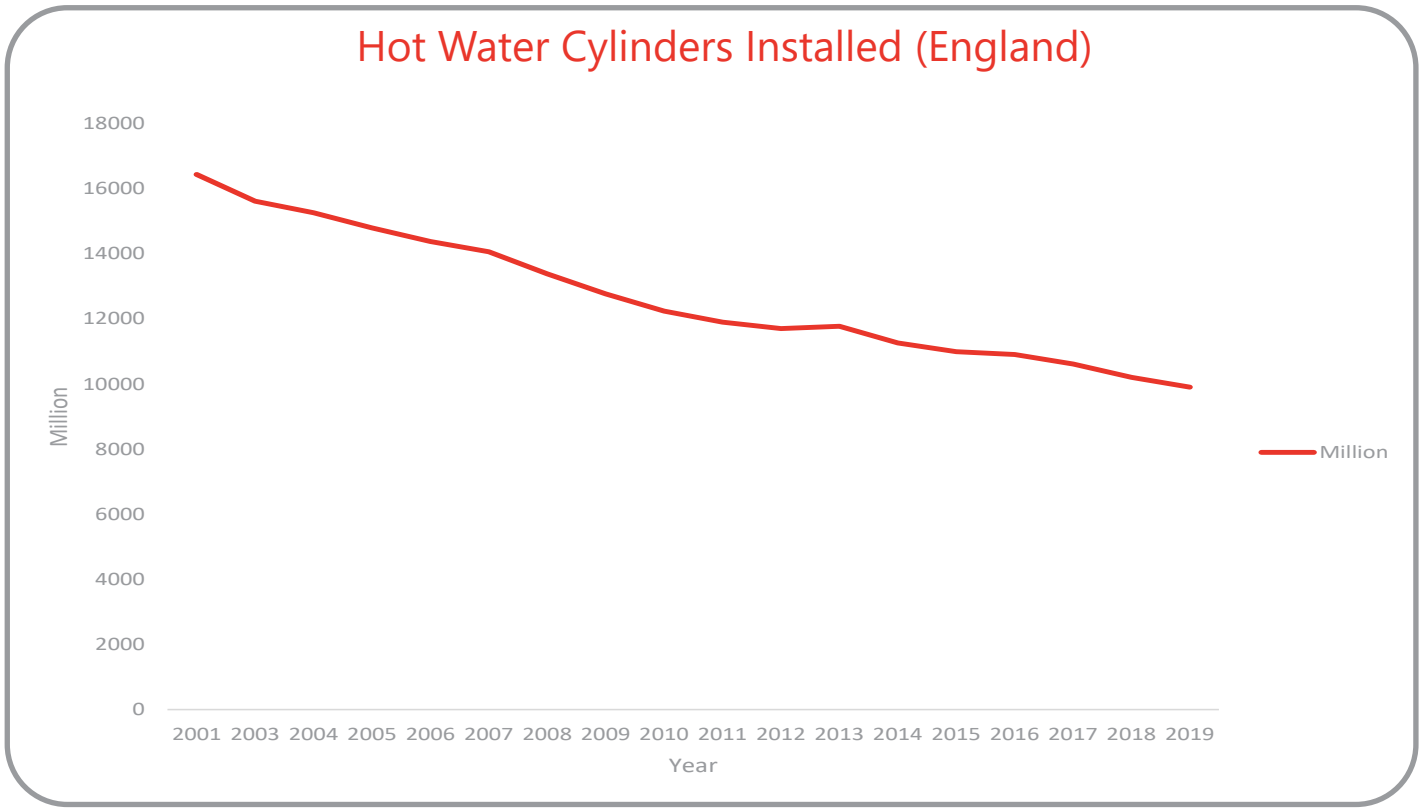
The UK has ambitious plans to reduce carbon emissions by 78% by 2035 and 100% by 2050, Net Zero.

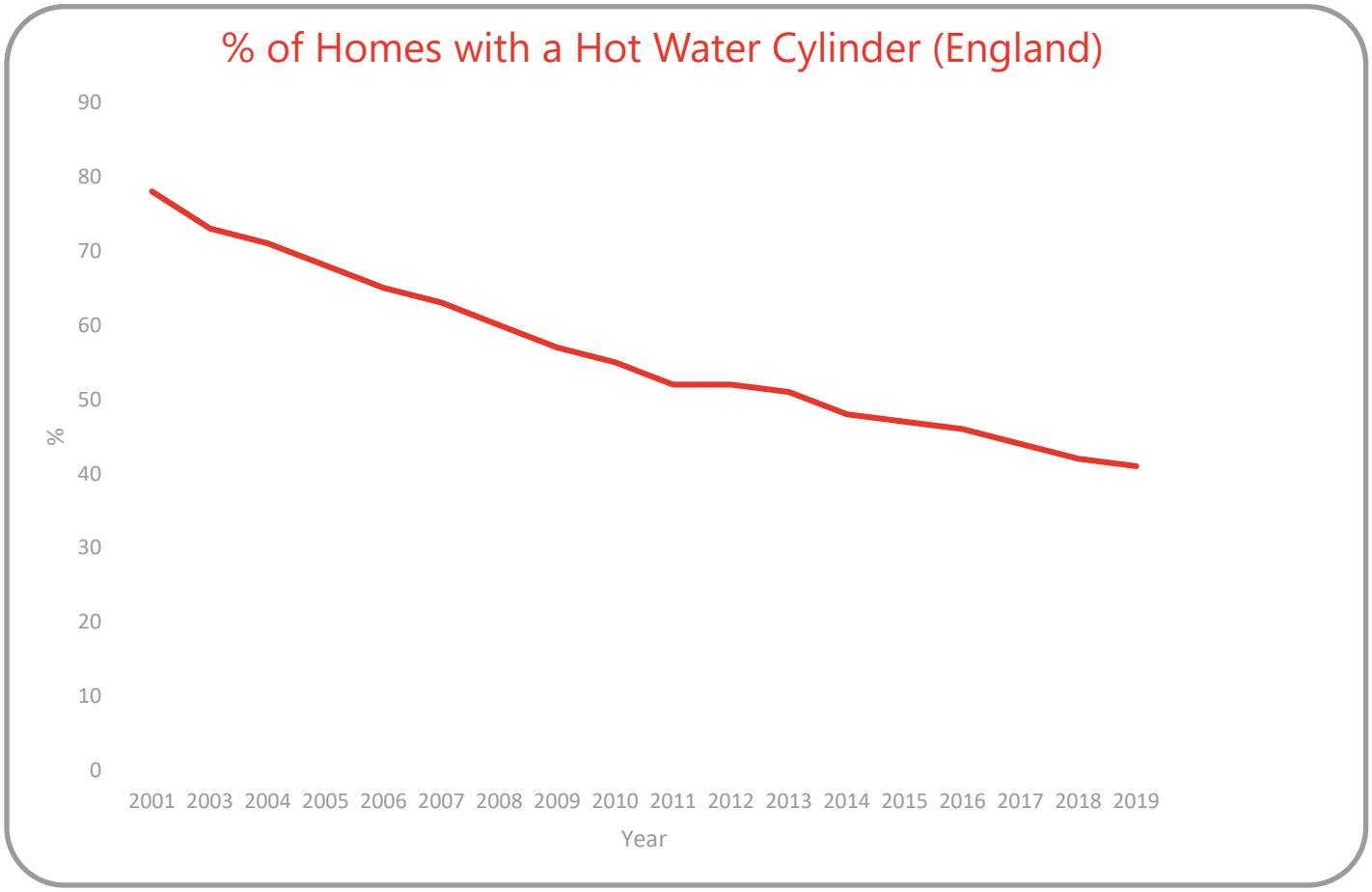
In order to do this, all UK homes will need low to zero carbon heating in addition to other improvements, such as insulation. Most currently available low carbon heating solutions require a hot water cylinder.

There are currently approximately 9 million hot water cylinders installed, in homes across England.

The Heating and Hotwater Industry Council's Heating Systems White Paper has explored the technical issues around the impact of this on the decarbonisation of heating. It is clear that homeowners are not replacing or installing these measures at the speed required to meet our decarbonisation targets. For this reason, we believe that the UK Governments need to step in and help homeowners with the cost of installing the measures required to decarbonise heating. This will also mean that in the future the cost of moving to new heating systems will be reduced.

Market


Hot Water Cylinders Installed (England)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Million
2001 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Year
Million


% of Homes with a Hot Water Cylinder (England)
90
80
70
60
50
40
30
20
10
0
%
2001 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Year

Less than 45% of homes in England currently have a hot water cylinder installed, down from 77% in 2001.

The main reason for this is the popularity of the combination boiler. Of the approximately 1.6 million boilers installed every year, around 80% are combination boilers. The combination system does not require a hot water store as they produce the hot water instantaneously.

Household hot water needs vary greatly. The more people in the property, the greater the demand for hot water from multiple outlets simultaneously. Storage, particularly mains pressure storage, overcomes multi outlet demand because the water is already heated and ready to go. Something that most Combi boilers cannot generally do.

Homeowners with demand for simultaneous multiple outlet use have come to realise that they are not suitable for every installation.

In addition to meeting multi outlet demand, storage systems are essential partners to any renewable energy input as these sources need to be harvested and stored. Hot water storage is the only practical solution to turning the energy into something useful and banking it for when it needs to be used.

As other forms of home heating, such as heat pumps, rise in popularity, the need for hot water cylinders increases. As these systems will require a hot water store.

The challenge then is around space. Where a hot water store has been removed the space is often repurposed for additional storage or bathrooms, and therefore re-introducing a hot water store can prove challenging.

HWA believes that homeowners with a hot water cylinder should be educated on its full potential and encouraged to retain it in order to future proof their heating system.

There are solutions to this issue, such as more compact stores, alternative means of storing the energy for hot water such as phase change material stores that require less space, and solutions that allow cylinders to be installed in lofts and garages.

Additional Benefits

There is much excitement around the role that energy storage technologies can play to help accommodate more renewable energy sources into the UK's generation infrastructure, however, relatively little attention has been paid to hot water cylinders which are currently installed in over 9 million homes across England.

A standard 150 litre hot cylinder tank can hold approximately 7kWh of energy with a range of anywhere between 90 litres (4.2kWh) and 300 litres (14kWh). This is comparable to the storage capacity of a home battery system from brands such as Tesla, Sonnen, Powervault, and Moixa. The UK potentially has 70GWh of untapped energy storage (around 7 times the capacity of the UK's largest pumped hydro facility, Dinorwig in Wales[1]).

1 Dinorwig is a pumped hydro-electric station with a capacity of 9.8GWh. It took 10 years to build from 1974 to 1984 at a cost of £1.8bn in today's money

The energy storage potential associated with the UK's installed capacity of domestic hot water cylinders is comparable to our entire fleet of pumped-hydro-electric storage and with just a fraction of this resource, it would be possible to absorb the largest surpluses of renewable power that arise from offshore wind and solar PV.

Currently, there are large fluctuations in the price of electricity on the UK's balancing market, which has been set up to ensure that power generation and demand are always matched. This price volatility is leading to innovation in the retail electricity market where flexible tariff products have emerged, a notable example being the Octopus Agile tariff. There are frequent instances where the cost of domestic electricity is negative to incentivise customers to utilize energy at these times, to help absorb surpluses of wind generation that arise.

In response to these market dynamics, several companies have launched products and hot water stores which operate with conventional gas boilers, whilst at the same time make use of low carbon electricity whenever there is an over-supply of wind or solar generation relative to demand.

Connected hot water cylinders, can also deliver a similar service to the grid, to that of home battery storage systems. Not only this, it can be delivered with a considerably lower environmental footprint. For example, a home battery consists of upwards of 100kg of materials such as Cobalt, and Lithium, which all come with a hefty environmental footprint. In comparison, a modern hot water tank weighs around 30kg and is made from recyclable materials such as copper and stainless steel.

Hot water cylinders also come at a lower cost to the end consumer. A hot water tank can be installed to provide grid services for around £200/unit. When you compare this to a home battery storage system, which currently costs upwards of £3k without installation, the savings are significant.

The Climate Change Committee has identified that load shifting through behavioural change will be a key part of our transition to Net Zero. In particular, 'pre-heating' as opposed to 'peak-heating' is essential and for this, we need to encourage the uptake of flexible energy storage through domestic hot water tanks and smart controls.

From a consumer's perspective, replacing an old hot water cylinder with a modern, well-insulated cylinder with smart controls provides an opportunity to use low cost or even negatively priced electricity alongside their existing heating system.

Technology

SMART Immersion Heater

Using a smart thermostat allows homeowners to control their Immersion Heater to suit their lifestyle. There are models available with a built-in learning function, which prepares hot water based upon historical usage.

In addition, there are smart thermostats with built-in programmers, that allow the user to set time and temperature requirements throughout the day, similar to a heating thermostat, these features will also allow the homeowner to heat water to a higher temperature at off peak times relieving demand on the grid and utilising energy at its most cost-effective time. Smart controls with an open API allow the homeowner to control their device from multiple sources and even offer the possibility to link to Demand Style Response from their energy supplier. These devices are an affordable retrofit solution that can be retrofitted to most existing cylinders.

Smart Tariff Management

Cylinder manufacturers are working with energy companies to link their systems. In practice, this means creating a protocol that results in the hot water cylinder being heated when tariffs are at their cheapest.

This has the potential to halve running costs for homeowners, in certain situations. Using this technology with a thermal store can also allow for this technology to provide affordable space heating solutions as well.

Tariff management would happen automatically via an app so the homeowner would automatically get the lowest cost. This can also be applied to the wider energy grid management system.

Smart Hot Water Tanks

New technology is constantly emerging, there are cylinders on sale today that use thermal stratification on charge (direct and indirect) and discharge (direct, indirect, and heat pump). A stratified cylinder is a fast, energy-efficient, and economical way to provide hot water. In this cylinder, the stratification of the warm water takes place at different heights according to its temperature. The water at the top of the cylinder has the highest temperature.

This reduction in heat loss, improves available renewable capacity and allows for the exploitation of smart tariffs. This could, in the future, allow the grid to take advantage of the excess unused capacity for balancing activity or for the homeowner to take advantage of when time of use tariffs are low or indeed negative. This technology is also compatible with Solar PV to help save energy when the sun shines for use later in the day.

Smart Hot Water Thermostats

Some modern hot water thermostats can be enabled for intelligent heating using low grid carbon/cost with agile tariffs.

For example, they can be set to activate when the energy price is below a certain price per kWh then increase the temperature of the home to take advantage of low prices. These can be retrofitted onto existing hot water systems therefore enabling practically any system to connect to the energy grid. They also operate for both electricity and gas.

Policy Proposal

We believe that homeowners, local authorities, and social landlords should be encouraged to improve their hot water systems to enable them to support the UK's decarbonsation targets.

Incentives

Homeowners should be able to access incentives if they wish to replace their hot water cylinder and there should be no stipulation on the type of system to be installed only that it is a suitable replacement.

To encourage homeowners to replace their hot water store with a modern, high efficiency cylinder, we believe that Government needs to provide a financial incentive. Ideally, this should cover the full cost for the unit and installation. Typically costs for installing a new hot water cylinder are £900 for the unit and £500 for installation.

These costs are well below the £5,000 cap for vouchers that were provided by the Green Homes Grant. The added benefit is that if installed now then the cost of installing a low carbon heating appliance like a heat pump will be subsequently reduced proportionally. This will remove a significant barrier to their installation.

This is current practice for insulation measures and heating appliances. ECO provides financial assistance for homes needing new boilers and insulation. The Clean Heat Grant will do so for heat pumps and other renewable heating appliances.

However, we believe the focus needs to be expanded to cover hot water storage. If we do not invest in improving these then it will become more expensive to upgrade homes to become ready for Net Zero. We also will not be able to take advantage of the grid balancing potential of millions of hot water stores.

As there is not currently an incentive scheme for energy efficiency measures since the closure of the Green Homes Grant, we would propose working with Government to understand the potential of a new scheme and what role hot water cylinders and radiators could play within it.

The Hot Water Association (HWA) is a member organisation committed to effectively promoting the concept and use of stored hot water in domestic and commercial circumstances in the United Kingdom and Republic of Ireland. HWA's membership accounts for nearly 100% of hot water storage devices sold in the UK.

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