The Untapped Potential of Pumps in the UK'S Green Transition

How accelerating pump replacements and having a proper pumping strategy can decarbonise heating.

Contents

About Grundfos

Grundfos are the leading pump and water treatment manufacturer in the UK, providing low carbon technologies and millions of pumps whilst employing 550 staff in the UK and 20,000 worldwide. Grundfos develop water solutions for the world, setting the standard in terms of innovation, efficiency, reliability and sustainability. Grundfos connect with millions of people every day and our solutions help our partners and customers move water to where it is supposed to go.

Over 95% of households in the UK have central heating[1] which use a circulator pump to push water to the heat emitters in each room. Grundfos believe manufacturers have a responsibility to ensure that the impact they have on carbon and running costs is positive. This means ensuring the pump is efficient and effective, providing the best possible environment for the heat generator, whether this be a traditional boiler or a heat pump.

Aligning with Government Policy

Improvements in energy efficiency are a key part for driving Labour's net zero ambition under their plans to make Britain a Clean Energy Superpower, they have confirmed they will be reintroducing Minimum Energy Efficiency Standards (MEES) for the domestic private rented sector, and introducing the Warm Homes Plan, a regionally driven local energy area retrofit programme for homes. Under these plans, Labour intends to cut household energy bills by up to £1,400 a year.

For the non-domestic sector, Labour have committed to less, but they will need to confirm whether MEES will be implemented for the private rented non-domestic sector, as driving forward with this policy will support progress towards Labour's target to reduce business energy bills by £53 billion by 2030.

The Climate Change Committee (CCC) have highlighted that policy development in the building sector is lacking. Energy efficiency measures fell in 2023 and were already significantly off track in 2022, suggesting installation of measures are "moving in the wrong direction" in comparison to the scale-up required[2]. This is especially important given that the average reduction in emissions between 2015 and 2022 was below the pace needed and were not driven by sustained programmes replacing high-carbon technologies with low-carbon alternatives. The CCC states that these alternatives are necessary for a "deeper decarbonisation of the economy" and that progress must be sped up through supporting programmes, enabling quicker roll-out of key technologies before 2030.

ENABLING PUMP REPLACEMENTS THROUGH POLICY CHANGE

The EU Commission through the Energy Performance of Buildings Directive (EPBD), as well as Germany, recognise the need to replace old inefficient pumps. They have taken a dual-targeted approach by providing funding support alongside regulation to support their replacement. The UK Government should follow this dual approach to support the installation of new pumps as a credible energy improvement measure[3] (see footnote for definition of new), and reap the policy benefits of fuel bill savings for households and businesses by:

- **Updating scoring methodologies to reward pump replacements.** Circulator pumps need to be supported as a recommended energy efficiency measure within SAP and the subsequent Home Energy Model for the domestic sector, so that they are a recommended energy efficiency improvement measure on EPCs. This would ensure that those conducting pump replacements are rewarded for the energy efficiency improvement to the heating system. Within the non-domestic section, the National Calculation Methodology and Simplified Buildings Energy Model needs to be rating circulator and water pumps appropriately so that non-domestic EPCs are also recommending pumps as an energy efficiency improvement measure.

- **Provide support for pump replacements with a £125 voucher through the Warm Homes Plan, and include pump replacements with scoring in the Energy Companies Obligation.** This would result in an average payback period of 2 years for households, compared to 4 years if circulator pump replacements did not have financial support. This implies that the financial benefits of the scheme will be experienced by the households within this Government's parliamentary term. Supporting circulator pump replacements is an efficient use of government and household funding, providing value for money. Gemserv analysis has found that for every £1 spent on replacing old pumps with new ones, a household will get £1.65 back in terms of savings, an uplift of 65% in GVA.

- **Using MEES to drive the replacement of non-compliant pumps to more efficient compliant pumps in the domestic and non-domestic sector.** Supporting pump replacements through MEES has the potential to achieve the carbon reduction target for the homes pursued by this policy- reducing carbon emissions by more than 2.5MT CO_2e, relieving the economy of £141 million (the social cost of carbon). Pump replacements also offer a quick win, low-cost, short payback (four years) measure for landlords to demonstrate compliance. Owing to this, and the aggregate lifetime energy reductions of more than 620GWh, households under this policy can benefit from up to £1.88 billion in fuel bill savings, with a £398 reduction per household over the pump's lifetime. With the private rented sector having a notable proportion of fuel poor homes, pump replacements can be an effective measure to lift households out of fuel poverty.

- **Ensuring that a minimum standard pump strategy is implemented to reduce efficiency losses and save consumers on their energy bills.** Whilst installing and servicing heating systems, put in place checks and balances to ensure hydraulic balancing is recommended, alongside boiler efficiency checks, which test component efficiency. This can be enabled by investing in upskilling installers so that they can deliver pump replacements and heating system adjustments necessary to drive efficiency, and through implementing a centralised digital Benchmark document to drive up installations standards.

[1] USwitch. 2024. UK Boiler Statistics 2023. Available at: https://www.uswitch.com/energy/boiler-statistics/

[2] Climate Change Commitee. 2024. Progress in Reducing Emissions. Available at: https://www.theccc.org.uk/wp-content/uploads/2024/07/Progress-in-reducing-emissions-2024-Report-to-Parliament-Web.pdf

[3] The pumps being installed must Ecodesign compliant pumps produced after 2013. The definition of 'New' is that the Energy Efficiency Index EEI defined under Ecodesign must be below 0.23, for comparison an older pump might be around 0.7 making it 3 times less efficient.

Introduction

UK carbon emissions from buildings is high – it accounted for 18% of UK emissions in 2023. Existing buildings make up the vast majority of the buildings stock and will continue to do so – 80% of buildings today will still be standing in 2050. With UK buildings amongst the oldest and most energy inefficient in Europe, these buildings will need to be retrofitted in order for them to decarbonise, which is a big challenge[4].

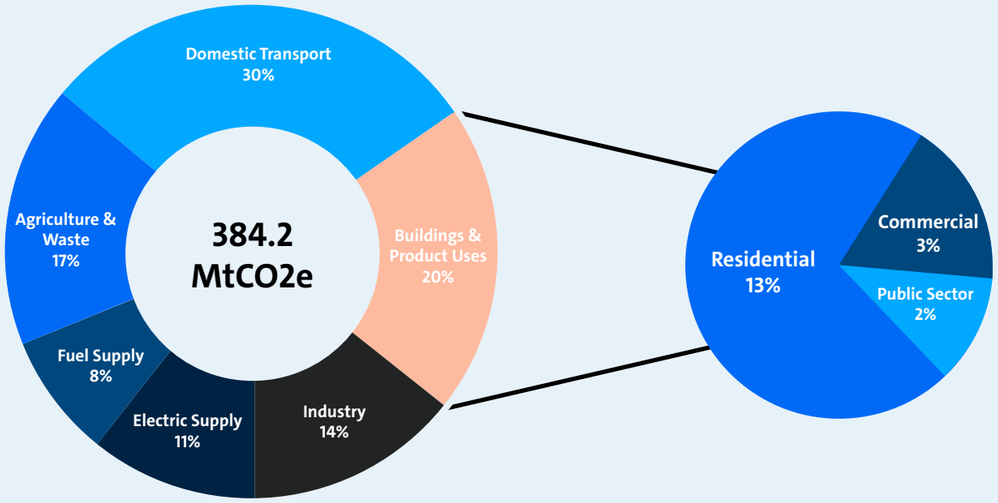


Figure 1: UK Emissions Attributable to Buildings (2023)[5].

The main source of heat for buildings in the UK is gas – 85% of homes are connected to the gas grid. Heat is attributed to the majority of buildings' emissions[6]. The UK has a target to install 600,000 heat pumps per annum by 2028, to replace the 1.5 million boilers installed every year. At present, progress has been slow for achieving the heat pump target – a 10 fold increase in annual installations is needed within 4 years.

Additionally, fossil fuel boilers continue to be installed today and with no backstop date for a fossil fuel phase out, installations may persist into next decade, with the average lifetime of a boiler being 15 years this will create locked in carbon emissions.

Therefore, improving the efficiency of these systems will be key to mitigating carbon emissions from heat.

All wet heating systems will have a pump to move water within the heating system. However, there are many inefficient pumps installed within heating systems, which is increasing energy use, driving up consumer bills, and increasing carbon emissions. The British Pump Manufacturers Association states that 100,000 of the 1 million circulator pumps installed each year do not meet UK regulation[7]. Non-compliant pumps are usually fakes which consume higher energy – the Energy Savings Trust field trial highlights the negative impact of inefficient pumps and a poor pumping strategy[8].

[4] House of Commons. 2019. Energy efficiency: building towards net zero. Available at: https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/1730/1730.pdf

[5] Department for Energy Security and Net Zero (2024). Available at: 2023 UK greenhouse gas emissions, provisional figures (publishing.service.gov.uk)

[6] BESI. 2023. Heat and Buildings Strategy. Available at: https://www.gov.uk/government/publications/heat-and-buildings-strategy/heat-and-building-strategy-accessible-webpage

[7] The Construction Index. 2023. One in 10 heating pumps not compliant. Available at: https://www.theconstructionindex.co.uk/news/view/one-in-10-heating-pumps-not-compliant#:~:text=BPMA%20chief%20executive%20Steve%20Schofield,now%20over%2Dthe%2Dcounter

Consequently, energy bills will be higher for recipients of these pumps. For those on the lowest incomes, such as the 3.18 million households in fuel poverty[9], this is a relatively high figure, as it could be the choice between heating or eating during the winter months. Therefore, a strategy to replace inefficient pumps in UK heating systems is needed.

For the circulator pump to deliver high efficiencies, and support the heating system to provide a comfortable indoor air temperature, a proper pump strategy must be followed. This includes ensuring the installer has the skills and experience to replace the circulator pump, hydronically balance the system and apply best practice. Without this application, installing heating systems, and replacing pumps can damage heating system performance, and result in higher than necessary consumer energy bills.

Replacing a circulator pump and hydraulic balancing the system is a quick win for improving the energy efficiency of the property in a cost-effective and non-invasive way, which can be done during scheduled service and maintenance. This paper therefore raises awareness of the need to accelerate circulator pumps replacements, and the implementation of a proper pumping strategy for UK heating systems, with suggestions for how policy can be used as a tool to achieve this.

Accelerating the Replacement of Older Ineffcent Pumps

Circulator pumps used within residential properties are often overlooked as electrical consumption devices, however the potential for energy savings is greater than draught proofing[10] or low energy light bulbs[11] for a modest capital cost. There are approximately 7 million older inefficient circulator pumps in use within the UK out of 30 million units in total, and at the current rate of replacement it will take 24 years[12], or these to be replaced contributing unnecessary emissions and costs to end users.

Newer circulator pumps introduced as part of the ErP regulation reduce the energy use by over 3 times (186kWh down to 55kWh), saving over £40 per annum for a modest £250 installed cost[13] – which if done as part of an annual service would present only an hour of down time. The ErP regulation forced manufacturers to design the new units to fit perfectly within the space of the old unit making the replacement process easy and simple.

As evidenced from Figure 2 below, installing a new, more efficient pump will lead to savings worth of roughly £400, as opposed to the cost of less than £250 for installing it. Our analysis also shows that the payback period for a household will be achieved in just four years if electricity costs remain stable.

[8] Energy Savings Trust. Detailed analysis from the first phase of the Energy Saving Trust's heat pump field trial. Available at: https://assets.publishing.service.gov.uk/media/5a79ada740f0b63d72fc7a4c/5045-heat-pump-field-trials.pdf

[9] Hinson, S and Bolton, P. 2024. Fuel Poverty. Available at: https://researchbriefings.files.parliament.uk/documents/CBP-8730/CBP-8730.pdf

[10] Energy Saving Trust. 2024. Draught-proofing. Available at: https://energysavingtrust.org.uk/advice/draught-proofing/

[11] Energy Saving Trust. 2024. Lighting. Available at: https://energysavingtrust.org.uk/advice/lighting/

[12] Grundfos Estimate based off of market data.

[13] DESNZ. 2023. Guidance: Placing energy related products on the UK market. Available at: https://www.gov.uk/guidance/placing-energy-related-products-on-the-uk-market

GRANT SUPPORT FOR PUMP REPLACEMENTS

The benefit to the household will be even larger if the government implements a voucher scheme. The Social Housing Decarbonisation Fund provides funding at present for the installation of heating controls. It provides it in the form of a at 50% grant for social housing providers[14]. Therefore, this analysis models the benefits of covering 50% (£125) of the cost for installing a new pump. In such a case, the Net Present Value (NPV) of the expenditure incurred by a household will be £121, down from £242. The cumulative financial benefit to a household will also increase from £291 to £416 – See Figure 3. Finally, the household will have a payback period of just a little over two years, rather than four years. This implies that the financial benefits of the scheme will be experienced by the households within this Government's parliamentary term.

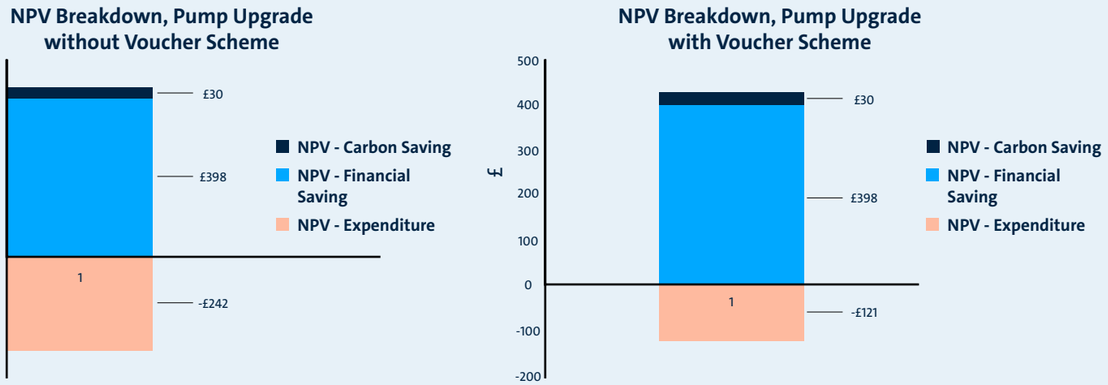


Figure 2: The NPV of Carbon Savings, Financial Savings and Expenditure for both with and without a voucher scheme[15]. Other source: Grundfos Data.

[14] DESNZ. 2024. Social Housing Decarbonisation Fund Wave 3. Available at: https://www.gov.uk/government/publications/social-housing-decarbonisation-fund-wave-3

[15] DESNZ Data Tables 1 to 19: Supporting the toolkit and guidance. Available at: v

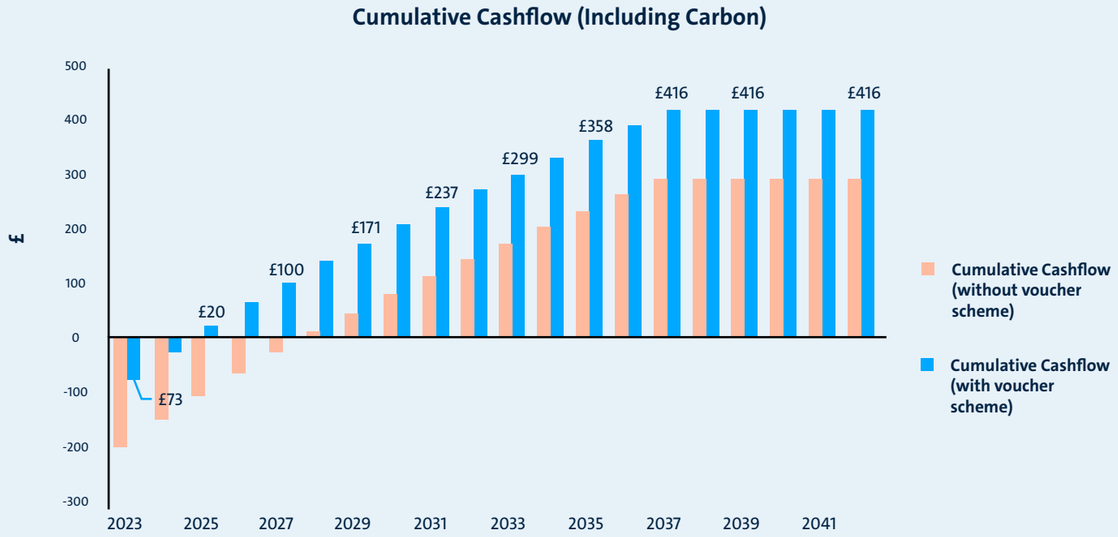


Figure 3: The cumulative cashflow of savings (including carbon savings) for both with and without a voucher scheme[16]. Other source: Grundfos Data.

Previous research commissioned by Grundfos suggests that the median amount that households are willing to spend on improving their energy efficiency is no more than £500 per year[17], therefore, by providing a small amount of financial support for circulator pumps, consumers will be more incentivised to install the measure, and so growth in pump replacements will occur.

Our analysis consists of a baseline scenario and a policy scenario. In the baseline scenario, we assume that no policy has been implemented. In this scenario, roughly 300,000 pumps will be sold every year in the UK, and they will lead to carbon savings of 1.39 million tonnes. In the policy scenario, we assume that a policy will be implemented which would accelerate the sales of these pumps.

Here, we have analysed the impact of increasing sales of pumps on both energy bill savings and energy efficiency. According to our analysis, a mere 40% growth in the deployment of these new pumps would almost double the carbon savings (in comparison to the baseline scenario) over the lifetime of the pump, resulting in 2.8 million tonnes of carbon saved per year. Therefore, the introduction of a simple policy mechanism that accelerates pump replacements can achieve significant energy and carbon savings, accelerating progress towards UK net zero targets.

[16] DESNZ Data Tables 1 to 19: Supporting the toolkit and guidance. Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fmedia%2F6567994fcc1ec5000d8eef17%2Fdata-tables-1-19.xlsx&wdOrigin=BROWSELINK

[17] Grundfos. 2023. Efficient Futures: An Exploration of Energy Efficiency Attitudes and Solutions in Bellwether Seats

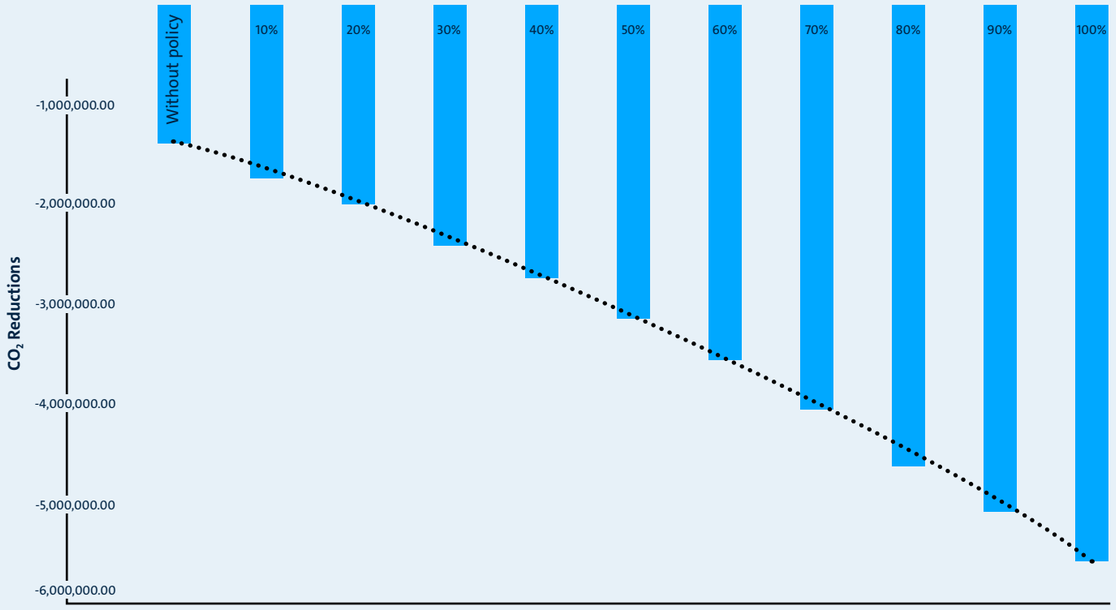


Figure 4: This figure shows the amount of reduction of CO2 emissions at different levels of pump sales growth[18]. Other source: Grundfos Data and Gemserv Calculation.

USING RETROFIT SCHEMES TO DRIVE UPTAKE

The main schemes that could incorporate and benefit the most from supporting pump replacements in the domestic sector are the proposed Warm Homes Plan and well-established Energy Companies Obligation (ECO). Pump replacements are quick and easy, and the pumps are low-cost measure. The value for money from supporting pump replacement is strong with £1.65 gained for every £1 spent and a short payback time for the consumer. With the pump replacement leading to immediate energy, carbon and bill savings, pump replacements are an easy and quick win for Government to achieve their policy objectives. As Labour intend to upgrade 1 million homes per year with energy efficiency measures, and in 2023 a rate of just over 300,000 was achieved[19], installations will need to increase over threefold for this ambition to be hit.

With a cost of living crisis squeezing businesses and consumers, and high appetite for cost-effective installations from those obligated under ECO, pump replacements can provide an opportunity to increase installation rates. Therefore, pump replacements should be listed as an eligible energy efficiency improvement measure in ECO4 and the upcoming Warm Homes Plan.

The commercial sector represents 23% of built environment carbon emissions in the UK[20]. The Climate Change Committee has identified a worrying lack of effective policies for decarbonising non-residential buildings in the UK. Within their 2023 Progress Report they state that current Government plans are unconvincing, and energy efficiency and heating policy must be revised to put the non-residential sector on track towards net zero[21]. This means that non-domestic sector buildings require greater policy support, if the UK is to meet it's net zero target.

[18] DESNZ Data Tables 1 to 19: Supporting the toolkit and guidance. Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fmedia%2F65667994fcc1ec5000d8eef17%2Fdata-tables-1-19.xlsx&wdOrigin=BROWSELINK

[19] DESNZ. 2024. Household Energy Efficiency Statistics. Available at: https://www.gov.uk/government/collections/household-energy-efficiency-national-statistics

[20] UKGBC. 2024. Building the Case for Net Zero: Retrofitting Office Buildings. Available at: https://ukgbc.org/wp-content/uploads/2024/01/Retrofitting-Office-Buildings-Building-the-Case-for-Net-Zero.pdf

[21] Climate Change Committee. 2023. Progress in reducing emissions. UK Progress Report for Parliament. Available at: https://www.theccc.org.uk/wp-content/uploads/2023/06/Progress-in-reducing-UK-emissions-2023-Report-to-Parliament-1.pdf

There is no national scheme to support businesses to improve their energy efficiency. Smaller businesses struggle with the higher capital cost of insulation and low-carbon energy generation technology, such as heat pumps, and solar. Many businesses want to make the change but struggle with the high capital cost[22]. This is where cost-effective pump replacements can support businesses to decarbonise at pace, owing to the lower resistance associated with low-cost, short payback period return measures.

With there being little material incentive for businesses to install energy efficiency measures at present, without intervention, the commercial sector may be left behind. Grundfos is therefore calling on Government to explore introduce energy efficiency scheme for the commercial sector and include pump replacements as an eligible measure.

USING MINIMUM ENERGY EFFICIENCY STANDARDS TO DRIVE PUMP UPTAKE

Domestic Private Rented Sector MEES

Government is still to implement the regulations for MEES and has committed to implementing MEES in homes by 2030 with a target of EPC C by 2030[23] to save consumers on their energy bills[24]. Using MEES as a policy mechanism for upgrading or replacing inefficient elements of the property is extremely useful as it is technology agnostic and places minimum EPC target on the rental property to drive energy efficiency improvements.

Measures eligible under MEES include upgrading insulation to avoid the loss of useful heat but some are for upgrading inefficient energy usage like lightbulbs to LEDs. Circulator pumps very much fit into this category. Many households choose to leave these types of products until they fail. Whilst this will eventually lead to the gradual replacement, using policy mechanisms like MEES to accelerate the uptake will lead to years of lower carbon output and facilitate meeting the EPC C MEES target for UK homes by 2030. These pumps also meet the seven-year payback test required for an improvement to be eligible under MEES, as the payback period of the pumps will be four years (two years if the voucher scheme is implemented).

The benefits of using MEES as a tool to drive uptake for these private-rented sector homes is below. According to the latest data by Ofgem[25], around 4.7 million houses in the UK are privately rented, out of a total of 27 million houses. Thus, 17% of all houses in UK can be targeted in this policy. The aggregate impact on financial savings and energy efficiency will be substantial. The total fuel bill savings will be £1.88 billion, whereas the total expenditure will be just £1.14 billion, providing a gross value added (GVA) of 65%. The positive impact is not just limited to the bill savings and energy efficiency. In monetary terms, £141 million worth of greenhouse gasses (GHG) emissions could be prevented from this scheme, thus having a substantial positive impact on the society.

The results of this analysis show that any policy that leads to accelerated adoption of such pumps will not only have a positive impact on the households targeted, but a significant positive impact on the society too. Circulator pumps very much fit into this category with many households choosing to leave these types of products until they fail. Whilst this will eventually lead to the gradual replacement, using policy mechanisms like MEES to accelerate the uptake will lead to years of lower carbon output, and facilitate meeting MEES target of moving UK homes to better energy efficiency levels. These pumps also meet the seven-year payback test required for an improvement to be eligible under MEES, as the payback period of the pumps will be four years (two years if the voucher scheme is implemented).

Non-Domestic Private Rented Sector MEES

There is currently a lack of clarity on non-domestic private rented sector MEES from the Labour Government. Many landlords made energy efficiency improvements to their properties to achieve the mandated EPC E level in rented properties, so they could continue to be leased/rented. There are proposals from the Department for Energy Security and Net Zero to raise this to an EPC D by 2025, EPC C by 2027 and EPC B by 2030, so building owners will need to install energy efficiency measures to comply. Without decisive action from Government on confirming these regulations, progress on decarbonising these buildings, lowering businesses energy bills and scaling up the retrofit market will be stifled.

[22] Lloyds Banking Group. 2021. The top three challenges business face to get to net zero. Available at: https://www.lloydsbankinggroup.com/insights/the-top-three-challenges-businesses-face-to-get-to-net-zero.html

[23] Hansard. 2024. Clear Energy Superpower Mission. Available at: https://hansard.parliament.uk/commons/2024-07-18/debates/1B2ABCB9-1455-4C86-8E2F-5E763B38E888/CleanEnergySuperpowerMission

[24] Labour. 2024. Labour Manifesto. Making Britain a Clean Energy Superpower. Available at: https://labour.org.uk/change/make-britain-a-clean-energy-superpower/

[25] Ofgem. 2024. Ofgem Energy Consumer Archetypes Update 2024. Available at: https://www.ofgem.gov.uk/sites/default/files/2024-02/Ofgem_archetypes_update_2024_FinalReport_v4.1.3.pdf

It should be noted that pumps are not included as a standalone recommended replacement measure under MEES, as the EPC does not suggest pump replacement as an eligible measure[26]. As circular pump replacements are a quick, and cost-effective energy efficiency measure with short payback times, Grundfos believes they should form part of a set of quick win measures to drive energy efficiency at different trigger points such as during routine service and maintenance.

The benefits of pump replacements (both circulator and water pumps) equally apply to the non-domestic sector – lower bills for businesses, increased energy efficiency, and increased occupant comfort. By including pump replacements within the list of eligible measures for MEES, progress can be made to achieving MEES and annual improvements in energy efficiency for large buildings.

CREATING A DUAL-TARGETED APPROACH FOR ENERGY EFFICIENCY IMPROVEMENTS

Research has found that a combination of incentive and regulatory-based approaches are most successful for driving uptake of energy efficiency measures to achieve climate policy targets[27]. Grundfos therefore advocate for MEES across the domestic and non-domestic sector to work in tandem with financial support for pump replacements for buildings. This will support landlords to meet their MEES obligations successfully and reduce political backlash from reintroducing the policy.

A dual-targeting approach (regulation & funding) is needed for the low-hanging energy efficiency improvements in the UK building stock. In other countries, such as Germany, low-cost energy efficiency improvements for heating systems are regulations and financially supported with great success. This includes support for thermostat and circulator pump replacements and hydraulic balancing mandates – all of which can be done in hours, having high impact on energy bills and offer short payback times.

EU Energy Performance of Buildings Directive

The EU's revision of its Energy Performance of Buildings Directive (EPBD) has further supported the case for hydraulic balancing. From 2026, new residential buildings or buildings undergoing major renovations must implement self-regulating temperature controls and hydronic balancing, where appropriate[28].

The EU has also taken a controls-based approach to improving the energy efficiency and carbon performance of their buildings stock through mandating the installation of Building Control and Automation Systems (BACS). As an example, BACS must be implemented in non-residential buildings with a heat and cooling power output of 290kW plus by 2025. This will drop to 70kW in 2030. Circulator pumps that have automation and energy monitoring capabilities would be an eligible measure for reducing energy usage. This is an example of how regulation is driving energy efficiency standards within buildings through the installation of pumps. This standard will be subsequently adapted by EU member stated by 2025.

The revision has also established the introduction of minimum energy efficiency standards/minimum energy performance standards for non-residential buildings, aiming to trigger renovation of the worst-performing buildings[29]. The standards will be based on the maximum energy performance thresholds, leading to renovation of the 16% worst-performing non-residential buildings by 2030, rising to the worst-performing 26% by 2033. Alongside the policies above, this highlights where pumps, controls and hydronic balancing technologies will be implemented.

Germany Heating Optimisation Programme & Building Energy Act

The Heating Optimisation Programme[30] aims to increase the amount of energy efficient pumps installed in German for homeowners and businesses and encourage heating system optimisation. As part of this, up to 15% of the total cost of replacing the old heat and hot water pumps with high efficiency ones are available for heat generator technology. Additionally, hydraulic balancing is supported, as well as replacing controls within the heating system, such as thermostatic radiator valves (TRV).

The German Government have a balanced approach with driving energy efficiency and carbon reduction within buildings. Through supporting businesses and homeowners financially with installing pumps, but also through mandating the installation of controls technology through the EPBD, through the §71a "Building Automation" in the Building Energy Act (GEG).

[26] NCM 2023. A Technical Manual for SBEM. Available here

[27] RAP. 2022. A policy toolkit for global mass heat pump deployment. Available here: https://www.raponline.org/knowledge-center/policy-toolkit-global-mass-heat-pump-deployment/

[28] European Union. 2024. Directive (EU) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202401275

[29] European Union. 2024. Questions and Answers on the Revised Energy Performance of Buildings Directive. Available at: https://ec.europa.eu/commission/presscorner/detail/en/qanda_24_1966

[30] BMWK. 2024. Enhancing Energy Efficiency in Buildings. Available at: https://www.bmwk.de/Redaktion/EN/Dossier/enhancing-energy-efficiency-in-buildings.html

UPDATING SCORING METHODOLOGIES TO REWARD PUMP REPLACEMENTS

For the benefits of pump replacements to be realised, organisations engaging within policy scheme must be properly incentivised. A key requirement of many schemes is to increase the EPC rating – ECO4, the Warm Homes Plan, and MEES for both domestic and non-domestic will require increases in the EPC ratings to evidence energy efficiency improvements. The measures used to increase EPC ratings will be scored according to Government's calculation methodologies, the Standard Assessment Procedure (SAP) for the domestic sector and the National Calculation Methodology for the non-domestic sector. In the domestic sector SAP will be superseded by the Home Energy Model for scoring how energy efficient the measure.

At present, in SAP, pumps are not scored and assumed to be part of the system as an ancillary function. The installation of a new efficient pump is also not included in the PCDB. This means in schemes such as ECO, and the Warm Homes Plan, and for compliance with EPC requirements through MEES, their installation will not be included as a measure to increase the EPC rating, and so are excluded as a measure. We therefore believe circulator pumps should be supported as a recommended energy efficiency measure within SAP and the subsequent Home Energy Model for the domestic sector, so that they are a recommended energy efficiency improvement measure on EPCs. This would ensure that those conducting pump replacements are rewarded for the energy efficiency improvement to the heating system.

If non-domestic private rented sector MEES are introduced, to drive pump replacements within the non-domestic sector the National Calculation Methodology and Simplified Buildings Energy Model would need to be rating circulator and water pumps appropriately. This would ensure that non-domestic EPCs recommend pumps as an energy efficiency improvement measure, which they currently do not explicitly do[31].

[31] NCM 2023. A Technical Manual for SBEM. Available here

SUPPORTING THE EFFICIENCY HEATING SYSTEMS THROUGH AN EFFECTIVE PUMP STRATEGY

A minimum standard pump strategy would reduce efficiency losses and save consumers on their energy bills. An effective pumping strategy would follow the proper design, installation, and commissioning of the heating system. This would involve pumps only running when the heat source is used, including start up and cool down (pump overrun), the pump should be set to proportional pressure for radiators, if underfloor heating is at a constant pressure and all systems should be balanced (a bypass would possibly have different rules).

Modern circulation pumps are speed controlled and support the heating system by preventing differential pressure (the resistance to flow, for example squeezing a hose pipe to restrict flow) to increase under partial load conditions, and so should replace non-compliant pumps. This would ensure that pressure is optimal for energy and heat deliver efficiency across the building.

PUMP PERFORMANCE AND HEAT PUMPS

Poor design and commissioning decrease the efficiency of the heating system. For example, when pumps are set to their maximum speed, or installing additional pumps to achieve the flow rate as opposed to resizing the system, they use energy unnecessarily. With heat pump installations set to increase to hit targets, there is a risk that circulator pumps are misinstalled, leading to unnecessarily high energy consumption – an issue identified by the Energy Savings Trust Field Trial. Poorly designed pumping strategy can affect the Seasonal Coefficient of Performance (SCOP) of a heat pump by as much as 0.3[32] (or 10% of well performing heat pump) – a 10% drop in SCOP of 3 would add £149 to the annual bill of an average property (18,000kWh demand, electricity price 22.36p/kWh[33]).

HYDRONIC BALANCING

Unbalanced systems can result in radiators not heating up properly, causing hot and cold spots to emerge within a property[34]. The user is then left unhappy with the system or, worse left still making changes like turning the boiler temperature up in order to try and get the cold room temperature up, causing the boiler not to condense.

Additionally, unnecessarily higher return water temperatures reduce the operational efficiency of the heat source, whether this be a boiler or heat pump. Ultimately, this means that heating systems cannot work to optimum levels if the system is not properly balanced. This results in higher heating costs or greater emissions than expected and less comfort. In contrast a balanced heating system can lead to energy savings of up to 20% annually[35].

Whilst servicing heating systems hydraulic balancing should be checked and amended, alongside boiler efficiency checks which test component efficiency. However, this is not currently done as around 10% of the UK's heating systems are properly balanced[36]. Therefore, more needs to be done to avoid unnecessary losses in heating system efficiency and consumer bills.

ECONOMIC ANALYSIS SUPPORTING BEST PRACTICE PUMP STRATEGY

Implementing an effective pumping strategy will improve the efficiency of the heating system, regardless of the technology. The analysis below considers the difference of effective pumping strategy versus ignoring the pumping strategy. The numbers have been scaled up to reflect the number of heat pumps needing to be deployed up to the mid-2030s according to the CCC. As shown in Figure 5, the initial upfront (capital) and training costs for ensuring an effective pumping strategy gives far higher fuel bill savings as well as carbon savings to create a strongly positive NPV.

[32] Energy Savings Trust. Detailed analysis from the first phase of the Energy Saving Trust's heat pump field trial. Available at: https://assets.publishing.service.gov.uk/media/5a79ada740f0b63d72fc7a4c/5045-heat-pump-field-trials.pdf

[33] OFGEM. 2024. Energy Price Cap Figures. July to September. Available at: https://www.ofgem.gov.uk/energy-price-cap

[34] BEIS. 2021. Heat and Buildings Strategy. Available at: https://assets.publishing.service.gov.uk/media/61d450eb8fa8f54c14eb14e4/6.7408_BEIS_Clean_Heat_Heat___Buildings_Strategy_Stage_2_v5_WEB.pdf

[35] Sky News.2023 Your boiler, car and home: Do the government's plans really power up Britain - and what does it mean for you? Available at: https://news.sky.com/story/your-boiler-car-and-home-dothe-governments-plans-really-power-up-britain-and-what-does-it-mean-for-you-12845377

[36] Domestic heat distribution systems: Evidence gathering (2021) UK Government. Available at: https://assets.publishing.service.gov.uk/media/606c39c38fa8f515b4067b08/beis-dhds-final-report__1_.pdf

An effective pumping strategy for heat pumps will strongly benefit the economy as heat pump deployment increases, as shown by the costs & benefits of ensuring this best practise below.

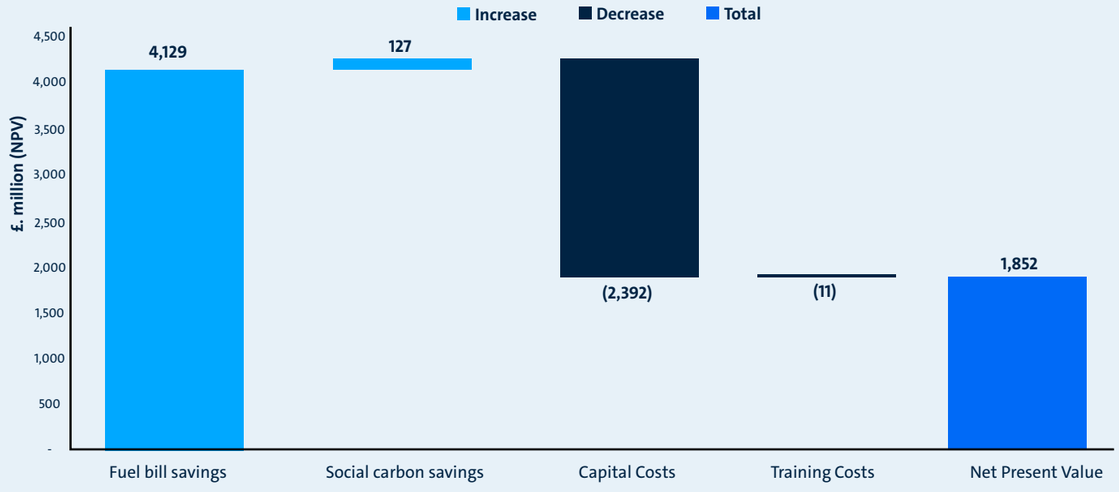


Figure 5: The NPV of fuel bill savings, expenditure and different types of costs if the best pumping strategies are used[37]. Other source: Grundfos data and Gemserv calculation.

This provides a compelling case to support best practice in pump strategy, particularly as the heat pump market grows.

CENTRALISED COMMISSIONING THROUGH DIGITAL DOCUMENTATION (BENCHMARK)

Standards for heat pumps installations will need to be increased in order to drive the installation of a well-performing heating system. Ensuring that an effective pumping strategy is implemented can enable this. To achieve this, better tracking through more accurate verification of the installation is needed.

One route to achieving this is through Benchmark, which sets the minimum installation standards during commissioning. At present, there is minimal oversight to ensure the minimum standards are being implemented.

Benchmark is used to verify the commissioning of new boiler installations. This document is maintained and owned by the Heating and Hot Water Industry Council (HHIC)[38]. Its purpose is to confirm the installer has met the minimum standards for the heating system. It is paper-based and includes the manufacturers manual. The installer fills it out and leaves it with the customer for their record. Many manufacturers require this document for proof before providing warranties for their product.

[37] DESNZ Data Tables 1 to 19: Supporting the toolkit and guidance. Available at: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fmedia%2F6567994fcc1ec5000d8eef17%2Fdata-tables-1-19.xlsx&wdOrigin=BROWSELINK

[38] Heating and Hotwater Industry Council. Nd. Benchmark Commissioning and Warranty Validation Service Record. Available at: https://www.hhic.org.uk/uploads/5D9B41557255E.pdf

The paper-based system is limited as:

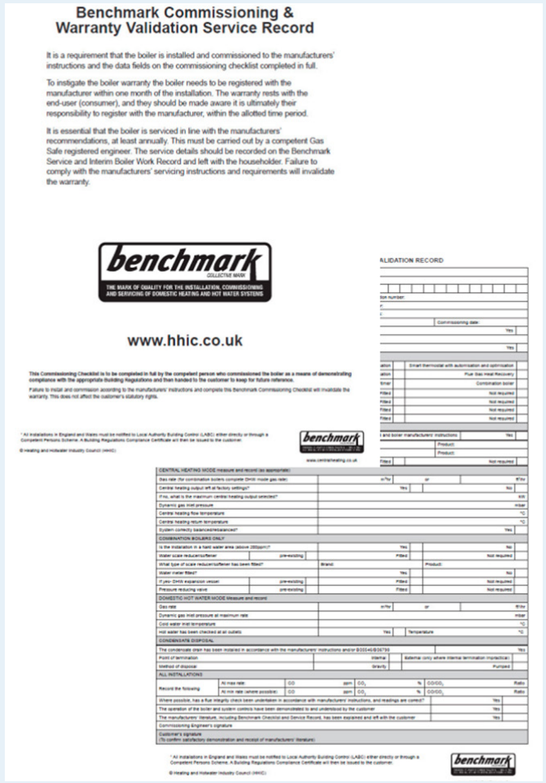
- The document is often lost as it is left with the homeowner who can misplace it.
- Industry cannot provide statistics on certain options the installer selects for the installation. For example, which Boiler+ solution is applied or whether TRVs and balancing have been used.
- There are no other alternative heat generator options e.g. heat pumps, biomass boilers etc.

Centralising Benchmark data through a digital format will facilitate greater understanding, and ability to analyse installation data to inform policy development as opposed to surveys. This database can be managed centrally, where industry/bodies can make requests for non-specific data for assessment. For example, what are the preferred methods of meeting Boiler+ or Building Regulations.

The benefits of such a system would be:

- Higher compliance levels by placing the onus on the installer to complete an online version, which is then kept centrally, to hold the installer to greater account.
- Policing of compliance can be done based on facts, currently any policing of installers requires a copy of such a commissioning document (which is hopefully kept by the homeowner). By having a centralised database this can be more targeted.
- Increased compliance will result in higher delivery of system interventions which will lead to higher efficiency and a lower carbon system. An example of this would be a balanced emitter system.

With 1.5 million boilers installed every year, there seems to be untapped potential to affect the behaviour of installers; just by asking them to declare on a digital central database what they did on site to comply with building regulations will make a real difference to what they actually do on site. There will be a proportion of installers that claim they did complete certain aspects of the installation. However, without a copy of the document and no ability for a central body to check, installers have less accountability to deliver the changes needed. It is this change in behaviour that will bring higher efficiency, lower fuel bills and reduced carbon across all heating technologies and help to pave the way for the best practice needed for the installation of low carbon heating technologies. This practice should be extended to heat pump installations, as their design, installation and commissioning will impact the systems performance and so consumer bills. Energy bills can be very high, and unsuitable indoor air temperatures, if a heat pump including the heat distribution systems and emitters are installed incorrectly. Consumers experiencing these installations would have a negative perception which could impede the speed of uptake through mistrust in the reliability of the system.


Benchmark Commissioning & Warranty Validation Service Record

It is a requirement that the boiler is installed and commissioned to the manufacturers' instructions and the data fields on the commissioning checklist completed in full.

To instigate the boiler warranty the boiler needs to be registered with the manufacturer within one month of the installation. The warranty rests with the end-user (consumer), and they should be made aware it is ultimately their responsibility to register with the manufacturer, within the allotted time period.

It is essential that the boiler is serviced in line with the manufacturers' recommendations, at least annually. This must be carried out by a competent Gas Safe registered engineer. The service details should be recorded on the Benchmark Service and Interim Boiler Work Record and left with the householder. Failure to comply with the manufacturers' servicing instructions and requirements will invalidate the warranty.

benchmark

www.hhic.co.uk

Figure 6: Benchmark commissioning document[38].

[38] Heating and Hotwater Industry Council. Nd. Benchmark Commissioning and Warranty Validation Service Record. Available at: https://www.hhic.org.uk/uploads/5D9B41557255E.pdf

Therefore, best practices when installing a heat pump, such as ensuring the systems is appropriately balanced. There will be a proportion of installers that claim they did complete certain aspects of the installation. However, without a copy of the document and no ability for a central body to check, installers have less accountability to deliver the changes needed. It is this change in behaviour that will bring higher efficiency, lower fuel bills and reduced carbon across all heating technologies and help to pave the way for the best practice needed for the installation of low carbon heating technologies.

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Figure 7 demonstrates the benefits of a centralised digital database for commissioning on one year of boiler installations. Assumptions have been used from Grundfos's installer survey[39]. There would likely be a slight additional cost associated with registering the document online, (similar to Gas Safe currently and may actually be quicker than writing it out as currently done) and an additional estimated hour and a half of work per system. These additional upfront costs yield considerable benefits in the long run. By increasing the levels of best practice, heating systems will run more efficiently, saving the consumer money on their fuel bills and reducing carbon to create a significantly positive NPV and a compelling case for making such a change.

If 1.5 million boilers are installed each year, 580,000 additional boiler heating systems could be balanced with a centralised database.
Below are the costs and benefits for the boilers installed in one year as a result of this change.

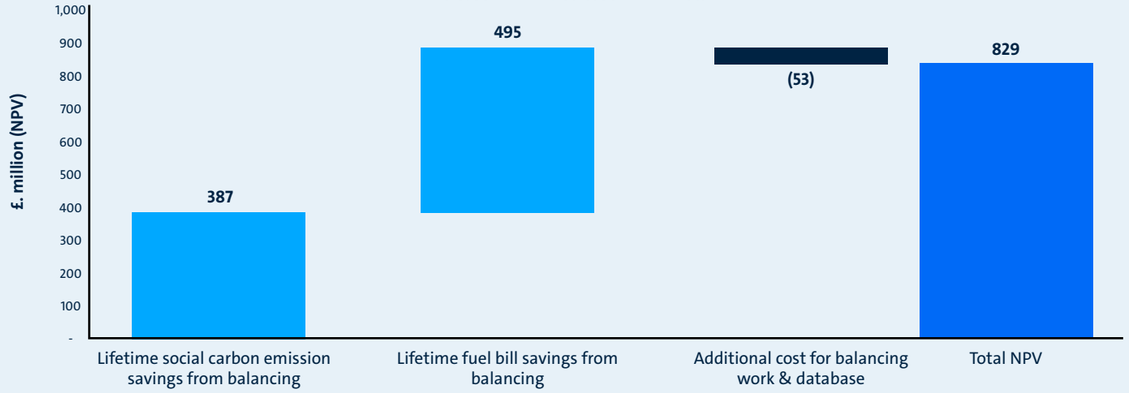

Figure 7: NPV of social carbon savings and fuel bill savings. Other source: Grundfos data and Gemserv calculation.

[39] Grundfos installer survey, which highlighted that although 74% of installers are familiar with balancing, just under half of these installers regularly carry out the practice. The analysis assumes for demonstrative purposes that the installers who know how to balance, but do not do so regularly, are incentivised to begin doing so as a result of being held accountable by the centralised database submission for each commission.

UPSKILLING INSTALLERS TRAINING STANDARDS

A route is needed to upskill or update the knowledge around pump strategy. This knowledge is not new or difficult but it needs to be part of a program of activity to keep installers informed and up to date. Many companies offer their own training schemes which could be de-personalised to provide training companies with the raw material.

Training requirements should cover some core subjects:

- The relationship between pressure, flow and velocity.
- The relationship between heat, delta T and flow rates.
- The effect of different pipe diameters at different load conditions.
- How to interpret a pump curve.
- The duty point and how to correctly size a pump to meet the needs of the index circuit.
- How to correctly size and position expansion vessels in heating systems.
- The effect of using additional accessories in heating systems and their effect on pressure loss and flow rate.
- The effects on pressure loss with different system.
- The effect of high velocities on the system design.
- The overall impact of the system on the consumer when designing for different sized properties.
- Calculating the size of the pipework and selecting the correct pump for a heating system.
- System controls and the principles of setting a system to work.

The skills needed to apply this knowledge already exist in the installer base; the goal of courses covering this material is to refresh these skills and remind installers to apply them.

EXAMPLE OF CIPHE

- Training cost included in the pumping strategy analysis was based on a 1 day course + ½ day assessment costing £235, based on LCL. It was multiplied by the number of heat pump installers that would be needed to reach the CCCs level of ambition for heat pump deployment, can add share these numbers too if needed.
- CIPHE course is expected to take two days with the criteria listed on their website[40].

[40] CIPHE. 2020. Qualification Specification: Level 3 Award in Low Temperature Heating and Hot Water Systems in Dwellings. Available at: https://www.ciphe.org.uk/contentassets/aa72a4505f2445f0a03ffcd0fcb04002/qualification-specification-for-low-temperature-heating-systems-consultation-final-1_6_20.pdf

CONCLUSION

The widespread use of inefficient, non-compliant circulator pumps in UK buildings is contributing to wasted energy, increased carbon emissions, and unnecessary costs on energy bills for occupants. To address these detrimental effects, the installation of new compliant pumps is needed. The benefits of replacing old non-compliant pumps with new compliant pumps provide a cost-effective, quick, and low-hassle approach to meeting government energy bill, energy efficiency, and net zero targets.

This paper has highlighted how pump replacements can provide value for money for Government policy and can support landlords to comply with minimum energy efficiency standards, owing to their short payback time. Alongside policy support for pump replacements, best practices can be implemented whilst installing and servicing a heating system to improve their efficiency, such as ensuring the system is hydronically balanced and components are working efficiently. The implementation of this can be supported by investing in upskilling engineers on pump strategy, and developing a centralised digital database for verifying the installation and service.

Given the notable benefits of pump replacements, Grundfos is calling on Government to:

- Update scoring methodologies to reward pump replacements.
- Provide support for pump replacements with a £125 voucher through the Warm Homes Plan, and include pump replacements with scoring in the Energy Companies Obligation.
- Use MEES to drive the replacement of non-compliant pumps to more efficient compliant pumps in the domestic and non-domestic sector.
- Ensure that a minimum standard pump strategy is implemented to reduce efficiency losses and save consumers on their energy bills.

Find out more: grundfos.com

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