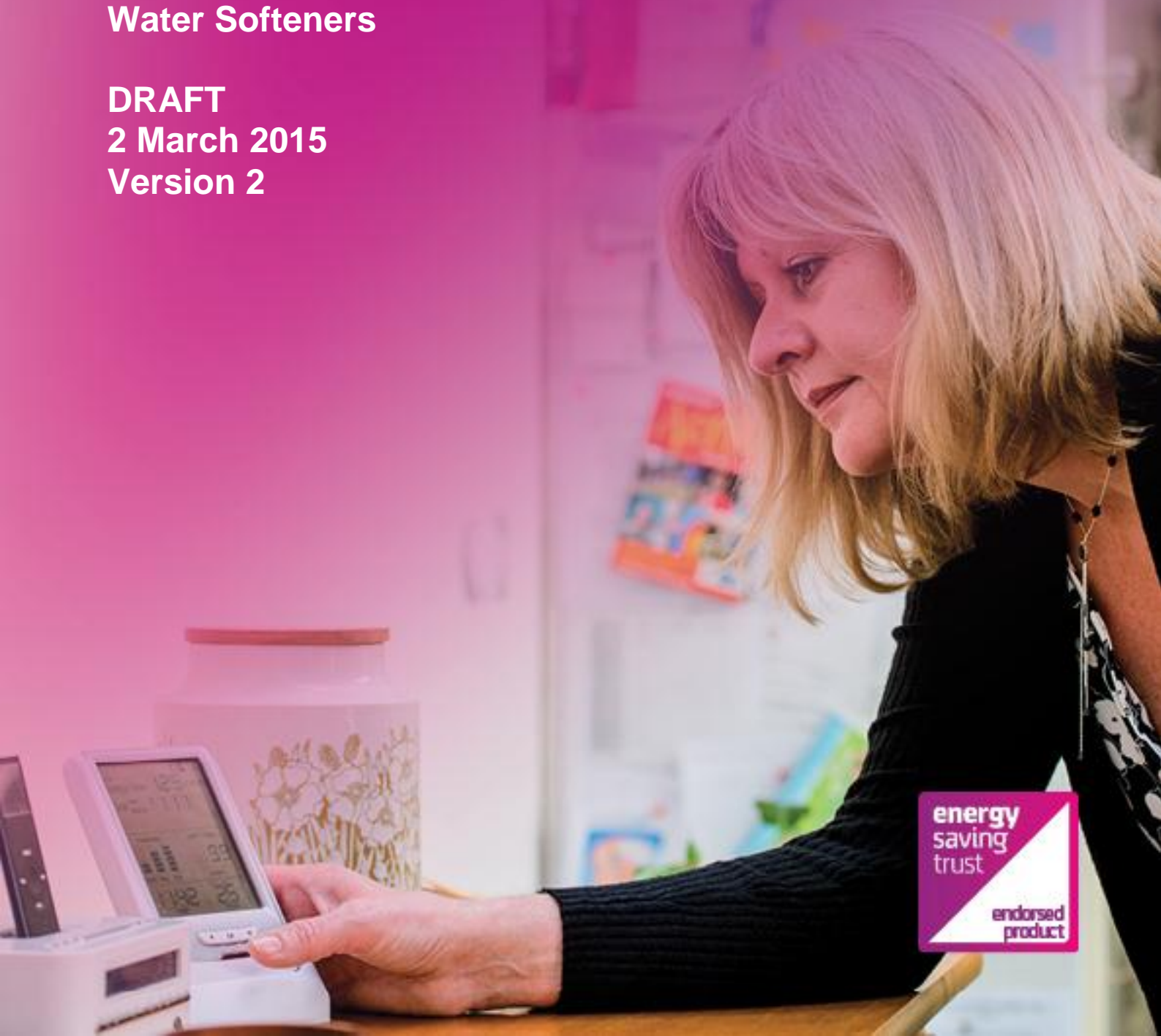


product performance standard

Water Softeners

DRAFT
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Introduction

It is estimated that around 60% of UK homes are supplied with hard water (considered to contain over 200 mg/l as calcium carbonate, CaCO₃). In hard water areas, precipitation of hardness salts as limescale is seen to occur. As limescale has insulating properties, when it is deposited on heating system components such as the boiler's heat exchanger, this can lead to reduced efficiency and higher energy and maintenance costs. Water softeners are devices that maintain a supply of water with reduced levels of calcium ions.

Most domestic water softeners work using an ion-exchange process. Hard water is abundant in calcium ions (and to a much lesser extent magnesium ions). When hard water passes through a softener unit, it comes into contact with a resin, made from microscopic polymer beads with active sites that ions bond to. This resin is rinsed in brine to deposit sodium ions; when it comes into contact with hard water the sodium ions exchange with the calcium ions, trapping them on the resin and preventing CaCO₃ from precipitating as limescale. The resin is periodically refreshed with sodium ions when it has trapped all the hardness minerals that it is able to, taking calcium ions away to waste.

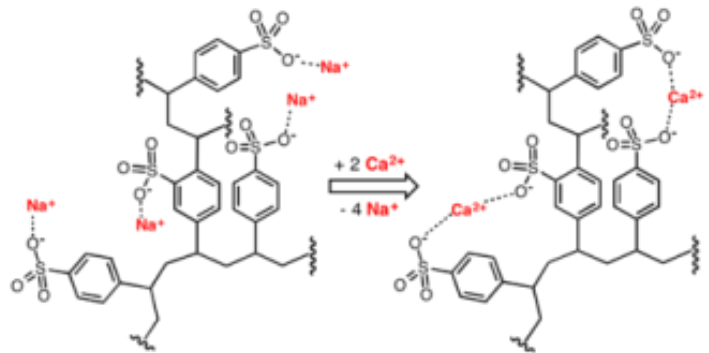


Figure 1 - Idealised image of water softening process, involving replacement of calcium ions in water with sodium ions donated by a cation exchange resin -

Two main types of water softeners exist – single cylinder and twin cylinder. Twin cylinder models are able to maintain a separate supply of softened water while regeneration is taking place, maintaining flow rates and recharging the resin more efficiently.

Energy Saving Trust (EST) calculated in 2014 that in a very hard water area (over 300mg/l as CaCO₃), using a water softening device could reduce maintenance and water heating costs by up to £50 per year, or £580 over the lifetime of a boiler.



Figure 1 - ion-exchange resin beads

In the broader area of water treatment, EST has previously developed a product standard for Chemical Inhibitors. Water Softeners will be the second water treatment product category to have performance criteria established for endorsement.

The following organisations have provided their input into the development of this standard:

- [UKWTA](#)
- [British Standards Institute](#)

In addition the following key stakeholders will be kept up to date on the development and implementation of the standard:

- [BEAMA](#): ‘the independent expert knowledge base and forum for the electrotechnical industry for the UK and across Europe’
- [British Water](#): ‘trade association for the water industry supply chain, representing the industry collectively to government, regulators, other institutions, customers and the media.’
- [BuildCert](#): The product certification arm of the WRc-NSF, a joint venture between NSF Limited and the Water Research Council (WRc)
- [Department for Environment Food and Rural Affairs](#) (DEFRA)
- [Department of Energy and Climate Change](#) (DECC)
- [Heating & Hot Water Industry Council](#) (HHIC)
- [Water UK](#): representing presents all major UK water and wastewater service suppliers
- [The National House Building Council \(NHBC\)](#) – standard-setting body and provider of warranty and insurance for new homes, working with the house-building industry to raise the standards of new homes and to provide consumer protection for homebuyers.
- [Federation of Master Builders \(FMB\)](#) – independent trade association in the building industry
- Boiler and other water heating application manufacturers

All references to water softener products for the purpose of endorsement by EST in this document refer specifically to ion-exchange water softeners.

Consumers

The area of water treatment bridges both the heating and water industries, but water softeners have been minimally promoted to consumers beyond the efforts of the industry. Information on softening water does go back several years; the UK Ministry of Health published a study on health benefits in 1949 and Sutton and East Surrey water have a long history of softening the supply for public use. In general, the focus has been on softeners’ ability to maintain a water supply providing greater comfort to the user and better performance of appliances, taps and showers, rather than energy savings from maintaining optimal efficiency of the boiler and central heating system.

However, EST calculated in 2014 that in a very hard water area (over 300mg/l as CaCO₃), using a water softening device could reduce maintenance and water heating costs by up to £50 per year, or £580 over the lifetime of the boiler.

The UKWTA is the UK’s leading trade association for companies involved in ‘Point of Entry’ and ‘Point of Use’ water treatment. UKWTA provides consumer information on a number of areas of water treatment through their website, including energy saving.

EST worked with Harvey Water Softeners in 2013/4 to produce a verification report of energy savings possible when using ion-exchanged softened water in the home, deriving the above cost savings figures. This is shown as part of the overall information section for consumers on the Harvey Water Softeners website.

None of the big six energy suppliers have any general advice about water softening in general on their webpages. Only one (SSE) makes any reference to water treatment in their FAQs regarding why a householder’s radiators may be cold at the bottom. In addition water treatment is mentioned as part of SSE’s additional services including powerflushing, magnetic filters and scale reduction.

Many of the water companies do provide information about hard water areas, softening and limescale with the main focus being on the benefit of improved water for washing and appliance performance. However, only two water companies (Southern Water and Cambridge Water) mention the additional effects of hard water on the heating system and in both cases consumers are advised to seek further information from a plumber.

EST has advice on their website on the benefits of regular maintenance of central heating systems, including the use of chemical inhibitors, but no guidance on water softeners at the time of writing this standard. This will be featured following the introduction of this standard.

In August 2014, and October 2014 as part of the Big Energy Saving Week, EST published research findings from the 'UK Pulse', relevant to water softener manufacturers in the context of the domestic heating market. This gave insight into consumers' understanding of heating systems; just 27% incorrectly said turning up their thermostat to a high setting heats the home faster, compared to 54% who said correctly that this statement was false. However 38% incorrectly thought it was more energy efficient to leave the heating turned on at a low temperature constantly, rather than turn it on and off.

Supply Chain

The market for water softeners includes the following companies and brands:

- [BWT UK Ltd](#)
- [Calmag](#)
- [EcoWater](#)
- [Fountain](#)
- [Harvey Water Softeners](#)
- [Kennet Water](#)
- [Kinetic](#)
- [Monarch](#)
- [Scalemaster](#)
- [Wickes](#)

EST has worked with the UKWTA to produce this standard. UKWTA has over 80 members including manufacturers, suppliers and installers of various water treatment products. The UKWTA will make product certification under this standard available as a benefit of association membership. Certification will include both direct approval of products from manufacturers and 'secondary' approval for third-party suppliers and distributors retailing endorsed products, and also be available to BEAMA WAtE Treatment and non-trade association members, enabling all companies to use the EST Endorsed Product landmark.

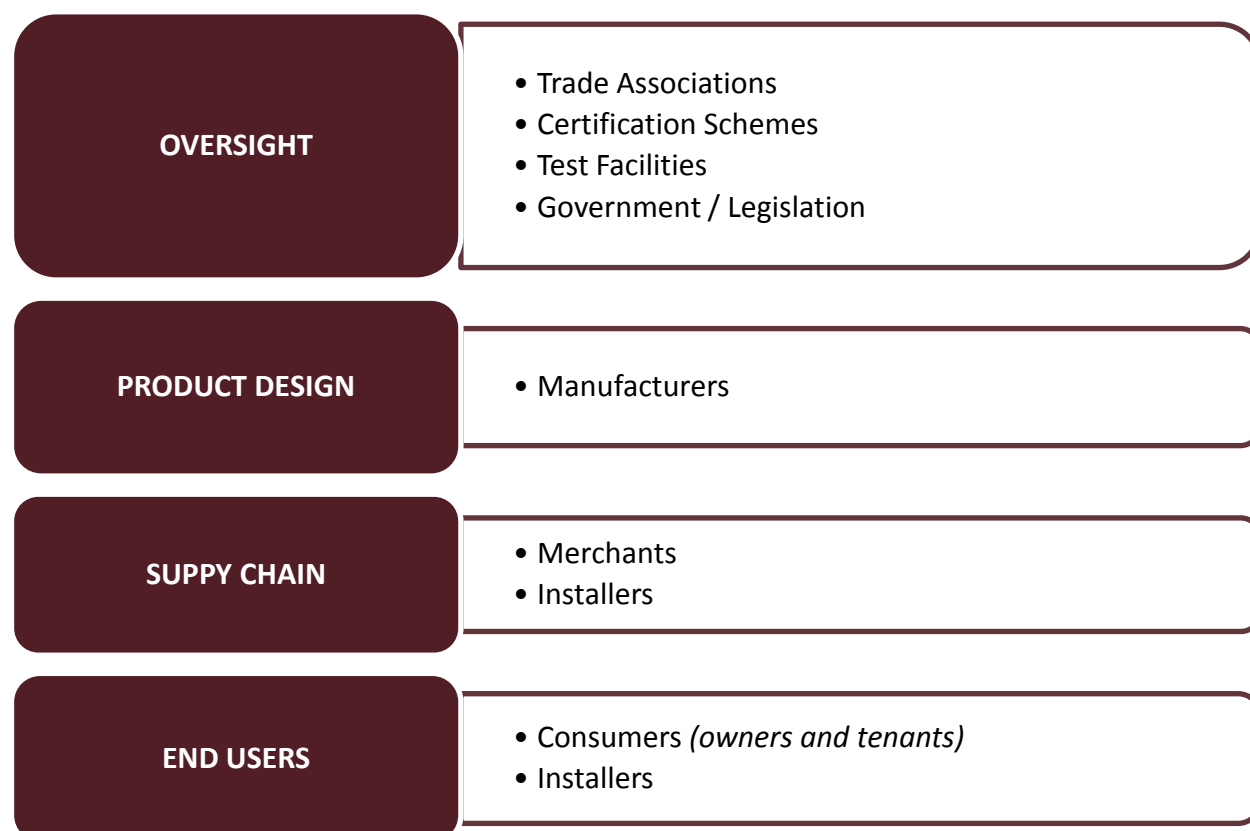
Summary Objectives

The objectives of this Endorsed Product Standard are to:

- Develop a central listing of endorsed products to which all relevant audiences can refer
- Identify the key performance requirements of endorsed products, and direction for future endorsement as the market develops
- Communicate to consumers about the benefits of softening water and the financial and energy savings it brings

- Increase awareness of the importance of independent product endorsement
- Increase awareness of the standard, product listing and brand mark

Stakeholder Mapping



Wider Product Policy Context

Building Regulations: The Department of Communities and Local Government has published new 2013 versions of the Domestic Building Services Compliance Guide that supports the 2013 edition of Approved Documents L1A and L2A and the 2010 editions of Approved Documents L1B and L2B (as amended in 2013). These changes came into effect from 6 April 2014.

Part L of the Building Regulations was changed in May 2006 to incorporate the provision for the treatment of hard water to inhibit limescale precipitation in water heating applications in hard water areas (minimum 200 mg/l total hardness) but no recommendations are made regarding the suitability of equipment or products for compliance.

Reference to artificially softened water is made in the UK Building Regulations regarding sodium levels and the increase that is seen when water is subjected to base-exchange softening. The relevant section recommends that where sodium levels are increased due to softening that this is not maintained as the household drinking supply, and a further tap is made available to provide non-softened water. Softened water can be used for the

household drinking supply, provided it is 'wholesome', as defined by drinking water regulations; sodium content below 200 ppm is considered to be wholesome.

WRAS: The Water Regulations Advisory Scheme (WRAS) is the UK Water Industry's approval scheme, providing third party certification. Products approved by the scheme have been shown to comply with the requirements of the Water Supply (Water Fittings) Regulations 1999 and amendments. Products, including water softeners, and components and materials are approved based on conformity with the regulators specifications, dealing with aspects such as waste, misuse, undue consumption and contamination of water.

The WRAS information and guidance note *Information for Installation of Ion Exchange Water Softeners for Systems Supplying Water for Domestic Purposes* gives detail on the provision of wholesome drinking water in the context of softening. Water of hardness in the region of 425 ppm calcium as CaCO₃, subject to base-exchange softening would exceed the sodium ion limit of 200ppm, thus creating the need for an unsoftened drinking supply. This document also contains guidance for installers related to the Water Fittings Regulations, efficiency and backflow prevention.

The Code for Sustainable Homes. The water calculator is used to assess the compliance of whole house potable water consumption against the Code for Sustainable Homes and Building Regulations. The performance of water softeners in terms of water used in the regeneration cycle (taking into consideration occupancy) is included in the overall household calculation. Softeners that use 4% or less of the total water softened during the regeneration process in hard water areas ($\geq 200\text{mg/l}$ total hardness) are defined as 'carbon neutral' by the Code.

Research into the effect of water softeners on boiler efficiency. Research has been carried out by a number of bodies on the effect of water softeners in abating limescale and the resulting boiler efficiency. One of the most comprehensive studies was carried out in 2009 by the Battelle Institute who tested 30 water heaters running on both hard and softened water to measure the effect of limescale build-up on boiler efficiency. The study found that water heaters running on softened water maintained their efficiency, but those on hard water saw reduced efficiency and in some cases blockages due to the build-up of limescale, requiring a de-scaling procedure to be performed.

Use of water softeners in the primary circuit of central heating systems. The question has been previously raised as to whether base-exchanged softened water, when used in the primary circuit of central heating systems, causes corrosion of aluminium components in heat exchangers. BSI and Midland Corrosion carried out testing in this area in March 2012 and found no significant risk of this taking place. However it is recommended that householders consult their boiler manufacturer if they are considering using base-exchanged softened water in the home and are aware of any conditions of the boiler's warranty or manufacturer's advice related to this.

The position as agreed by BEAMA Water Treatment and UKWTA, endorsed by HHIC on this matter is as follows: "Where a water softener is present in the dwelling ensure that a heating system primary circuit is filled with mains water via the general bypass valve as required within BS14743. Note: A water softener must comply with BS14743 (this states that there must be 'a general bypass valve which enables the softening unit to be isolated from the mains, while maintaining water supply to the end user'. For installation requirements, refer to WRAS Information and guidance Note No 9-07-01 "Information for the installation of ion exchange water softeners for systems supplying water for domestic purposes".

Drinking water regulations. The Water Supply (Water Quality) Regulations for the quality of drinking water have been established by DEFRA. these include standards for wholesomeness, covering both sodium and chloride content of domestic drinking water as a result of treatment processes.

The following **British Standards** are relevant to water softeners:

- BS EN 14743 *Water conditioning equipment inside buildings – Softeners – Requirements for performance, safety and testing*
- EN 973 *Chemicals used for treatment of water intended for human consumption – sodium chloride for regeneration of ion exchangers*
- EN 1717 *Protection against pollution of potable water in drinking water installations and general requirements of devices to prevent pollution by backflow*
- EN 60335-1 *Household and similar electrical appliances –Safety – Part 1: General requirements (IEC 60335-1:2001, modified)*
- BS 7593 *Treatment of water in domestic hot water central heating systems*

Requirements

- The residual hardness at the end of each softening run shall be no more than 10% of the untreated water (as per BS EN 14743).
- The chloride content after each regeneration shall not exceed 1.0 mmol/l above the chloride content of the original supply water.
- The percentage of water used for regeneration as a percentage of the water treated (softened) shall be less than 4% (for water of 200 mg/l initial hardness).
- The amount of salt used, and the number of regenerations per 1000 litres of water softened shall be declared in the manual or on the packaging
- Products shall be CE marked
- Products shall be accompanied by a warranty, covering as a minimum: full product replacement in the first two years, or both parts and labour warranty for a period greater than two years
- Products shall include in their instructions for installers that the softener is to be installed in accordance with WRAS information and guidance note 9/07/01 *Information for Installation of Ion Exchange Water Softeners for Systems Supplying Water for Domestic Purposes*

Verification / Conformity Assessment

Companies applying for certification will be required to supply:

- A completed and signed application form, detailing the products being applied for;
- A copy of the test report demonstrating conformance with the above criteria. Test reports confirming the above criteria shall be supplied from testing laboratories UKAS-accredited against ISO 17025 (or be in-house reports witnessed by a representative of a test facility, UKAS-accredited against ISO 17025) using the test method *Proposed performance test specification for 'endorsement' of performance in accordance with the EST Energy Efficiency Scheme* developed by UKWTA in accordance with BSI.
- Copy of instruction manual, product packaging or information for the installer demonstrating conformance with the above criteria.

- Evidence of warranty provision
- Copy of Declaration of Conformity to demonstrate evidence of CE marking

Endorsement against these criteria shall be valid for a period of 12 months from publication. Companies applying part-way through the 12 month period will be subject to pro-rata fees.

Key Messages, Audience & Dissemination

EST are designing, contracting and promoting product assurance solutions (endorsement & verification) covering a whole range of products within the domestic heating system:

- Gas and oil fuelled boilers
- Heating controls
- Hot water cylinders
- Circulating pumps
- Chemical inhibitors
- Water softeners and limescale reduction devices
- Radiators
- Heating system insulation (pipes and cylinder jackets)

The goal of this product standard in 2015 is for EST to improve communication to consumers and the supply chain about the energy and cost saving benefits of water softeners as part of overall heating system maintenance, recognising that limescale deposits can cause a substantial reduction in the effectiveness of heat exchangers and central heating system components.

EST will include this messaging in consumer advice provided through web and general communication and PR channels. Web content will also consist of an openly accessible register of water softener products verified against the quality and performance criteria contained in this proposal, acting as a reference source to both consumers and the supply chain to encourage informed choices about the products they choose to procure or install. It is EST's aim that these activities would run in parallel with other initiatives to raise consumer awareness on optimal use of heating systems, such as the UK Pulse and Big Energy Saving Week.

Product endorsement will include use of the EST Endorsed Product brand mark which manufacturers will be able to use in line with the relevant Brand Guidelines and Licence Agreement. EST will include the brand mark within the online database and any promotional activity in order to increase recognition.

Following publication of the standard the Energy Saving Trust will conduct PR activity via social media and relevant trade press. Other potential avenues of dissemination are the EST blog and short webinars where these are considered appropriate. Following publication of the standard EST will conduct PR activity via social media and relevant trade press.

EST can also provide supporting services to stakeholders on a bespoke one to one basis or as larger projects including all stakeholders. Services include:

- Verification of specific product performance claims (including cost to run) in addition to endorsement against the standard
- Quick reference consumer and/or supply chain guides and literature
- Update of existing supply chain guidance documents
- Supply chain training web tools – either for the supply chain or consumers to aid surveys, installation and/or buying decisions.

What is the resulting added value of the standard

Through this standard, EST aims to effectively communicate to consumers the energy and cost saving benefits of using a water softener in the home, provide greater exposure and support to the industry.

Future Direction

The scope and criteria will be subject for review after 12 months to assess whether market developments are appropriately reflected. Review will include assessment of the different measurement metrics that could be applied, portion of the market eligible and improvements in technology.

The effectiveness of the combined EST and Industry communication activities and approach, conducted in year one will also be considered, to ensure the future development of this market.

References

EST Publications

- Domestic heating by oil - CE29
- Domestic heating by gas - CE30

External Publications

- Domestic building services compliance [guide 2013](#)
- Non-domestic building services compliance [guide 2013](#)
- DEFRA hard water [map](#)
- Battelle [report](#)
- BSI report TR/12/562: [Corrosion Tests in Central Heating Systems filled with Hard and Base Exchange Softened Hard Mains Water](#)
- [The Water Regulations Advisory Scheme \(WRAS\)](#)
- [Code for Sustainable Homes](#)
- Drinking Water Regulations <http://dwi.defra.gov.uk/stakeholders/legislation/wqreg2007cons.pdf>

Websites

- [Energy Saving Trust](#)
- [Harvey Water Softeners Green Claims Verification](#)
- [Cambridge water](#)
- [Southern Water](#)
- Energy Supplier websites: (British Gas, EDF, E.ON, N.Power, Scottish Power, SSE)
- Manufacturer Websites (see introduction)
- [Planning Portal](#)
- Stakeholder Websites (see introduction)

- WRAS information and guidance note 9/07/01
Information for Installation of Ion Exchange Water Softeners for Systems Supplying Water for Domestic Purposes
https://www.wras.co.uk/downloads/public_area/publications/general/ign9-07-01.pdf/