SUSTAINABLE ENERGY ASSOCIATION

Phasing out New Fossil Fuel Heating

A Proposal to Regulate the Carbon Intensity of Retrofitted Heating Systems

2025

Contents

Executive summary

This paper develops a proposal for a stepped approach to the final phase-out of new fossil fuel heating systems through a Carbon Intensity Standard (CIS) for future retrofit domestic heating. It proposes what the SEA believes are sensible, implementable, step changes in carbon intensity of future replacement heating systems, which progressively reduces the permitted carbon emissions from new installations or the replacement of major components of heating systems over the 2029 – 2036 period. This policy proposal sets out a long-term, technology-agnostic, market-driven decarbonisation of domestic space and water heating. It avoids picking winners and would give investors the confidence to invest in the technologies and infrastructure that will take the future place of today's fossil fuel boilers, against a stable and predictable regulatory background.

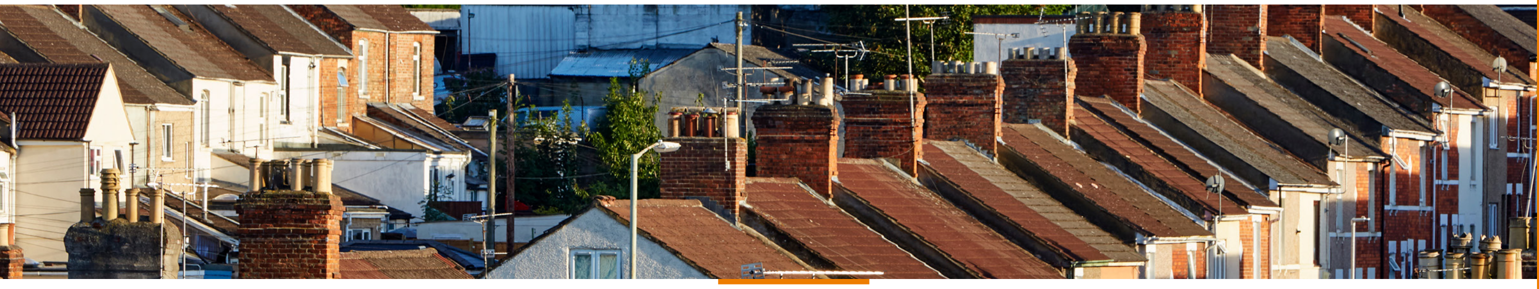
This proposal complements the early-stage subsidy schemes designed to support the uptake of individual technologies by regulating for step-change reductions in a technology-agnostic cap on carbon emissions per kWh of delivered heat. At its core, the Standard provides both a clear and implementable pathway from fossil fuel-based heating systems to low-carbon alternatives such as heat pumps, infrared, storage heaters and other forms of smart electric heating or biomass, benefiting both consumers and industry. It is designed in to allow the existing heating industry to adapt at each milestone by continuing, for the first two steps, (2029 and 2032) to allow today's dominant technology – condensing gas boilers – to continue to be installed, but progressively to require changes to their heat distribution systems (typically radiators) to ensure a new boiler operates to its maximum efficiencies. This approach lowers bills for those customers wishing to replace an existing boiler with another, but also ensures that existing hydronic central heating systems' operating temperatures are lowered, thereby making heat pumps more competitive by comparison and future-proofing the homes of those still choosing a boiler for the future installation of a heat pump.

The key findings of the modelling are that all the proposed stepped changes provide an **overall benefit to society due to the reduction in carbon emissions**. Heat pumps and direct electric heating technologies become **more competitive once levies on electricity bills are removed** and when the technologies utilise Demand Side Response (DSR). The Scenario without green levies on electricity bills and 50% DSR shows **heat pumps to be the cheapest form of heating in the first stage of the policy** (Step 1). A gas boiler at 55°C has a consumer Net Present Value (NPV) of £21,344 whilst a heat pump has a consumer NPV of £19,985.

For the substantial minority (around 20%[1]) of homes that do not currently have hydronic central heating systems, or where such systems are not cost-effective, the technology-agnostic nature of this policy also allows for competitive market entry for alternatives such as smart storage heaters, infrared, and other forms of low carbon heating, including biomass.

We believe this proposal, if implemented with the steps placed into legislation at the outset, would provide a clear and certain regulatory framework against which existing and new heating industry actors can have the confidence to invest in the technology development and associated installer capacity necessary to transition away from fossil fuel boilers over the next decade or so.

Finally, for full clarity, this proposal does **NOT** propose anyone should need to remove a well-functioning existing boiler. The proposal only applies to where a new boiler or other major component (such as the majority of the radiators, for example) requires changing.



Policy background

The UK Parliament has legislated to meet net zero emissions by 2050, with a 68% emission reduction target from 1990 levels to be achieved by 2030[2] – a target which is understood on an economy-wide basis to be particularly challenging. Reflected within the Climate Change Committee's (CCC) recent Carbon Budget[3], it notes UK progress in decarbonisation as slow and currently behind the curve.

Within government's long-term agenda for decarbonisation, domestic heat has been a notable priority over the years. Energy is required to heat the UK's 28 million homes and as of 2021, was responsible for 18% of total UK emissions[4]. A failure to decarbonise domestic heating has not necessarily been due to government inaction, as government continues to allocate bottom-up policy funding towards schemes designed to improve the uptake of low-carbon technology. Rather, it is a failure to roll out a successful series of policy ideas which effectively incentivise low-carbon technology adoption, and accurately consider the state of the UK supply chain at the time of each schemes implementation.

Decarbonising space and water heating requires increased adoption of low-carbon technologies and a gradual reduction in fossil fuel boiler installations until they are phased out entirely. In the new-build sector, the Future Homes Standard—set to be implemented by the Government in 2025—will regulate the maximum emissions intensity of new homes to a level unachievable with fossil fuel boilers. This will compel developers to adopt alternative, lower-carbon technologies for space heating and hot water. However, new builds represent only 10% to 15% of the market, with annual fluctuations depending on total boiler sales and the number of homes constructed.

Furthermore, the high costs of energy disincentivises the uptake of low-carbon heating and hot water systems within the retrofit market. This is further exemplified by increasing levels of fuel poverty in the UK, slowing down progress to eliminating fossil fuels.

THE SUBSIDY FRAMEWORK IN THE RETROFIT SECTOR

The subsidy framework has started to make progress through current and previous subsidy schemes for heat pumps. However, in 2023 only 60,000 heat pumps were installed[5], far below the target of 600,000 per year by 2028 and the circa 1 million needed by 2030 according to the Climate Change Committee[6], representing the need for a tenfold increase in installations needed within 3 short years. Out of the 17 European countries examined in 2021, the UK had the slowest rate of heat pump installations[7]. Moreover the Government has indicated in discussion with industry that heat pumps may not be the most cost-effective solution for up to 20% of current homes, and there is so far very little by way of subsidy, regulation, or other encouragement for the uptake of solutions other than heat pumps – such as biomass, or alternative electric heating solutions like infra-red, modern storage heating or pulse-controlled systems.

Finally, to set the scene: while bottom-up, technology-focused subsidy schemes are beneficial in the early years to develop the market, relying solely on subsidies to transition the heating market from fossil fuel boilers to alternative systems is unsustainable. For instance, if the current Boiler Upgrade Scheme grant of £7,500 per installed heat pump were to be maintained once deployment reaches 1 million installations per year, the cost of the subsidy alone would amount to £7.5 billion annually. Although this may represent an upper limit and the grant level is likely to decrease over time, the installation and running costs of heat pumps are expected to remain significantly higher than those of boilers for the foreseeable future. Therefore, any exclusive reliance on subsidies to encourage uptake would require several billion pounds at any realistic future estimate.

The next section provides a brief overview of some of the Government's efforts to promote low-carbon technology uptake through previous schemes. It is also worth noting other retrofit schemes in the UK such as the Energy Company Obligation, Social Housing Decarbonisation Fund, Home Energy Scotland and the Welsh Optimised RetroFit Programme.

RENEWABLE HEAT INCENTIVE: 2014 – 2021

The Renewable Heat Incentive (RHI) was launched to promote renewable heat technologies in homes, businesses, and communities through financial incentives. However, it notably excluded air-to-air heat pumps and ultimately achieved only one-third of its targeted emissions reductions. While the programme led to the installation of around 60,000 renewable appliances, this figure was overshadowed by the installation of 6.2 million gas boilers during the same period[8].

Several factors contributed to the RHI's limited success. The scheme set overly optimistic targets and failed to address key barriers, such as the high upfront costs of renewable technologies compared to cheaper gas and oil boilers—a challenge that remains relevant today. The Government also recognised a limited understanding of consumer preferences regarding heating options and called for a more integrated policy approach. In Northern Ireland, a flawed payment structure enabled individuals to profit from excessive renewable energy use, as payments exceeded fuel costs.

In response to these issues, the Public Accounts Committee (PAC)[9] urged the Government to establish clear goals, metrics, and milestones to support a sustainable low-carbon heating supply chain in future policies.

GREEN HOMES GRANT: 2020 – 2021

The Green Homes Grant (GHG) aimed to fund energy-saving improvements, such as fabric insulation and low-carbon heating upgrades, with an ambitious target of reaching 600,000 homes. Only 47,500 homes received benefits, falling significantly short of this goal. Out of the Government's £1.5 billion allocation, only £315 million was utilised, with 16% of total funding directed towards administrative costs[10].

While the GHG aimed to deliver energy-saving improvements and stimulate growth within the energy efficiency supply chain, its abrupt termination reportedly led to widespread redundancies and bankruptcies in the sector[11]. The PAC later highlighted that[12], while training specialists to support the GHG's objectives could require 48 months to four years, the programme itself was designed and launched within just 12 weeks. The PAC also noted that government retrofit schemes have often been short-term and have fallen short of optimistic promises[13], underscoring the need for thorough, long-term planning to ensure effective use of resources and adequate preparation for delivery.

BOILER UPGRADE SCHEME: 2022 – 2028

The Boiler Upgrade Scheme (BUS) is a grant initiative designed to assist households in offsetting the cost of replacing fossil-fuel heating systems with low-carbon alternatives that include heat pumps and biomass boilers. Despite its objective of promoting sustainable heating transitions, uptake has been limited. The House of Lords Environment and Climate Change Committee has noted that at current participation rates, only half of the allocated budget is likely to be utilised[14], making it improbable that the Government's target of installing 600,000 heat pumps by 2028 will be achieved.

A significant challenge has been the shortage of qualified installers, which restricts capacity to meet even the current demand[15]. Additionally, high upfront costs have proven prohibitive, particularly for low-income households, further limiting the scheme's reach. Studies from Nesta[16] and findings from government inquiries indicate that public awareness remains low, with many households uncertain about their eligibility and the benefits of low-carbon heating options.

MOVING FROM FRAGMENTED POLICIES TO A UNIFIED DECARBONISATION STRATEGY

A more effective decarbonisation strategy for domestic heating requires moving away from bottom-up funding schemes and fragmented regulations. Instead, the focus should be on establishing a coordinated, top-down approach that sets clear limits on carbon emissions from heating. This approach would drive gradual improvements in emissions and support both the adoption and development of low-carbon technologies. The Future Homes Standard, for example, will set a precedent for new homes using the Target Emission Rates of the Building Regulations. The retrofit market would benefit from utilising a similar principle.

Today's condensing boilers, which typically have a cheaper up-front cost, and in some cases are also cheaper to run, than low-carbon alternatives, have undermined the effectiveness of previous schemes. To address this, our proposed policy aligns with the recommendations of the Climate Change Committee, aiming to minimise costs and disruptions by allowing existing systems to operate until they reach their natural end of life[17]. It is designed to facilitate a smoother transition towards a variety of low-carbon technologies in the UK market.

The recent government decision to delay the phase-out of off-grid boilers until 2035, aligning it with the on-grid timeline, underscores the urgency for effective policies that can drive real emissions reductions in domestic heating. The UK is currently behind on both economy-wide and domestic heating decarbonisation. A comprehensive policy framework is essential for meeting interim targets, developing the market, increasing technology uptake, and reducing costs, ultimately enabling the full decarbonisation of space and water heating in homes. As the Climate Change Committee has highlighted, business confidence—and, consequently, investment—depends on clear, long-term policy commitments from the Government[18].

An overview of the Carbon Intensity Standard

The development of the proposed Carbon Intensity Standard (CIS) follows engagement with both its members and wider stakeholders. Notably, technologies involved go beyond the boiler and heat pump industry to also include the likes of for example, solar thermal, biomass, direct electric heating and electric showers.

Technology agnosticism is central to this proposal as it provides for the fairest and most competitive and investible approach to achieving a fully decarbonised society.

A NEED FOR MASS-MARKET DEMAND AND DEPLOYMENT

While low-carbon technologies are becoming more accessible, fossil fuel heating systems still dominate the home energy market. Recent analysis suggests that, to meet 2030 installation targets, approximately 10% of homes will need to transition to heat pumps—an increase from the current adoption rate of around 1%[19]. At the same time, there is significant potential for other technologies to capture portions of the heating market. For example, heat networks are estimated to fulfil up to 20% of total heating demand by 2050[20], while direct electric solutions could address an additional 20% gap in the market, helping to meet the UK's heating needs.

Despite substantial challenges in meeting the UK's legally binding climate goals, low-carbon technologies are advancing toward viable mass-market solutions. However, creating the necessary ecosystem to support large-scale delivery and adoption will be crucial to achieving this transition.

A CARBON INTENSITY STANDARD

We propose a Carbon Intensity Standard (CIS) that introduces sensible, implementable step changes in carbon intensity which progressively reduce the permitted carbon emissions from new installations of heating systems over the 2029 – 2036 period. This proposal provides a long-term, predictable, investible, market-driven decarbonisation of domestic space and water heating. It complements the early-stage subsidy schemes by placing a regulatory cap on carbon emissions per kWh of heat generated through these step changes.

The first two of these step changes are calibrated to continue allowing the installation of replacement fossil fuel boilers, but with the goal of improving their in-situ performance efficiency by reducing their operating temperatures. In some cases, ancillary work such as changing radiators or pipework will be necessary to achieve the year-round efficiencies modern boilers are capable of, but cannot deliver unless the water returning from to the boiler from the heating system is below 55°C.

As efficiency limits approach 93-94%, the adoption of hybrid systems—combining boilers with low-carbon heating technologies—will become essential to meet space and water heating demands. As illustrated in Figure 1, the subsequent stage requires the use of standalone systems like heat pumps, direct electric heating, or biomass for new installations starting from the year 2036.

The proposal acknowledges the political sensitivity of banning boilers, as highlighted by Labour's continued commitment to not force people to "rip their boilers out"[21]. To be clear, this proposal does NOT propose anyone is required to remove a well-functioning heating system or component such as a boiler. Instead, it would require that the carbon intensity standard in force at the time is met whenever a major component such as a boiler is changed. Our proposal is supported by detailed modelling which calibrates the carbon intensity values, and their proposed implementation dates, seen below in Figures 1 and 2.

Space Heating	Step 0	Step 1	Step 2	Step 3	Step 4
Start Year	2025	2029	2031	2034	2036
End Year	2029	2031	2034	2036	N/A
Maximum CI (kgCO_2e/kWh)	0.21429	0.20225	0.19565	0.05583	0.02500
Gas Boiler (70°C)					
Gas Boiler (55°C)					
Gas Boiler (40°C)					
Hybrid Heat Pump with Boiler at 70°C					
Direct Electric Heating					
Heat Pump					
Biomass Boiler					

Figure 1 - Space Heating Technologies compliant with proposed Carbon Intensity Standard Thresholds.

Domestic Hot Water	Step 0	Step 1	Step 2	Step 3	Step 4
Start Year	2025	2029	2031	2034	2036
End Year	2029	2031	2034	2036	N/A
Maximum CI (kgCO_2e/kWh)	0.21429	0.20225	0.19565	0.05583	0.02500
Combi Gas Boiler					
System Gas Boiler					
Solar Thermal and Boiler					
Immersion Heating					
Heat Pump					
Solar Thermal and Immersion					
Solar Thermal and Heat Pump					

Figure 2 - Hot Water Technologies compliant with proposed Carbon Intensity Standard Thresholds.

At its core, the Standard provides both a clear and sensible pathway from fossil fuel-based heating systems to low-carbon alternatives, benefiting both consumers and industry. In alignment with the demands of the CCC[22], it offers a long-term, consistent message on the importance of climate action to businesses and households. Supported by policy, this framework aims to encourage investment and remove barriers to the deployment of low-carbon technologies, drawing on the lessons learned from the rollout of past and present programmes. However, recent policy changes, such as the rollback of the 2026 off-grid boiler phase-out and the reduction in heat pump credit obligations under the Clean Heat Market Mechanism from £3,000 to £500, have created a weaker incentive than previously expected, so underscoring the urgent need for clear and consistent policy direction for both industry and consumers.

Clarity is essential for both decarbonisation efforts and preserving jobs in the heating industry. Many of these companies are prepared to transition to low-carbon technologies but need clear timelines to guide their efforts and effectively allocate capital. A CIS can provide this certainty, helping to address decarbonisation challenges of domestic heating while supporting industry adaptation.

Implementation

Decarbonising heat and water are widely acknowledged as a complex challenge, evidenced by the limited progress in this area to date. A CIS offers a practical, structured approach to decarbonising heating systems. While some costs will inevitably fall on consumers, the urgency of addressing climate goals in line with legally binding targets means these costs are largely unavoidable.

We recognise that traditional boilers are affordable, and while various factors contributed to the shortcomings of schemes like the RHI and GHG, cost remains central to the discussion. Given the sensitivity around passing the costs of new heating technologies onto consumers, we advocate for continued financial assistance particularly for low-income consumers, and some of the current grant funding could, for example, be used in a more focussed way to assist low-income consumers with the additional cost of radiator upgrades or other ancillary work needed to comply with the CIS. The detail of that is not within the scope of this proposal, but is put forward to address obvious questions that this proposal may create. However, as competition increases, prices are expected to fall, reducing the need for significant government support. Currently, schemes like the Boiler Upgrade Scheme support only a limited range of technologies but adopting a technology-agnostic approach would foster competition, driving down costs across a wider spectrum of solutions needed for decarbonisation. In turn, alternative technologies to boilers would become progressively more competitive by comparison, thereby reducing the future need for subsidy. Such appetite as a future Government may have for continued subsidy could then be re-focussed more effectively into assisting with heating system upgrades, particularly for low-income consumers, as necessary.

RADIATOR UPGRADE SCHEME

We recognise the concerns surrounding fuel poverty and the financial constraints faced by many households. Ensuring an inclusive transition is essential, which is why we propose a means-tested "Radiator Upgrade Scheme" for hydronic systems, top assist low-income consumers with the additional cost of meeting the standard, and directing support where it is most needed. For households where lower boiler flow rates might reduce warmth, additional, larger radiators may be required. A means-tested scheme can help address fuel poverty concerns, ensuring those unable to fully afford new heating technologies are not left behind.

IMPLEMENTATION OF THE PROPOSAL – INITIALLY THROUGH ECODESIGN AND UPSKILLING OF OUR SUPPLY CHAIN

The implementation of these measures through the CIS would require regulatory oversight, which can be addressed in the initial three steps through the existing Ecodesign regulations[23]. Ecodesign legislates the environmental performance of specific products and can be used to monitor and mitigate environmental impacts while enhancing energy efficiency. A straightforward way to implement Steps 0-2 of this policy would be to legislate that the operating temperatures of any boiler sold after the date of a step-change are factory set to a lower temperature. This would require installers to ensure that the associated heat distribution system is fit for purpose, making any necessary changes to radiators and/or pipework to accommodate the lower operating temperature, while still providing sufficient heating capacity for consumers.

The Government is already considering this option, suggesting a factory-set maximum of 60°C to ensure year-round high-efficiency performance[24]. The Government are currently consulting on requiring all gas combination boilers being supplied with a 60°C low flow temperature factory default setting by mid-2026 in their latest consultation[25]. The first step in our proposal for a Carbon Intensity Standard would follow exactly the same legislative route, but requiring 55°C, the temperature at which water returning from the heating system to the boiler will ensure that the water vapour contained in flu gases condenses, thereby recycling heat back into the consumer's heating system, that would otherwise be vented to the outside air, and wasted. By setting the "flow" temperature at 55°C, this repeats the precedent introduced in June 2022 for all new heating systems[26].

A key consideration is the readiness of the supply chain, with installer competency playing a crucial role in ensuring that boilers function properly as new standards are introduced. The Government has previously consulted on Improving Boiler Standards and Efficiency[27], and a significant majority of respondents supported the need for boiler installers to be trained in low-temperature heating system design. The Government's response indicates an intention to proceed with this requirement. While these measures may seem challenging, the heating industry has a proven track record of adapting to rapid changes, as demonstrated by the introduction of condensing boilers in 2005 (seen in Figure 3).

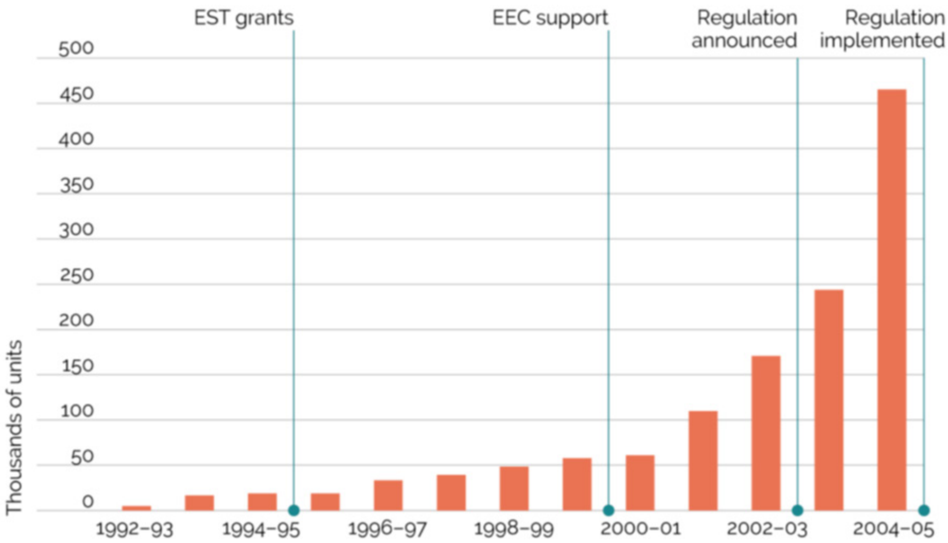


Figure 3 - Condensing boiler installations in the UK 1992 to 2005[28].

In this case, a significant installer training programme took place in a short period of time, with the Government, manufacturers, the Energy Saving Trust and other partners collaborating to retrain around 65,000 heating engineers in under 2 years. This provides for a powerful case study of how quickly the heating industry can transform when facing clear and unwavering regulatory interventions.

In summary, while government oversight ensures regulation is enforced where necessary, this Carbon Intensity Standard policy proposal assigns responsibility to both boiler manufacturers and installers. By providing installers with the necessary training, the proposal ensures that efficiency standards are consistently met, fostering shared accountability for regulatory and performance outcomes, even in the absence of direct government involvement. Importantly, if we are to have a successful, long-term, joined-up policy, the supply chains of technologies in both Step 3 & 4 parameters of the CIS must be supported simultaneously.

Methodology

The calibration points were designed to represent practical step changes. Initially, the proposed standard is equivalent to a gas boiler operating at a flow temperature of 70°C. This means that today's practise of boiler changes that do not require evaluations of operating temperatures or ancillary system changes to meet a particular temperature requirement can continue as normal until Step 1. Step 1 is not proposed to be introduced until 2029 to allow for relevant legislation to be consulted on, introduced, and the industry given a sufficient lead time to adjust to the changes and introduce the necessary training and other supply chain changes. In Steps 1 and 2, the carbon intensity standard is calibrated to be the equivalent of a condensing boiler whose maximum flow temperature is reduced to 55°C and 40°C respectively, enabling the boiler to operate more efficiently with reduced carbon emissions[29]. The Step 3 carbon intensity standard is calibrated to be the equivalent of a hybrid heat pump system, with the heat pump component delivering 80% of the space heating demand. This 80% contribution is based on findings from trial data obtained by the University of Salford, the Energy House Labs and Nesta, which demonstrated that high-quality hybrid installations can achieve this level of heat pump performance annually[30] .The final step represents a carbon intensity equivalent (at the time of its introduction in 2036) of direct electric heating, which is by the time the grid is expected to be all but fully decarbonised. The modelling used to support this proposal uses carbon intensity values derived from the Government's Green Book assumptions to account for the efficiency of the technology and the emission intensity of the fuel used in each case[31].

Emissions intensities for the Domestic Hot Water technologies were calculated in a similar manner. It is assumed that solar thermal panels meet 60% of domestic hot water demand, with the remaining 40% being provided by the backup system[32].

Data on domestic hot water sCOPs, including the impact of waste heat recovery, was provided by SEA Members. Improvements in the sCOP of heat pumps was taken from research conducted by the Sustainable Energy Association of Ireland (SEAI) on Low Carbon Heating and Cooling Technologies.[33]

Across each scenario a single property archetype has been used to limit the volume of modelling required for what is, in this paper, a conceptual proposal. This was taken from Gemserv's proprietary archetype modelling tool. It was modelled as a Detached House built between 1965 and 1980. Table 1 below indicates the dimensions.

Table 1 - Dimensions of modelled property used within the scenarios.

Property area	Dimension
Room Height	2.5 m
Floor Area	74.91 m^2
Roof Area	74.91 m^2
Wall Area	122.99 m^2
Window Area	26.47 m^2
Door Area	3.8 m^2

We assumed a delivered space heating demand of 9,972 kWh per annum. We also assumed a delivered domestic hot water heat demand of 1,590 kWh per annum[35].

Consumer costs and societal costs were both considered. Societal costs were modelled using the Social Cost of Carbon[36](SCC) values used by the Government. A discount rate of 3.5% was applied[37].

Costs were modelled with and without green levies on electricity bills. To assess the impact of removing green levies, the proportion of policy costs contributing to electricity prices was examined. According to Nesta's report[38], these policy costs add 4.82p/kWh to the price of electricity.

Costs were also modelled in scenarios with Demand Side Response (DSR). We had two DSR sensitives, a scenario with a 30% reduction in OPEX and a 50% reduction in OPEX.

When modelling heat pumps and direct electric heating, we assumed that the household would disconnect from the gas grid and thus not pay the gas standing charge.

SPACE HEATING COSTS

Consumer costings looked at CAPEX (capital expenditure) and OPEX (operational expenditure). CAPEX included the cost of the heating system itself and the costs of radiator upgrades and smart controls if needed. OPEX included the fuel bill, standing charges[39]and yearly maintenance. As per discussions with SEA Members, direct electric systems were assumed to have negligible maintenance costs. The maintenance costs for a biomass boiler was sourced directly from SEA Members. The maintenance cost for a gas boiler was taken from Let's Heat[40] and the maintenance costs for a heat pump was taken from British Gas[41].

CAPEX was annualised to allow for a fair comparison of heating systems with various lifespans. Boilers were assumed to have a 15-year lifespan[42] and electric heating systems were assumed to have a lifespan of 20 years[43,44].

DOMESTIC HOT WATER

When modelling domestic hot water systems, only the incremental CAPEX and OPEX were considered. For example, in hydronic heating systems, the CAPEX includes the cost of the hot water cylinder. In the case of direct electric heating, the CAPEX corresponds to the cost of an immersion heater at £2000. For solar thermal heating systems, the costs encompass both the solar thermal panels and the hot water cylinder. The OPEX was limited to the fuel bill necessary to meet domestic hot water requirements.

To facilitate a fair comparison across various technologies, CAPEX was annualised. It was assumed that hot water cylinders have a lifespan of 10 years, immersion heaters a lifespan of 3 years, and solar thermal panels a lifespan of 25 years.

Results

SPACE HEATING TECHNOLOGY EMISSIONS PERFORMANCE OVER TIME

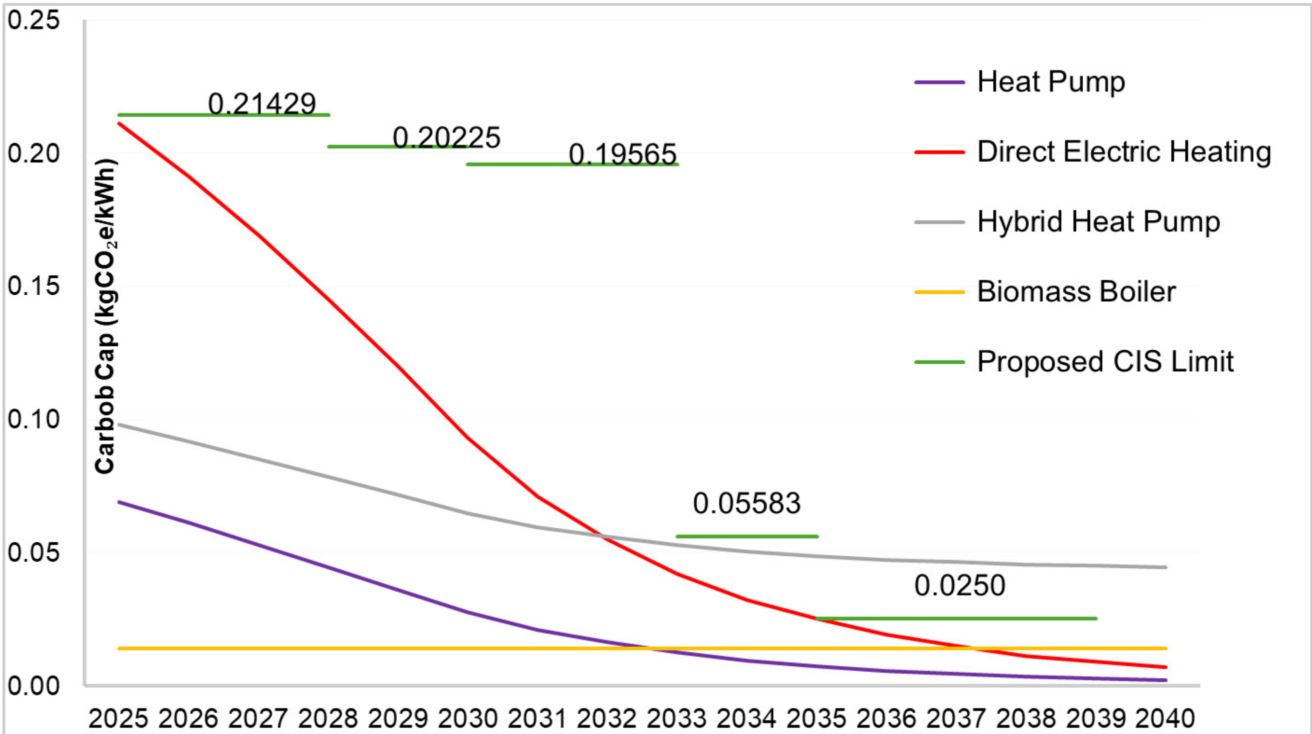


Figure 4 - Heating technology emissions between 2025 – 2040, based on the CIS.

Figure 4 illustrates the trends in carbon intensity across various space heating technologies over time. With the decarbonisation of the electricity grid underway—driven by the Labour Government's target of a 95% decarbonised grid by 2030[45]—electric technologies see the most significant and immediate reductions in carbon emissions. Heat pumps and hybrid systems also benefit from ongoing technological advancements, reflected in improvements to their seasonal coefficients of performance (sCOPs).

The calibration points were designed to represent practical step changes. Initially, a gas boiler is assumed to operate at a flow temperature of 70°C. In Steps 1 and 2, the maximum flow temperature is reduced to 55°C and 40°C, respectively, enabling the boiler to operate more efficiently with reduced carbon emissions[46].
The significant reduction in permitted carbon intensity in Step 3 reflects a hybrid heat pump system, with the heat pump delivering 80% of the space heating demand. This 80% contribution is based on findings from the EoH trial data, which demonstrated that high-quality hybrid installations can achieve this level of heat pump performance annually[47] .

The final step represents the carbon intensity of direct electric heating, which by the time of implementation will rely on a fully decarbonised grid. The carbon intensity for each system accounts for the efficiency of the technology and the emission intensity of the fuel used[48].

DOMESTIC HOT WATER TECHNOLOGY EMISSIONS PERFORMANCE OVER TIME

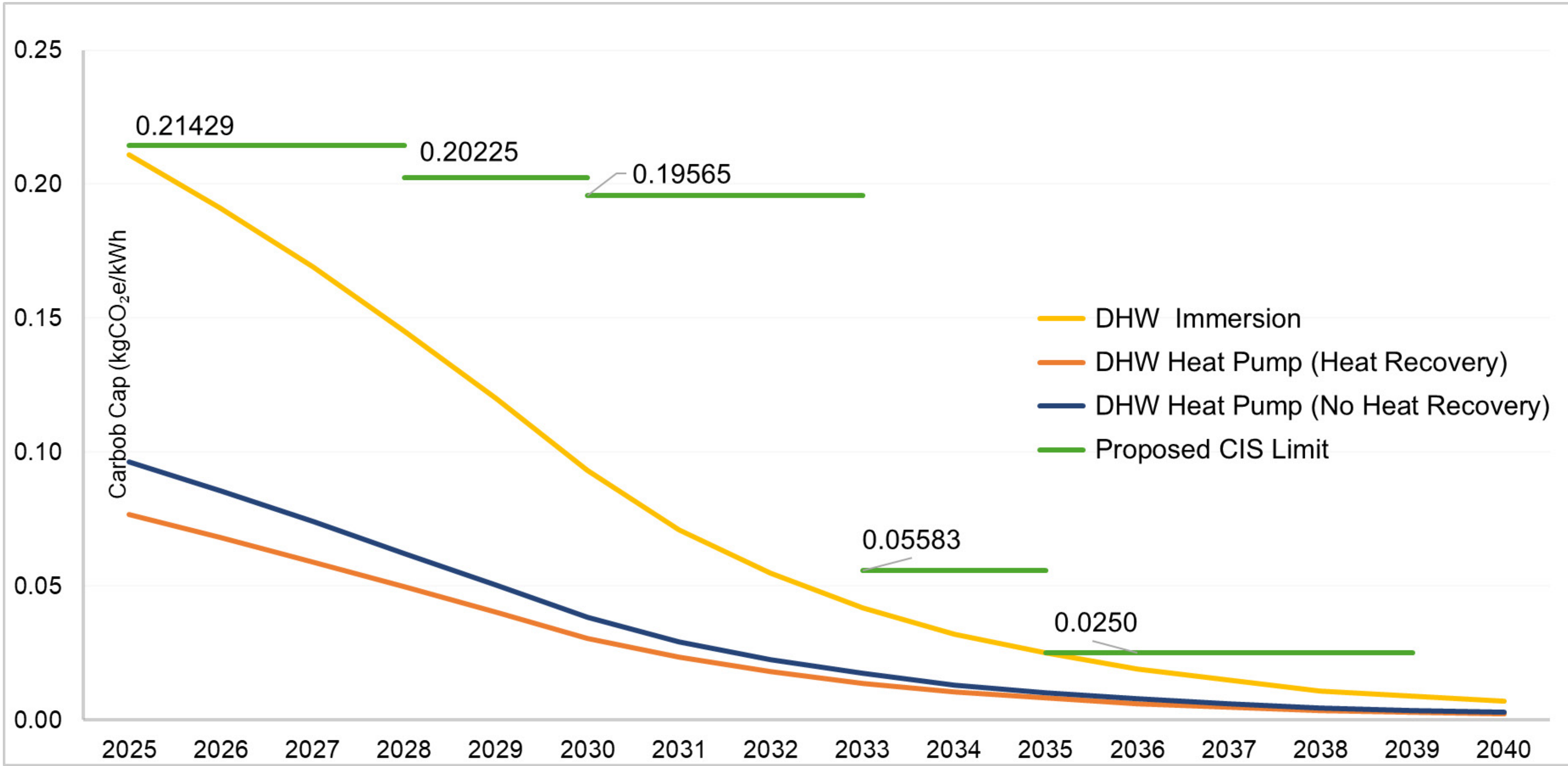


Figure 5a: Hot water emissions between 2025 – 2040, based on the CIS.

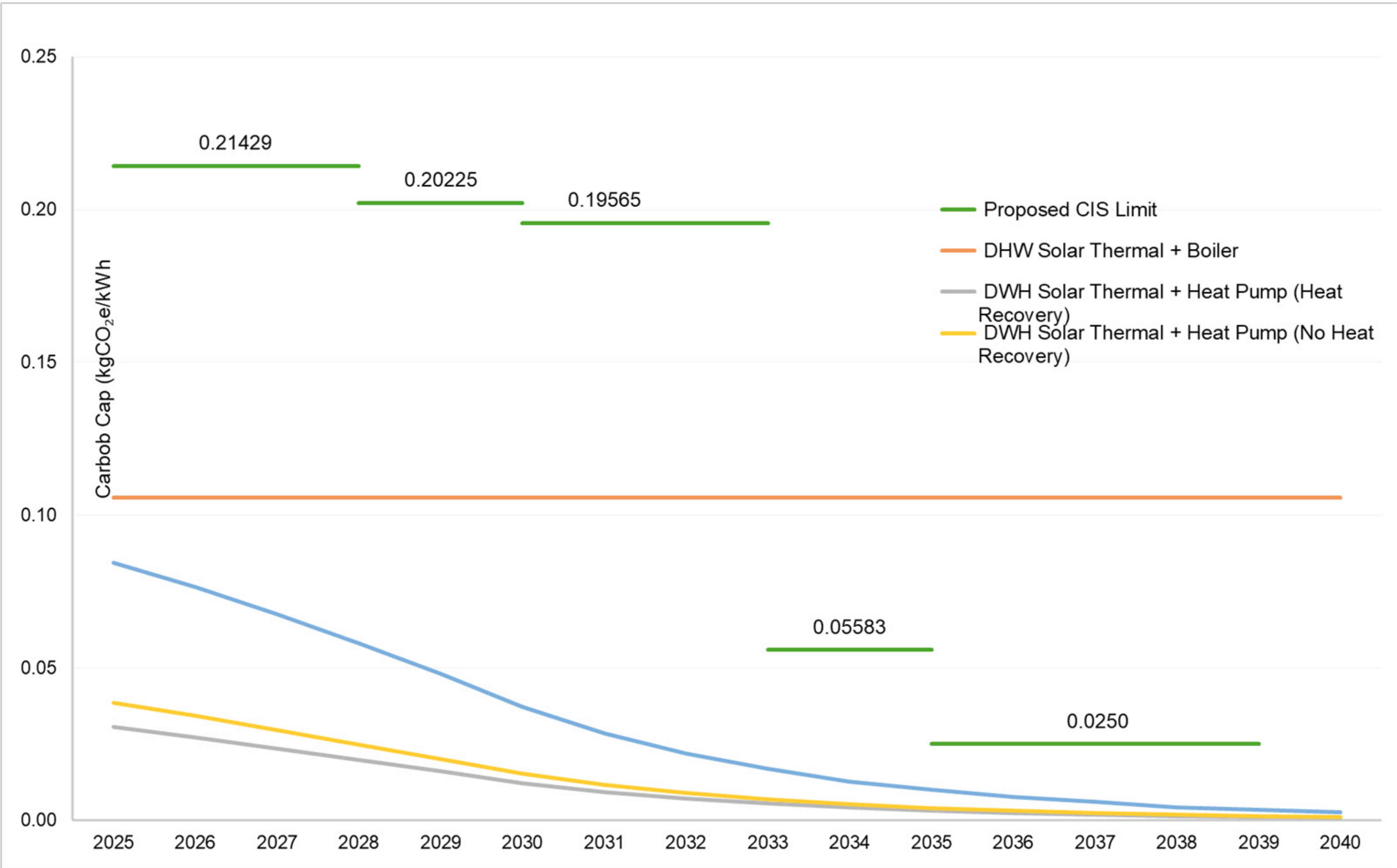


Figure 5b: Hot water emissions between 2025 – 2040, based on the CIS.

Figures 5a and 5b illustrate the performance of domestic hot water technologies over time. By the final steps, the only remaining technologies are direct electric heating, heat pumps, and solar thermal system with an electric backup.

Step 0: Boiler at a flow temperature of 70°C

Step 1: Boiler at a flow temperature of 55°C

Step 2: Boiler at a flow temperature of 40°C

Step 3: Hybrid Heat Pump System with a Boiler at 70°C

Step 4: Heat Pump System

BASE CASE SCENARIO RESULTS:

STEP 0 VS STEP 1:

The increase in up-front cost to the consumer is £540 as this is the cost of three additional radiators and a smart control system. The decrease in discounted running costs to the consumer is £588. After annualising the CAPEX, the difference in total ownership cost to the consumer is an increase of £148. From a societal perspective, the value of avoided carbon (the Social Cost of Carbon) is £600. When added to the difference in cost the consumer faces, the cost difference to society overall is a reduction of £452.

STEP 0 VS STEP 2:

The change in up-front cost to the consumer is £890 as is the cost of six additional radiators and a smart control system. The decrease in discounted running costs to the consumer is £841. After annualising the CAPEX, the difference in total ownership cost to the consumer is an increase of £295. From a societal perspective, the value of avoided carbon (the Social Cost of Carbon) is £885. When added to the difference in cost the consumer faces, the cost difference to societal overall is a reduction of £590.

STEP 0 VS STEP 3:

The change in up-front cost to the consumer is £3,980 as this is the how much extra a hybrid heat pump would cost compared to a gas boiler. We have assumed that CAPEX cost reductions continue. The discounting running costs increase by £2,222. After annualising the CAPEX, the difference in total ownership cost to the consumer is an increase of £4,893. From a societal perspective, the value of avoided carbon (the Social Cost of Carbon) is £6,598. When added to the difference in cost the consumer faces, the cost difference to societal overall is a reduction of £1,706.

STEP 0 VS STEP 4:

The change in up-front cost to the consumer is £3,980 as this is the how much extra a heat pump would cost compared to a gas boiler. We have assumed that CAPEX cost reductions continue. DESNZ have assumed that the CAPEX cost of a hybrid heat pump is equivalent to the CAPEX cost of a heat pump. The discounting running costs fall by £1,034. After annualising the CAPEX, the difference in total ownership cost to the consumer is an increase of £1,814. From a societal perspective, the value of avoided carbon (the Social Cost of Carbon) is £8,545. When added to the difference in cost the consumer faces, the cost difference to societal overall is a reduction of £6,731.

POLICY COSTS AND DEMAND SIDE RESPONSE

The above results reflect the case scenario of carbon intensity implementation, which includes the retention of policy costs (green levies) on electricity and the non-implementation of Demand Side Response (DSR). It can also be noted that we are seeing positive momentum from through the introduction of SMETER consideration in recent consultations[49].

When levies are removed and DSR is introduced, the outcomes change significantly. In the 30% DSR scenario, where policy costs are still applied to electricity, the final step—transitioning from a gas boiler to a heat pump—yields NPV consumer savings of £383. In contrast, the 50% DSR scenario shows NPV savings of £1,847.

Once the levies on electricity are removed, the NPV savings increase to £1,566 and £2,692 for the 30% and 50% DSR scenarios, respectively.

Visualisation of the results can be found in the Space Heating Annex.

DOMESTIC HOT WATER

The combination of solar thermal systems with electric heating produces the lowest-emissions heating solution, as solar thermal panels generate emissions-free heat. Given that the CAPEX for domestic hot water only reflects the incremental costs, heat pumps become more cost-competitive compared to fossil fuel heating systems.

In Step 0, a heat pump with waste heat recovery (WHR) is marginally cheaper for consumers overall compared to a system boiler, with a consumer NPV of £3,389 versus £3,483 for the system boiler. However, in scenarios where boilers are allowed, the analysis indicates that combi boilers are cheaper for DHW due to the absence of cylinder CAPEX costs.

Once electricity levies are removed and there is a 50% reduction in OPEX, only heat pumps with waste heat recovery provide total NPV consumer savings. In Step 0, the NPV consumer costs are nearly identical, with the heat pump with WHR being cheaper by just £0.05. In Steps 1 and 2, the NPV consumer savings for a heat pump with WHR compared to a combi boiler are £21 and £55, respectively.

Conclusions

This paper proposes what the SEA believes are sensible, implementable, step changes in carbon intensity of future replacement heating systems, which progressively reduces the permitted carbon emissions from new installations or the replacement of major components of heating systems over the 2029 – 2036 period.

The CIS policy proposal sets out a long-term, technology-agnostic, market-driven decarbonisation of domestic space and water heating. It avoids picking winners and would give investors the confidence to invest in the technologies and infrastructure that will take the future place of today's fossil fuel boilers, against a stable and predictable regulatory background.

THE KEY FINDINGS FROM THIS PAPER ARE THAT:

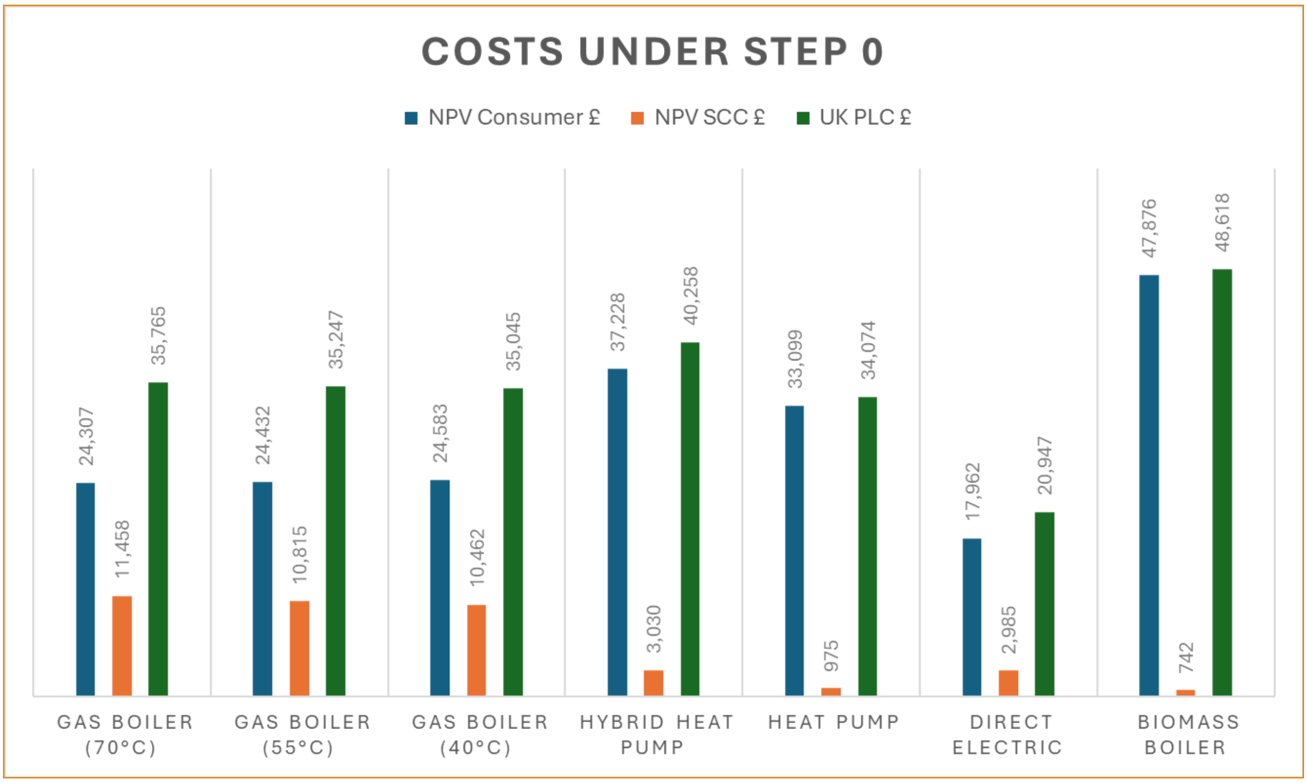
- All the proposed stepped changes provide an overall benefit to society due to the reduction in carbon emissions.
- Heat pumps and direct electric heating technologies become more competitive once levies on electricity bills are removed and when the technologies utilise Demand Side Response (DSR).
- The Scenario without green levies on electricity bills and 50% DSR shows heat pumps to be the cheapest form of heating in the first stage of the policy (Step 1).
- A gas boiler at 55°C has a consumer Net Present Value (NPV) of £21,344 whilst a heat pump has a consumer NPV of £19,985.

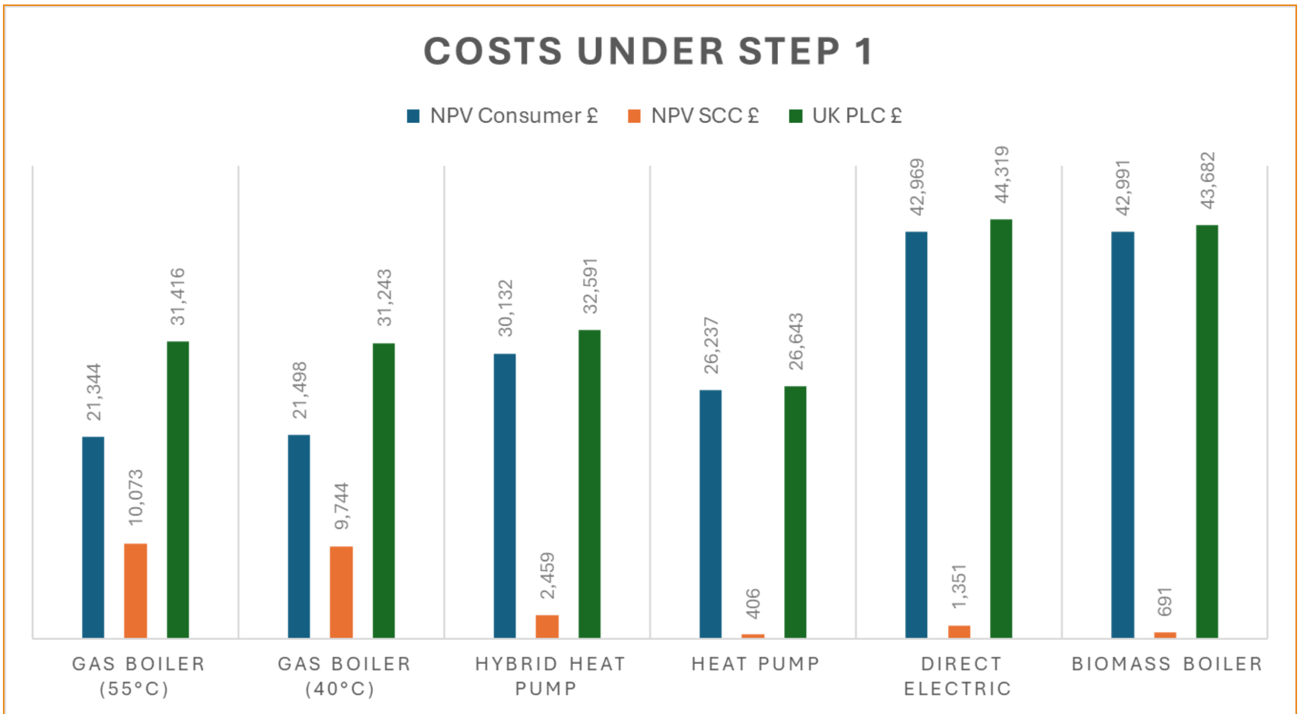
We believe this proposal, if implemented with the steps placed into legislation at the outset, would provide a clear and certain regulatory framework against which existing and new heating industry actors can have the confidence to invest in the technology development and associated installer capacity necessary to transition away from fossil fuel boilers over the next decade or so.

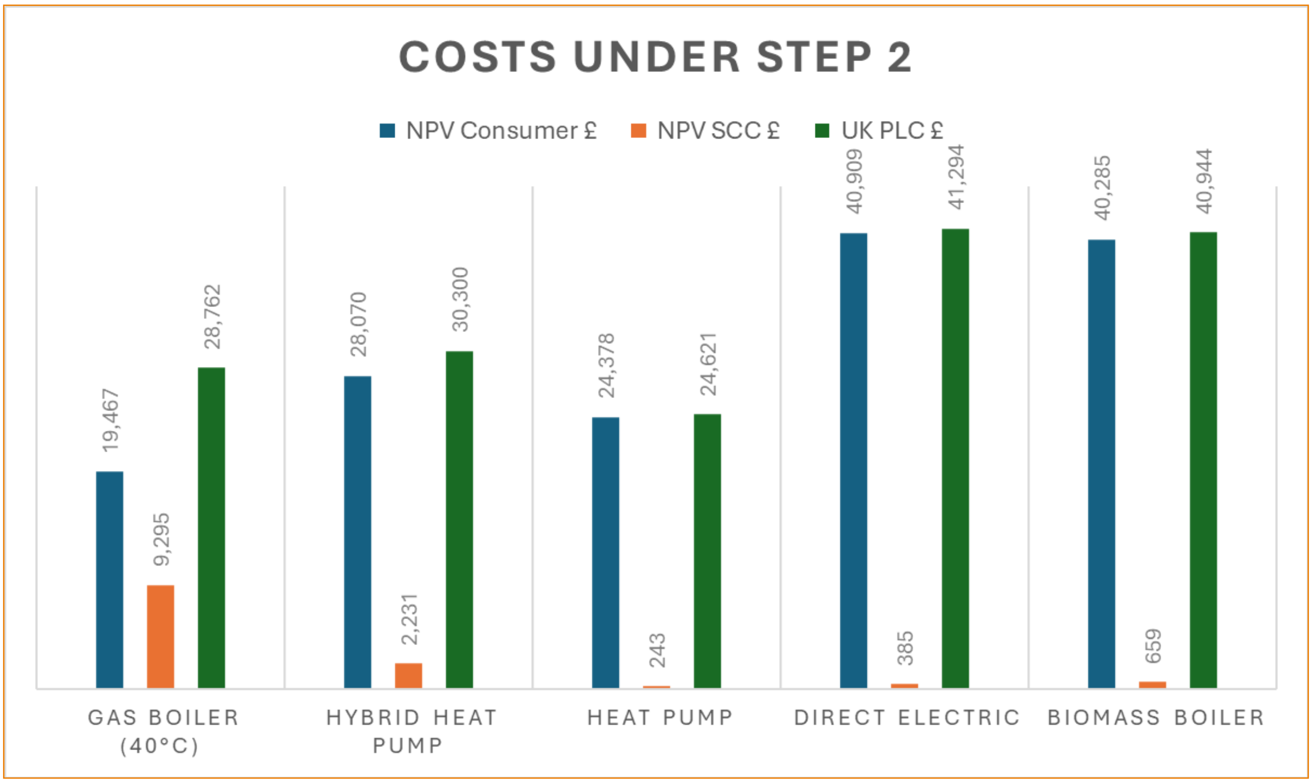
We therefore recommend to the Government to consider implementation of the CIS policy proposal. This will not only provide a clear route forward for the market but will enable decarbonisation of the UK's housing stock and ensure the 2050 net zero target can be met.

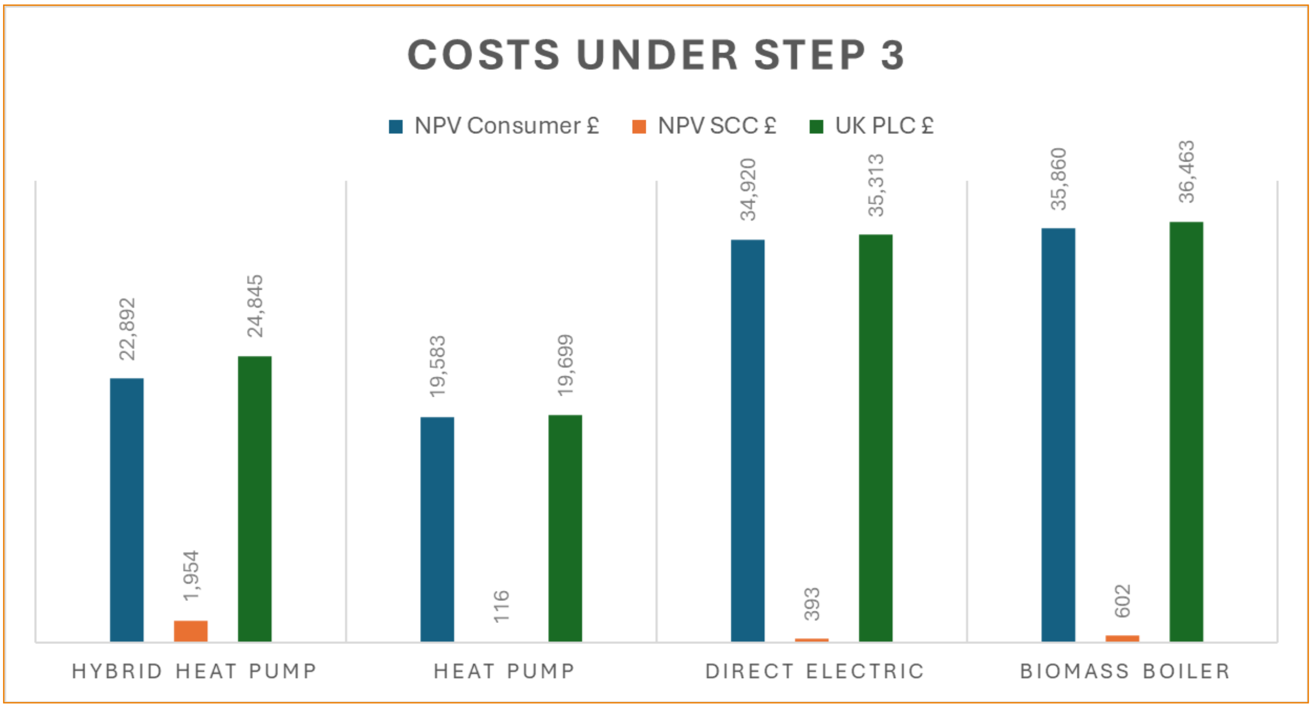
SPACE HEATING ANNEX

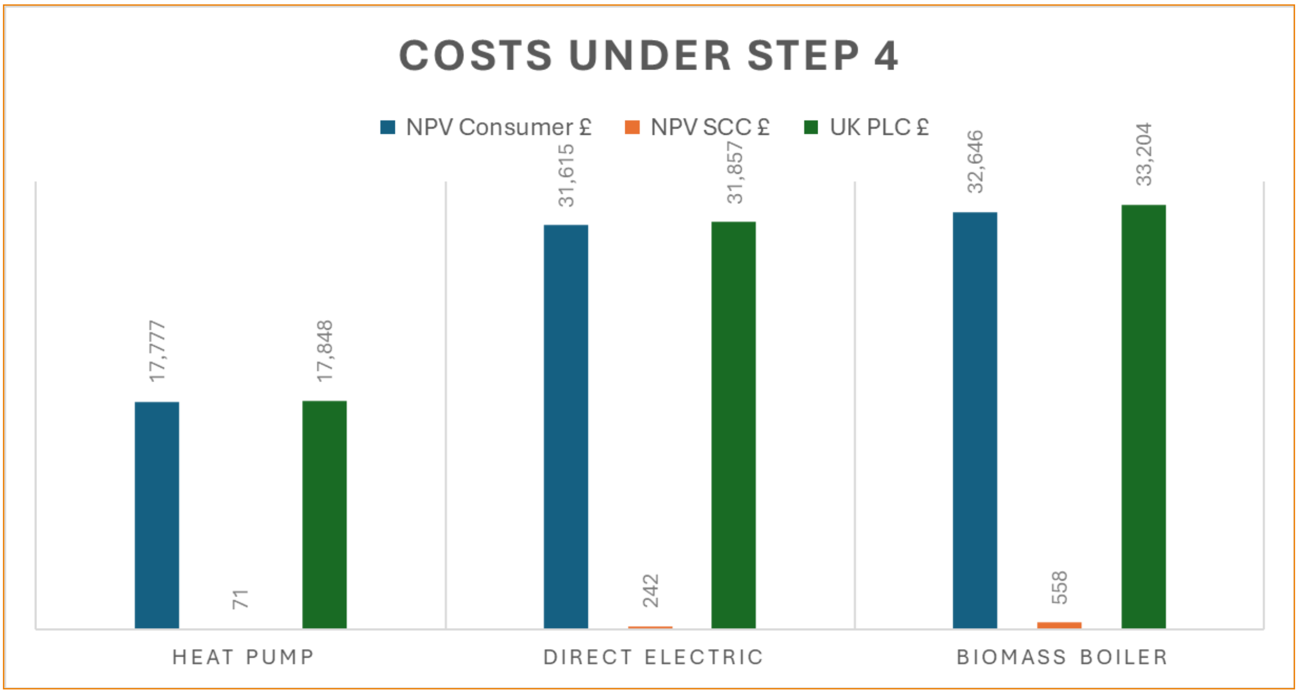
1. SPACE HEATING WITH LEVIES, NO DSR



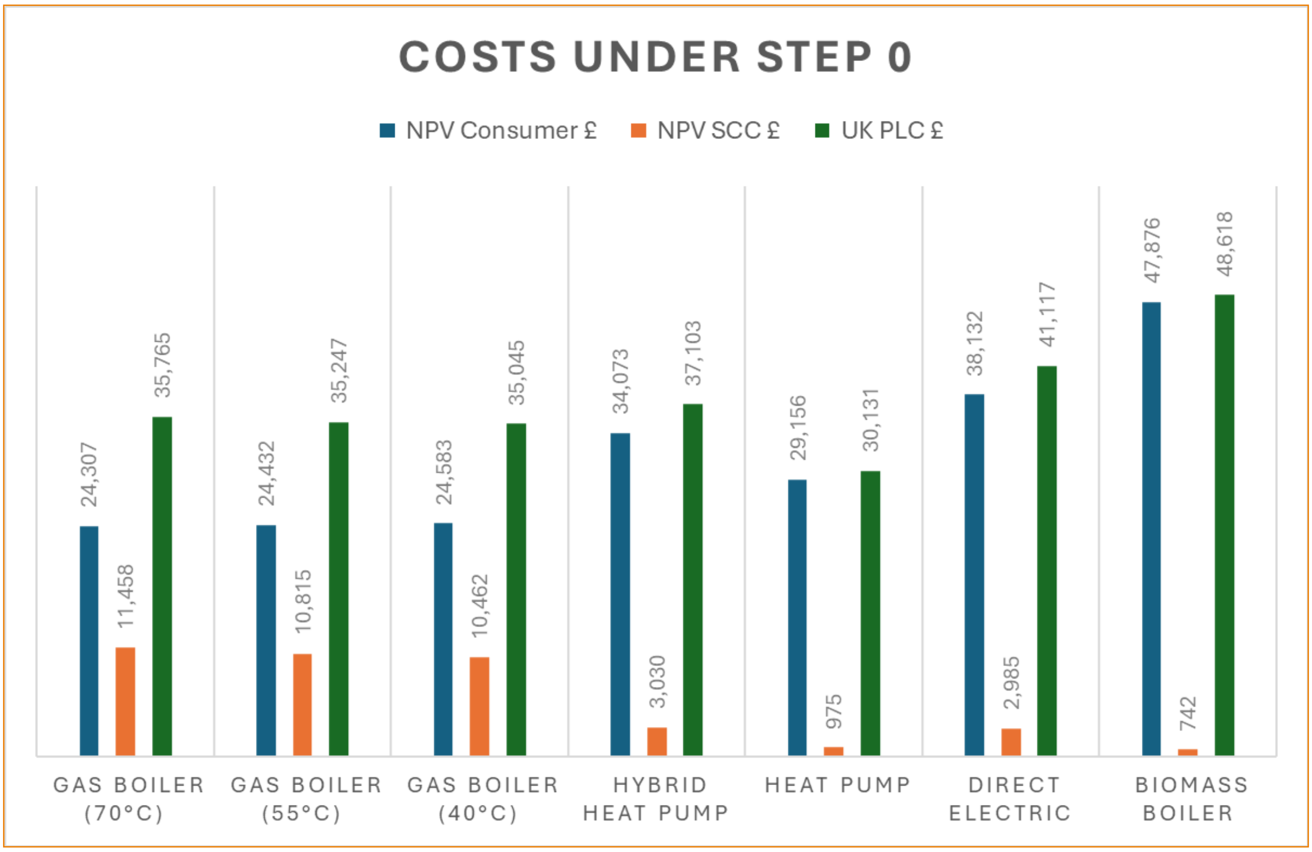


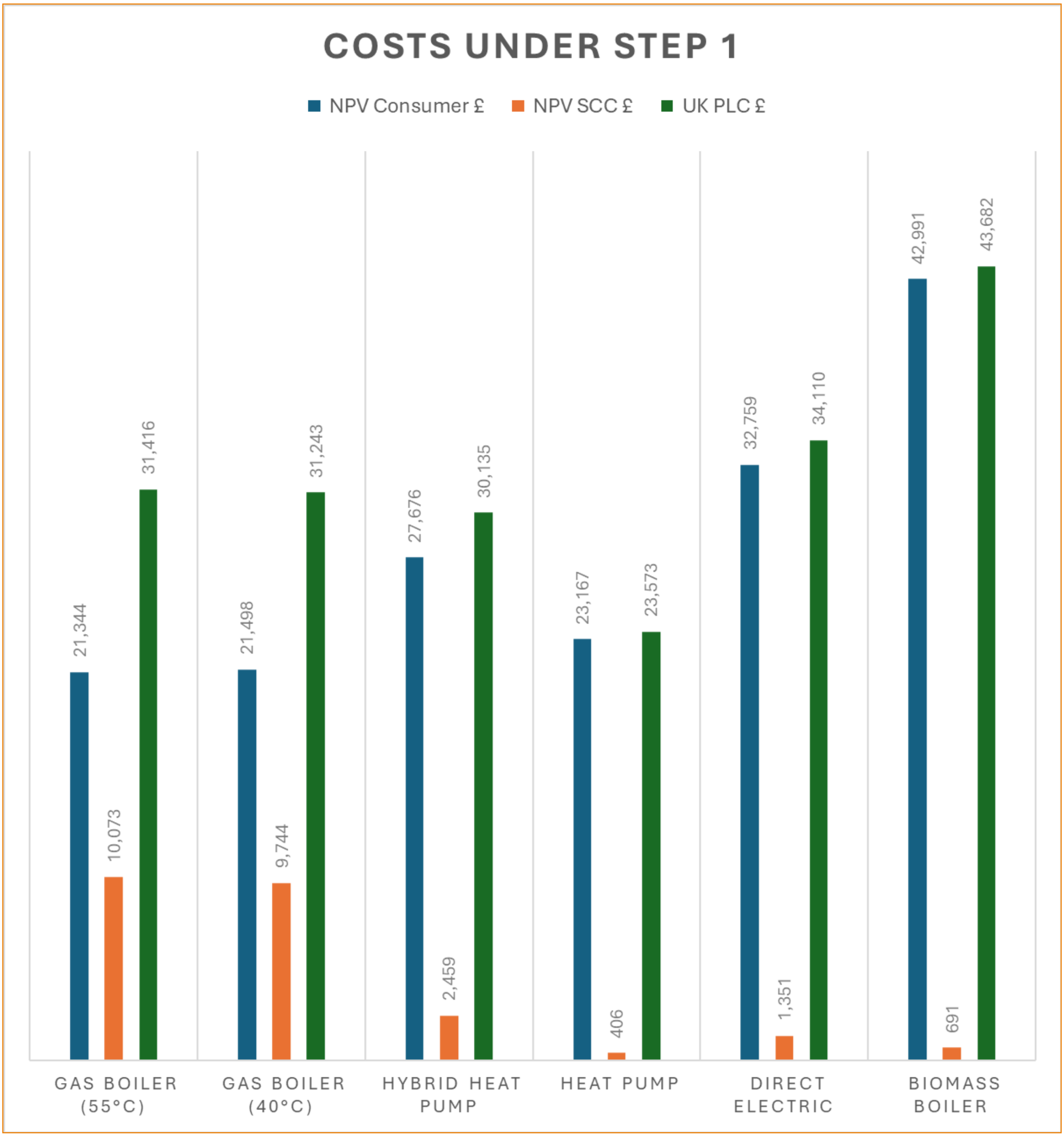

COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
19,467
9,295
28,762
28,070
2,231
30,300
24,378
243
24,621
40,909
385
41,294
40,285
659
40,944
GAS BOILER (40°C)
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

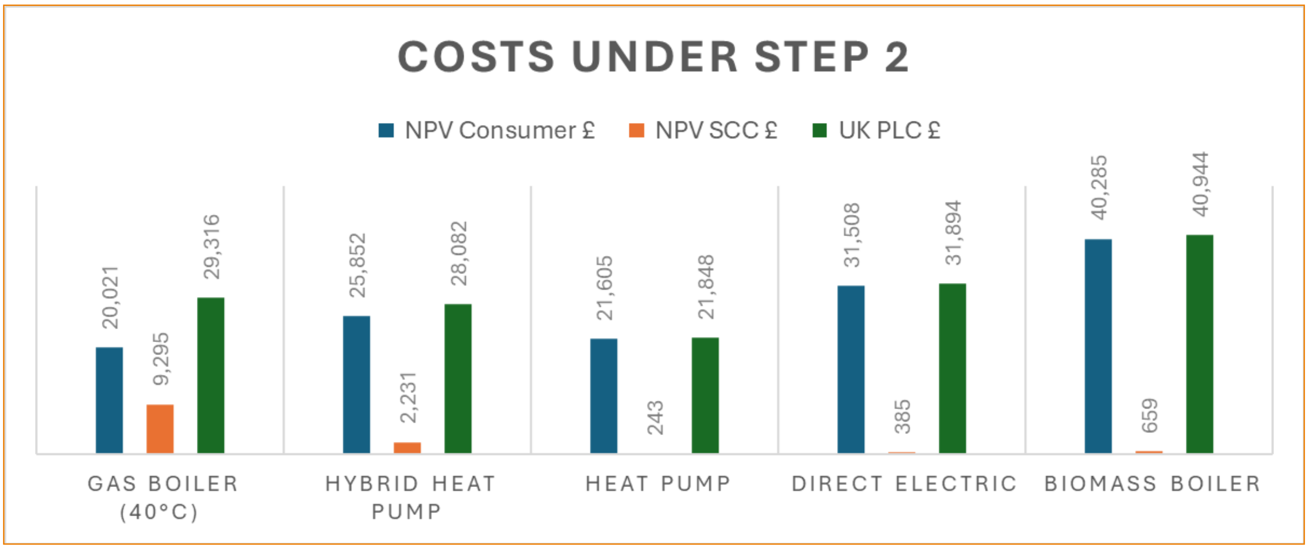

COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
22,892
1,954
24,845
19,583
116
19,699
34,920
393
35,313
35,860
602
36,463
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

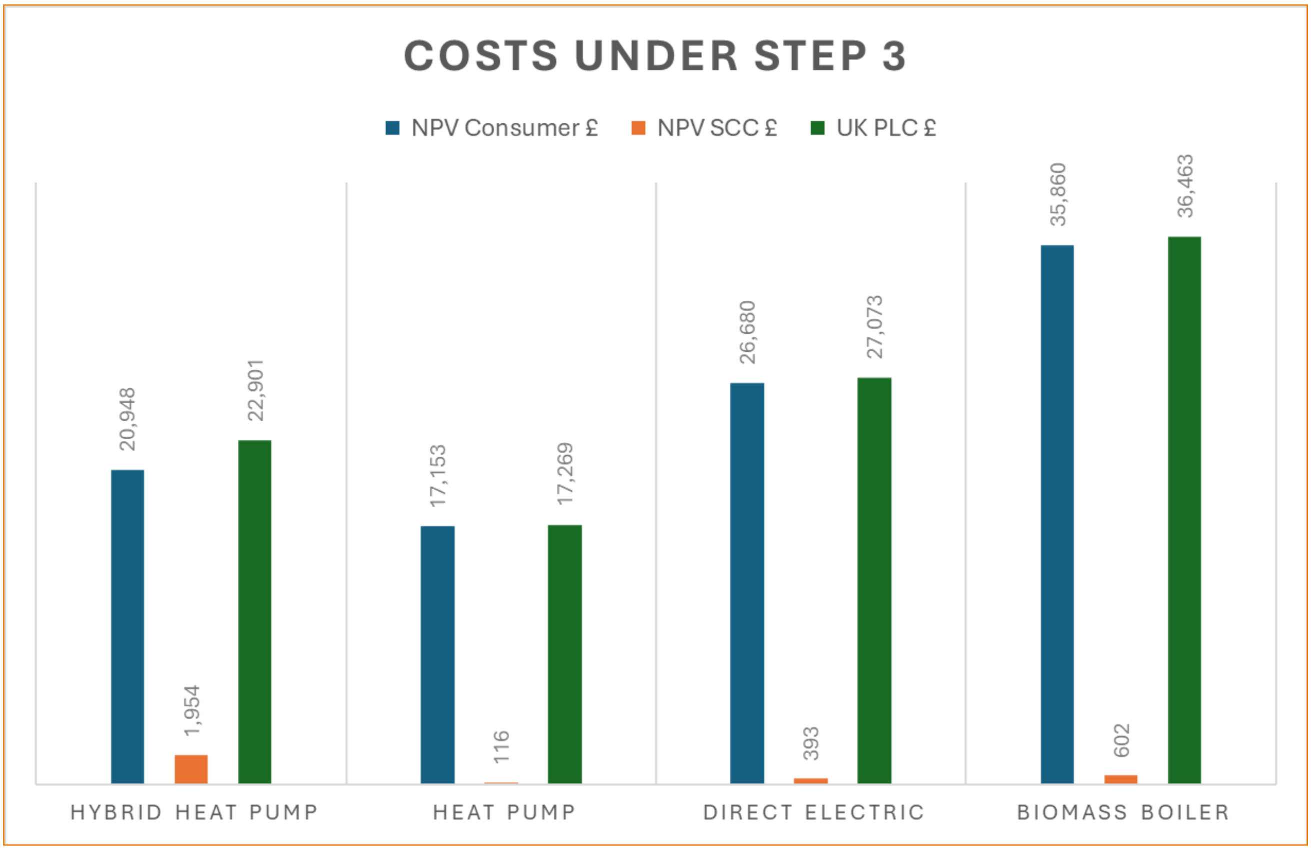


2. SPACE HEATING WITH LEVIES, 30% DSR

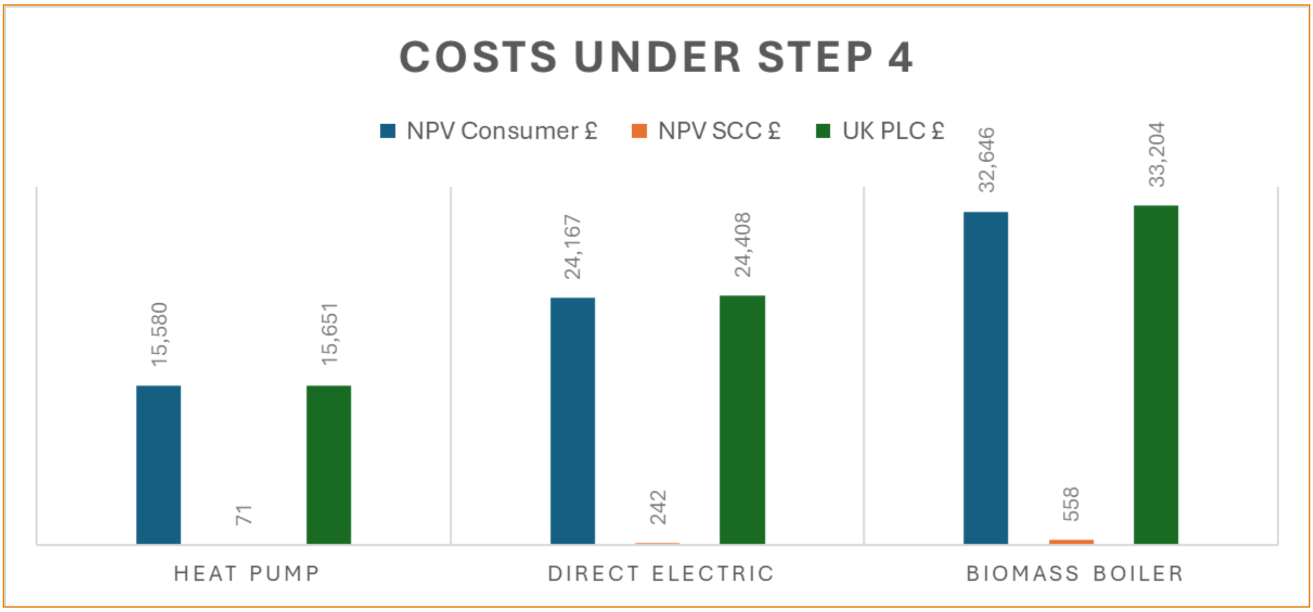



COSTS UNDER STEP 1
NPV Consumer £
NPV SCC £
UK PLC £
21,344
10,073
31,416
21,498
9,744
31,243
27,676
2,459
30,135
23,167
406
23,573
32,759
1,351
34,110
42,991
691
43,682
GAS BOILER (55°C)
GAS BOILER (40°C)
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER


COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
20,021
9,295
29,316
25,852
2,231
28,082
21,605
243
21,848
31,508
385
31,894
40,285
659
40,944
GAS BOILER (40°C)
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

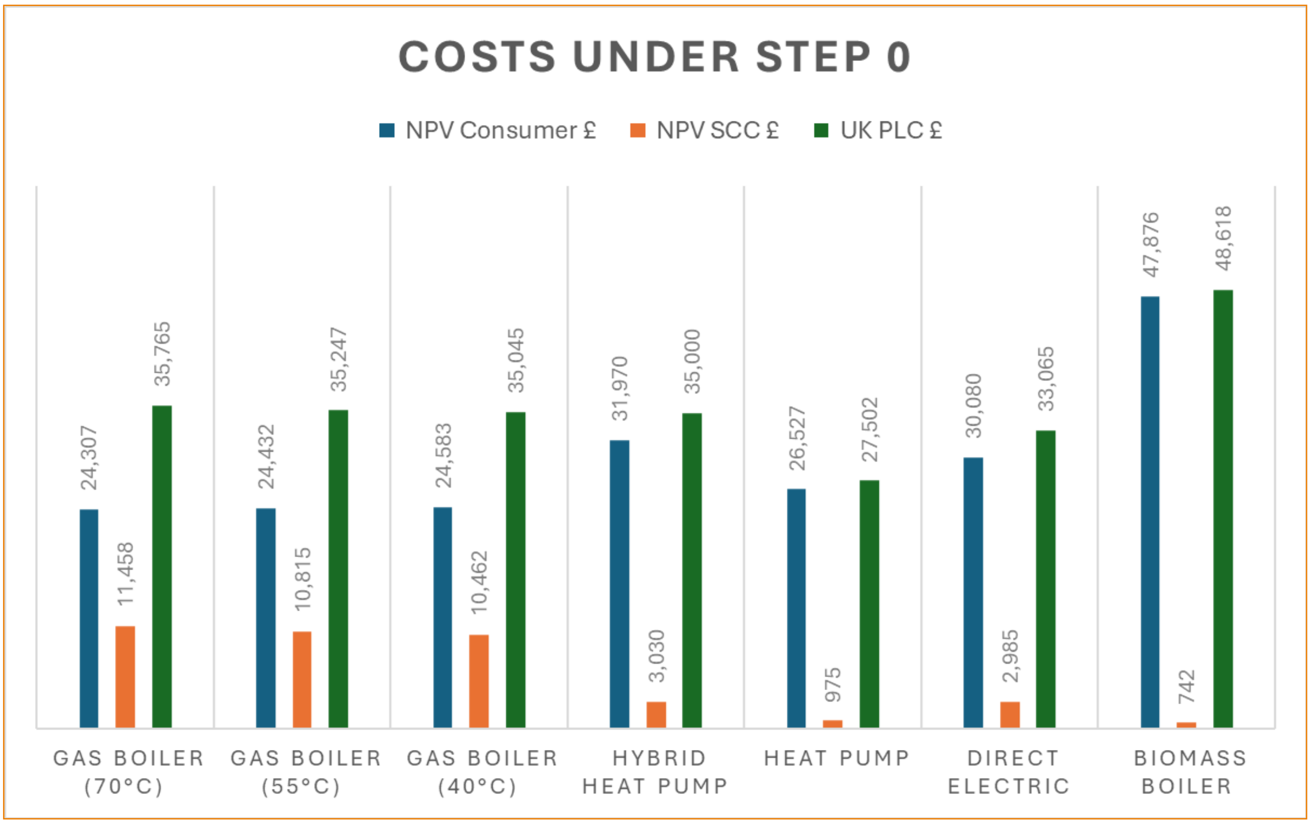


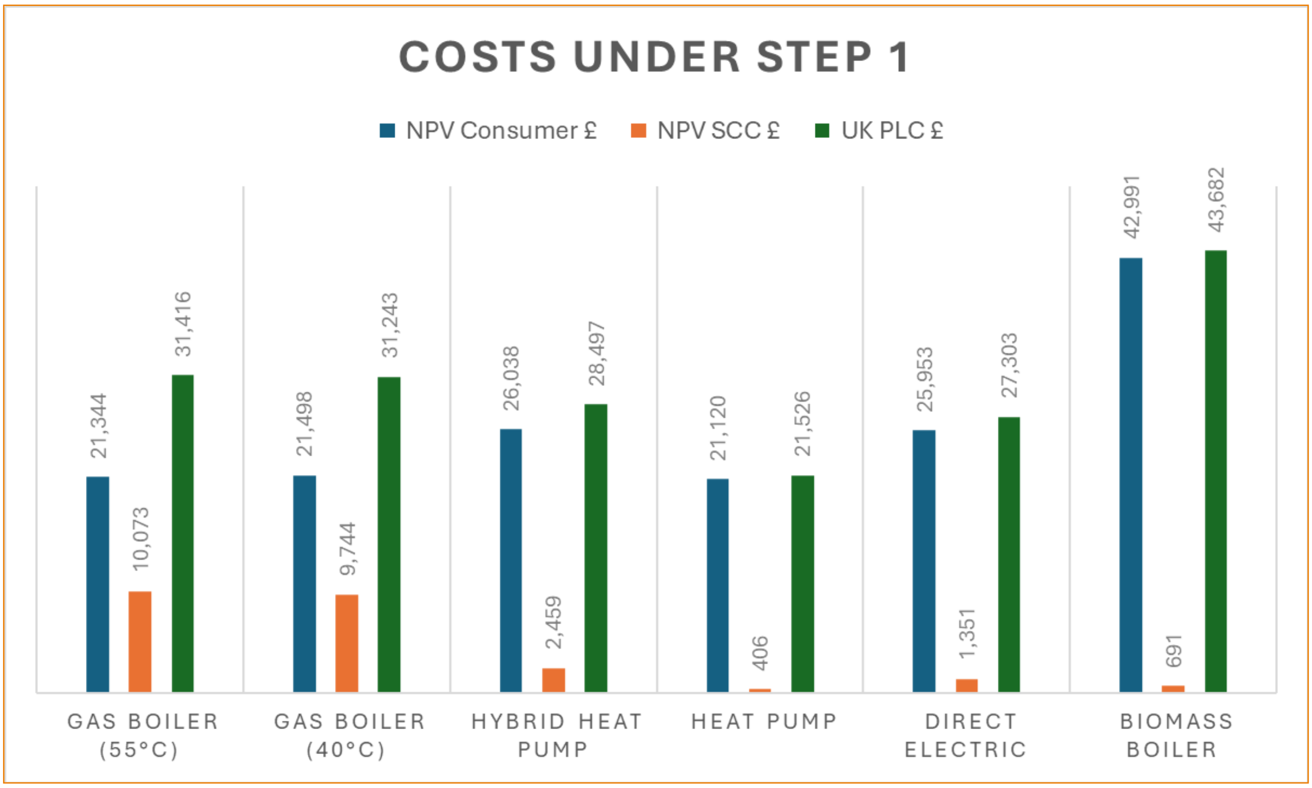
COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
20,948
1,954
22,901
17,153
116
17,269
26,680
393
27,073
35,860
602
36,463
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

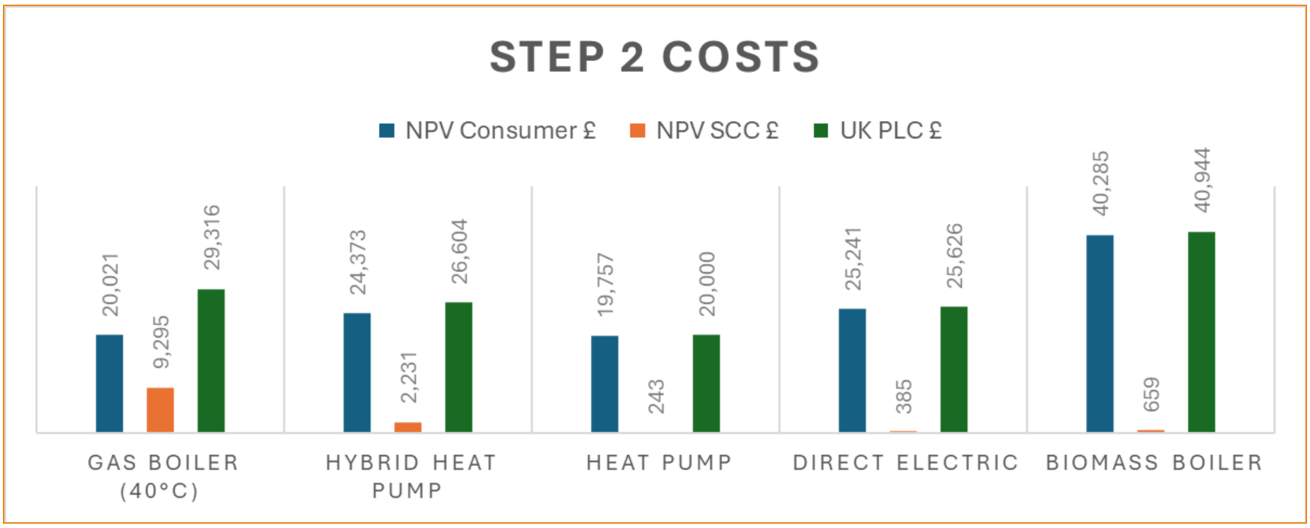


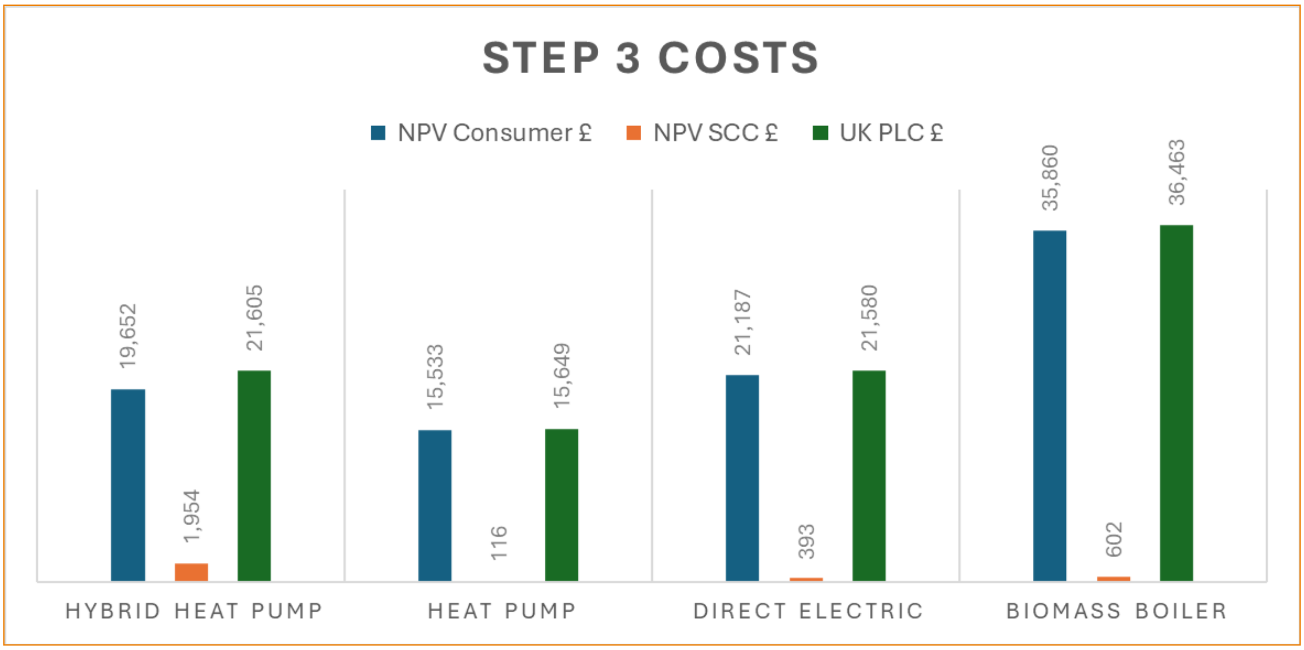
COSTS UNDER STEP 4
NPV Consumer £
NPV SCC £
UK PLC £
15,580
71
15,651
24,167
242
24,408
32,646
558
33,204
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

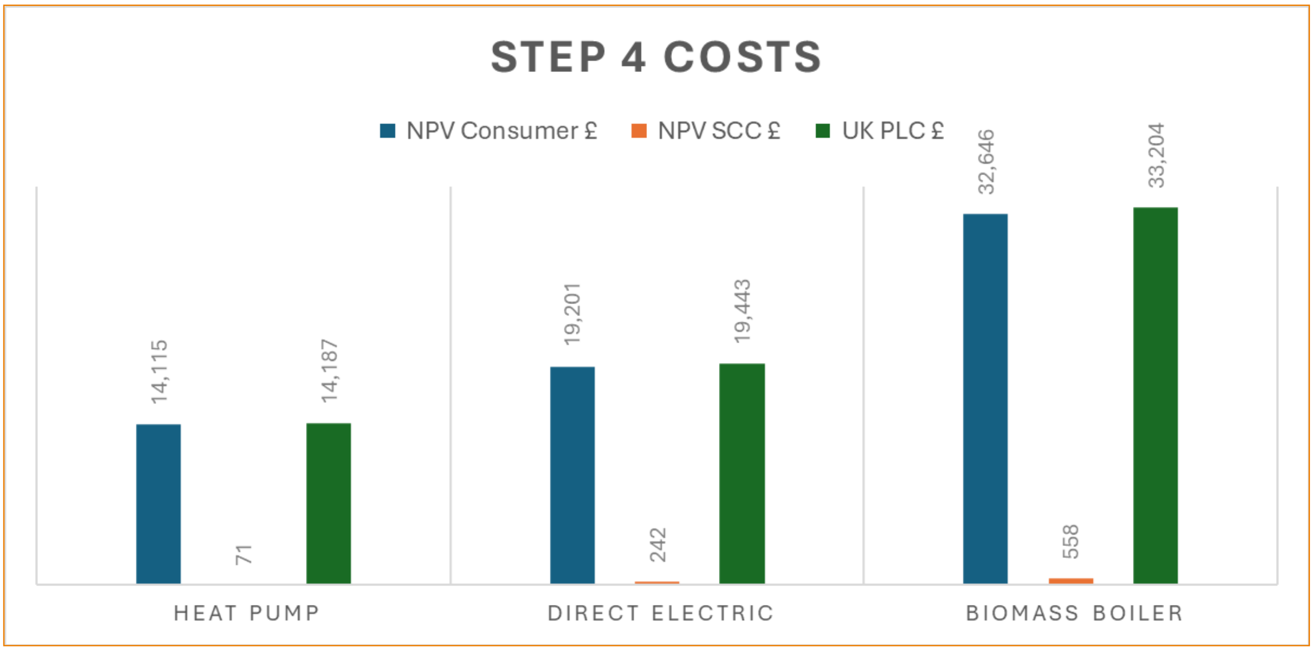
3.SPACE HEATING WITH LEVIES, 50% DSR



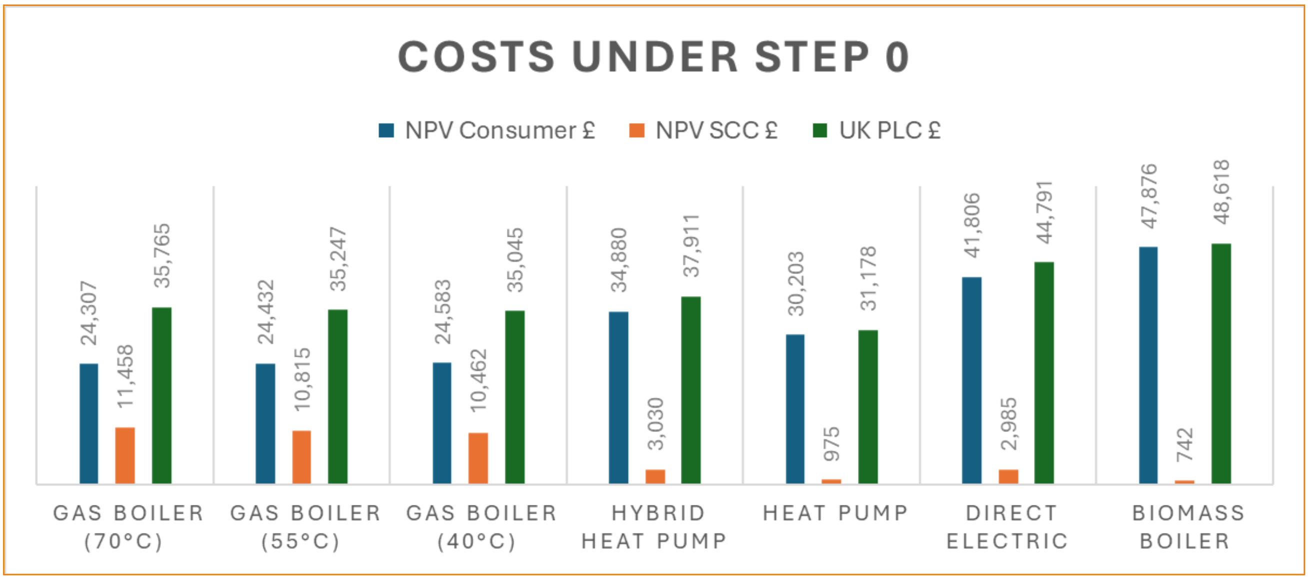


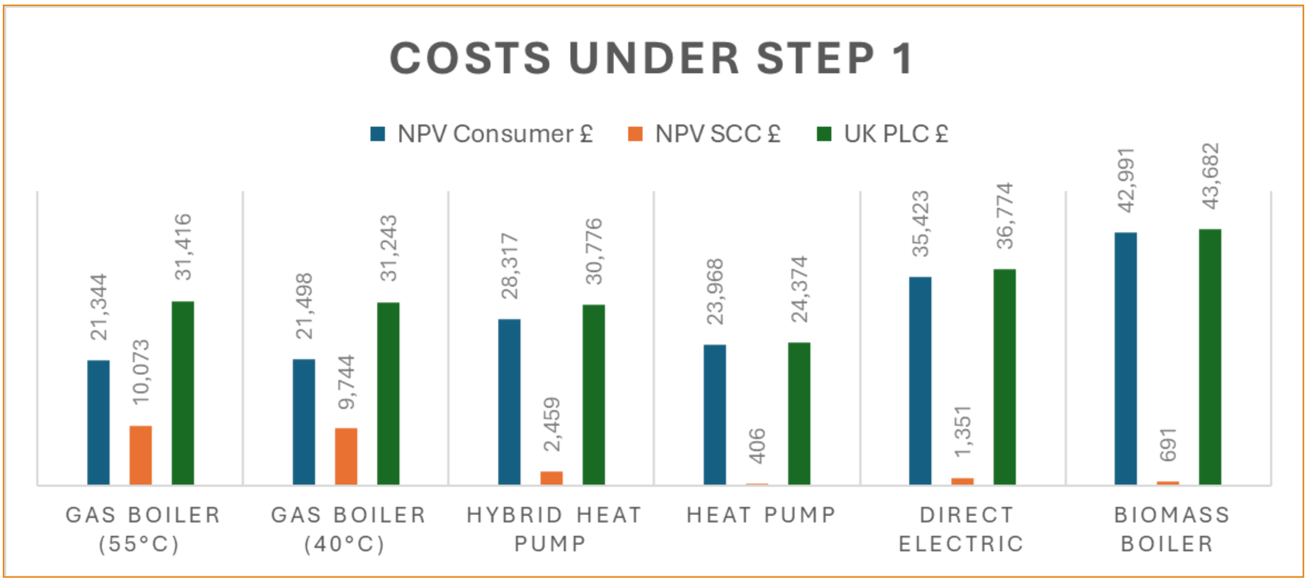

STEP 2 COSTS
NPV Consumer £
NPV SCC £
UK PLC £
20,021
9,295
29,316
24,373
2,231
26,604
19,757
243
20,000
25,241
385
25,626
40,285
659
40,944
GAS BOILER (40°C)
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

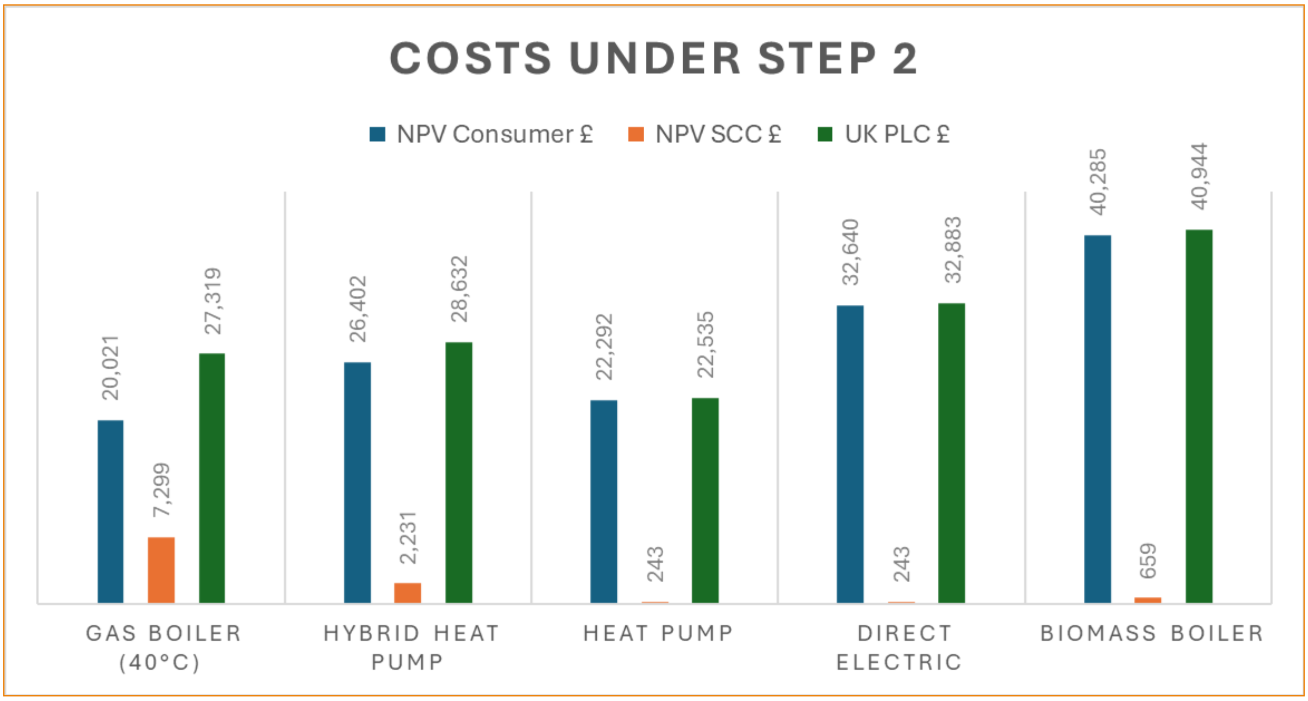

STEP 3 COSTS
NPV Consumer £
NPV SCC £
UK PLC £
19,652
1,954
21,605
15,533
116
15,649
21,187
393
21,580
35,860
602
36,463
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

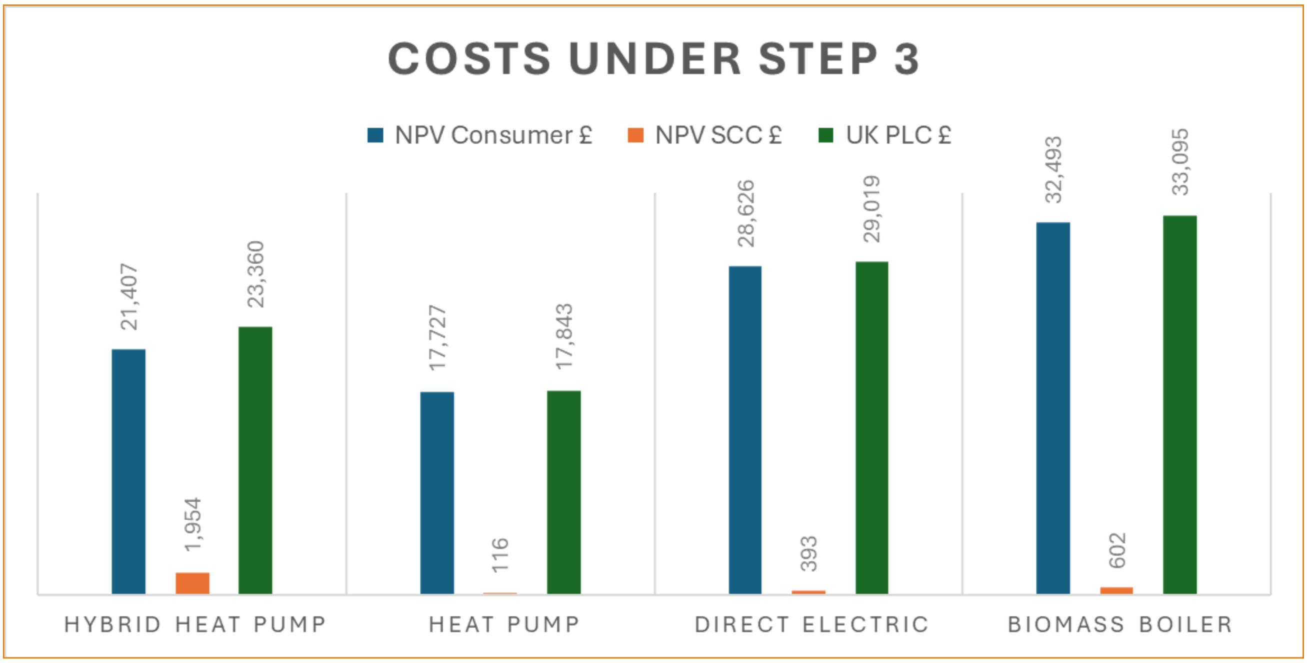

STEP 4 COSTS
NPV Consumer £
NPV SCC £
UK PLC £
14,115
71
14,187
19,201
242
19,443
32,646
558
33,204
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

4. SPACE HEATING NO LEVIES, NO DSR

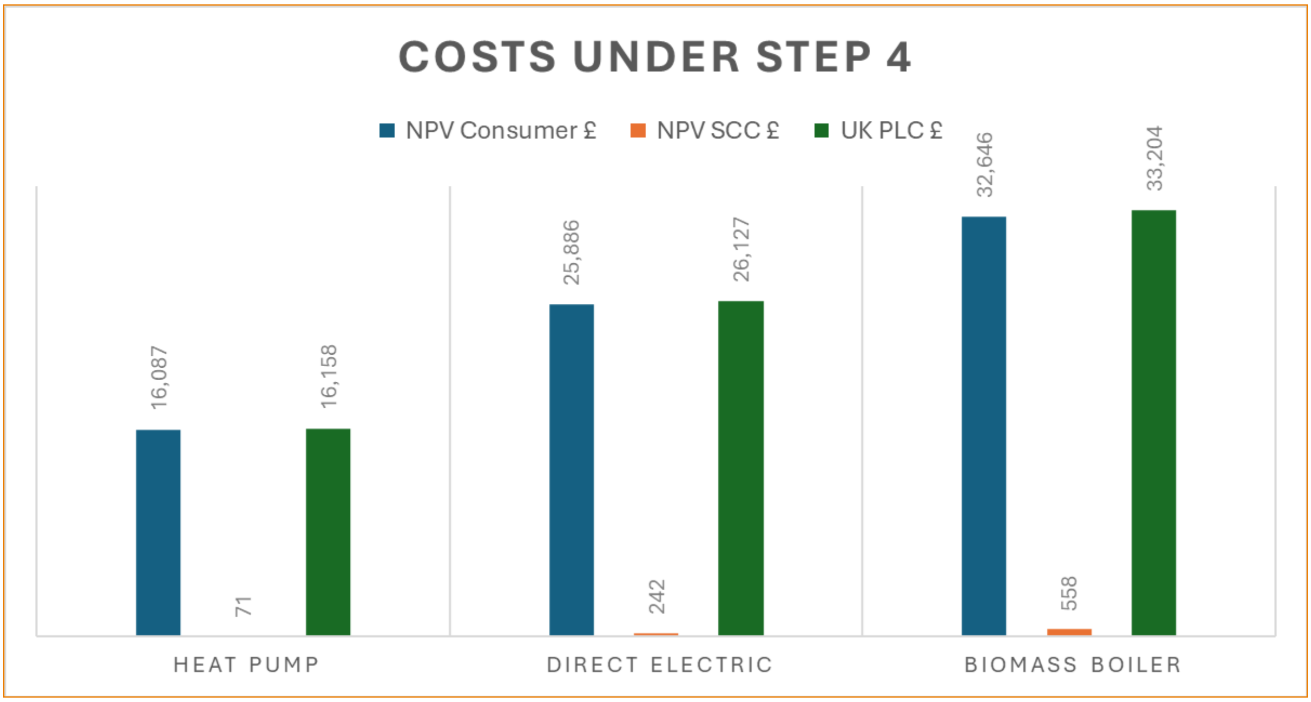






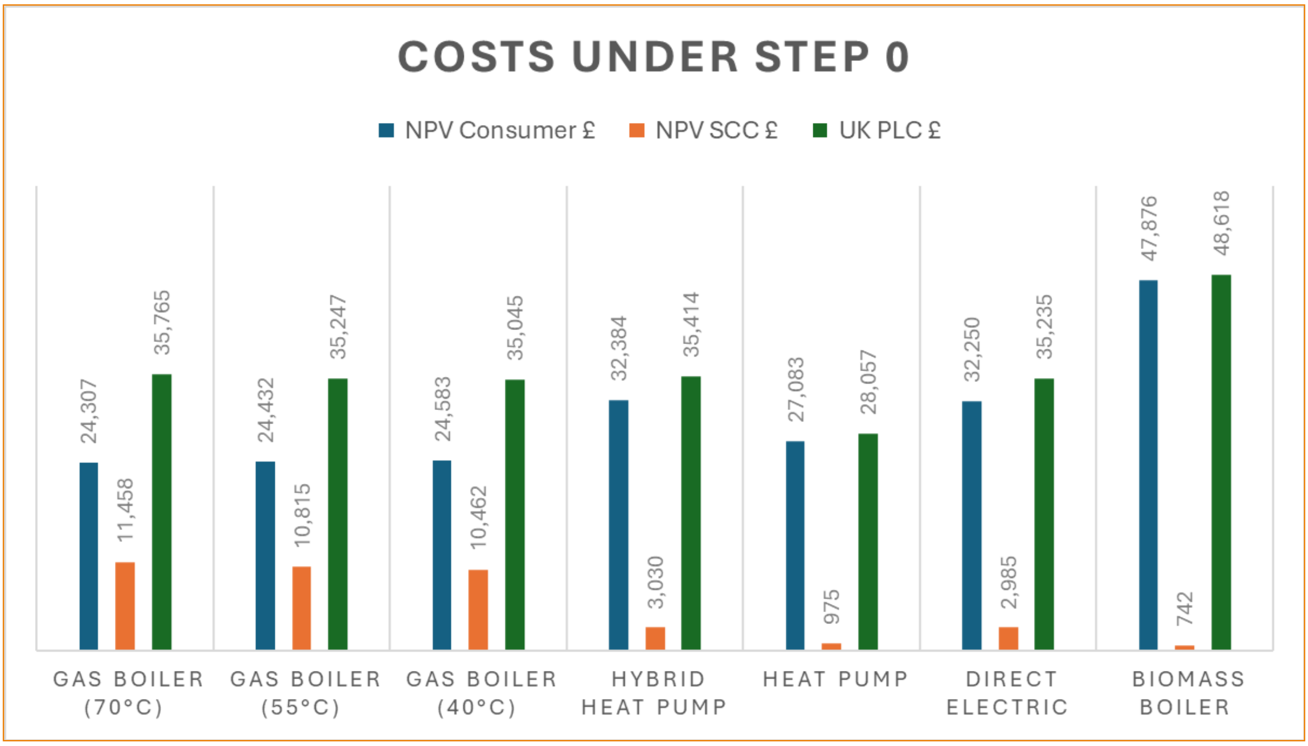


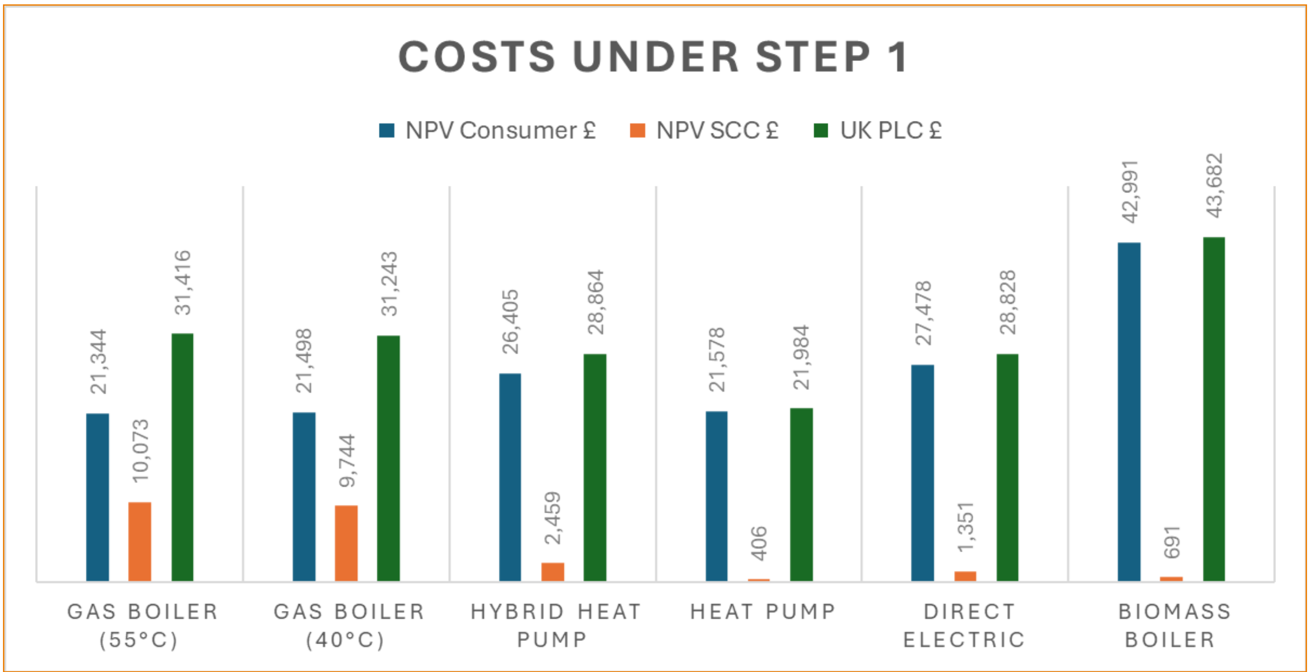
COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
21,407
1,954
23,360
17,727
116
17,843
28,626
393
29,019
32,493
602
33,095
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

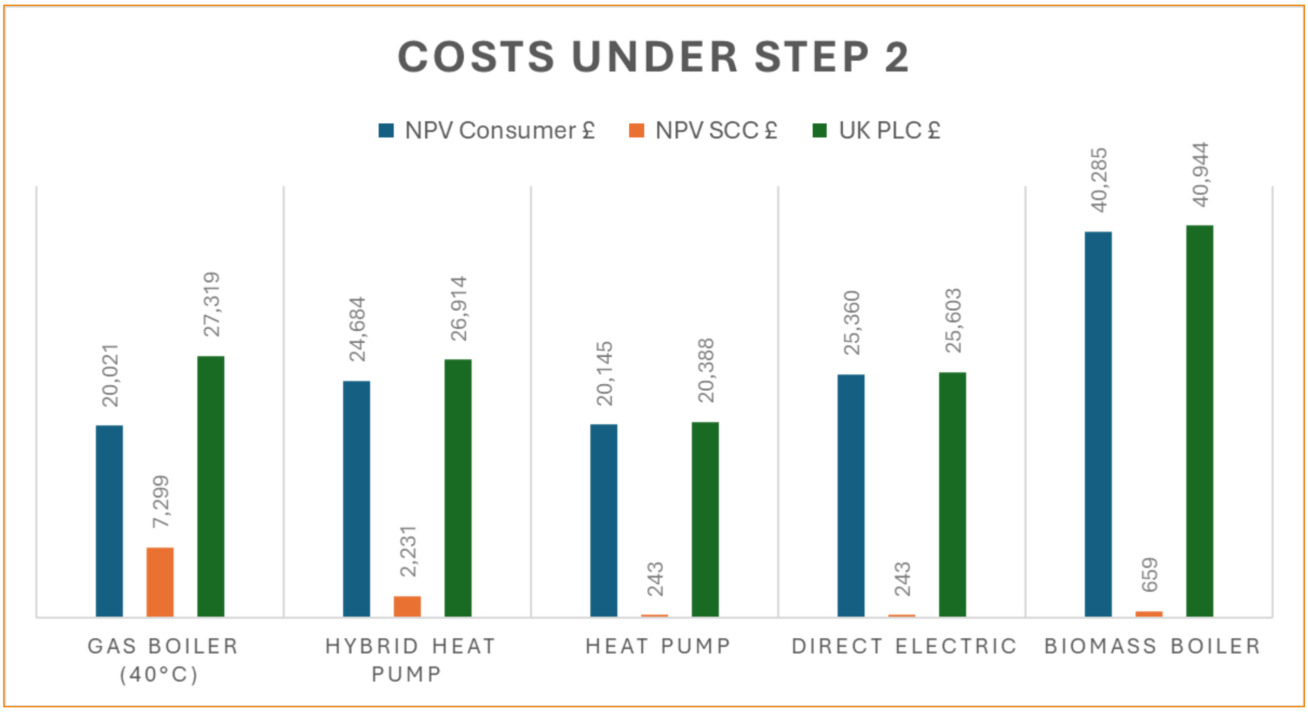


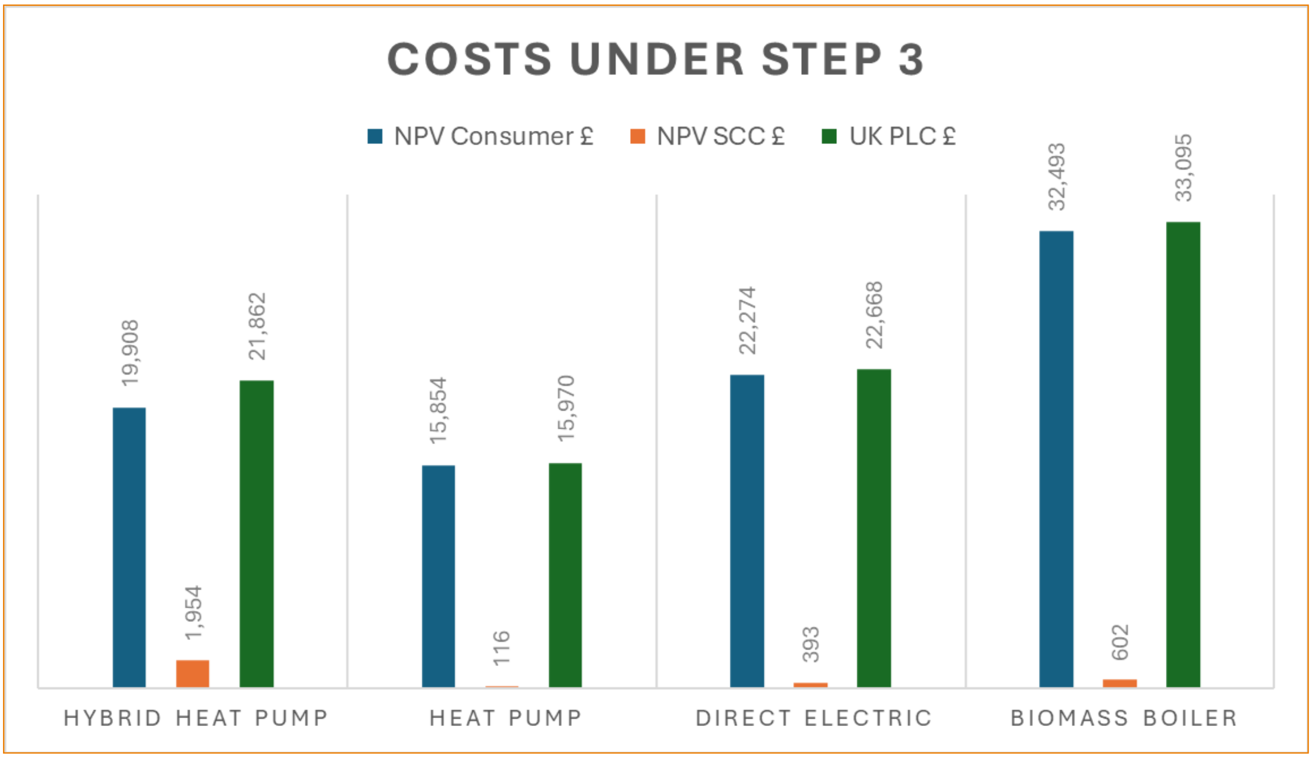
COSTS UNDER STEP 4
NPV Consumer £
NPV SCC £
UK PLC £
16,087
71
16,158
25,886
242
26,127
32,646
558
33,204
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

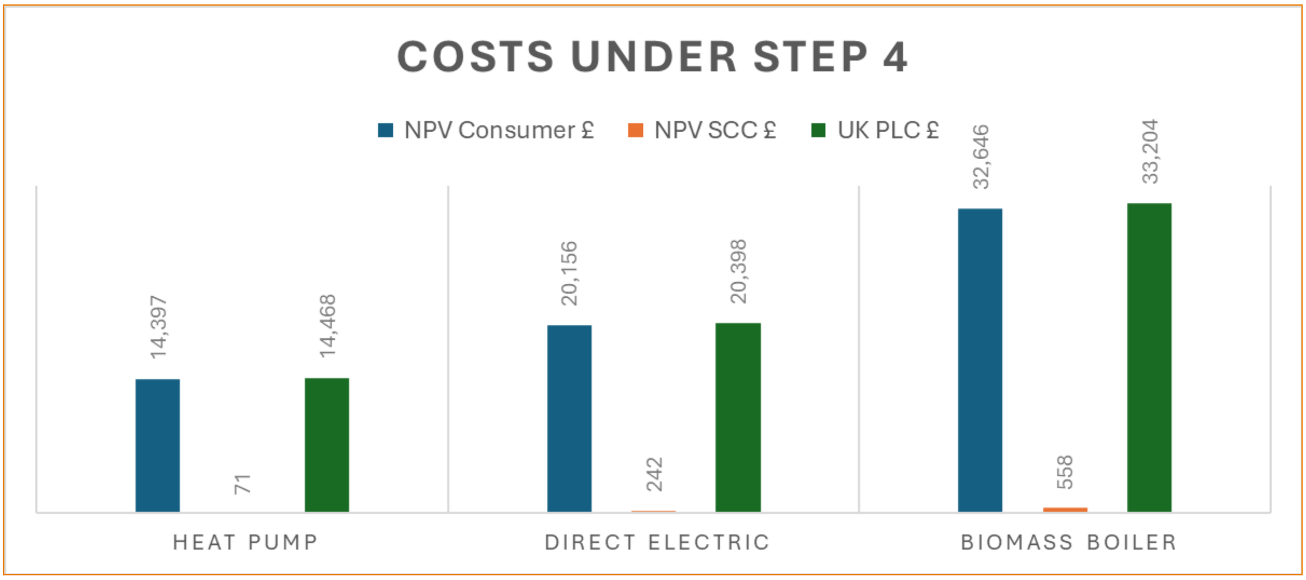
5. SPACE HEATING NO LEVIES, 30% DSR



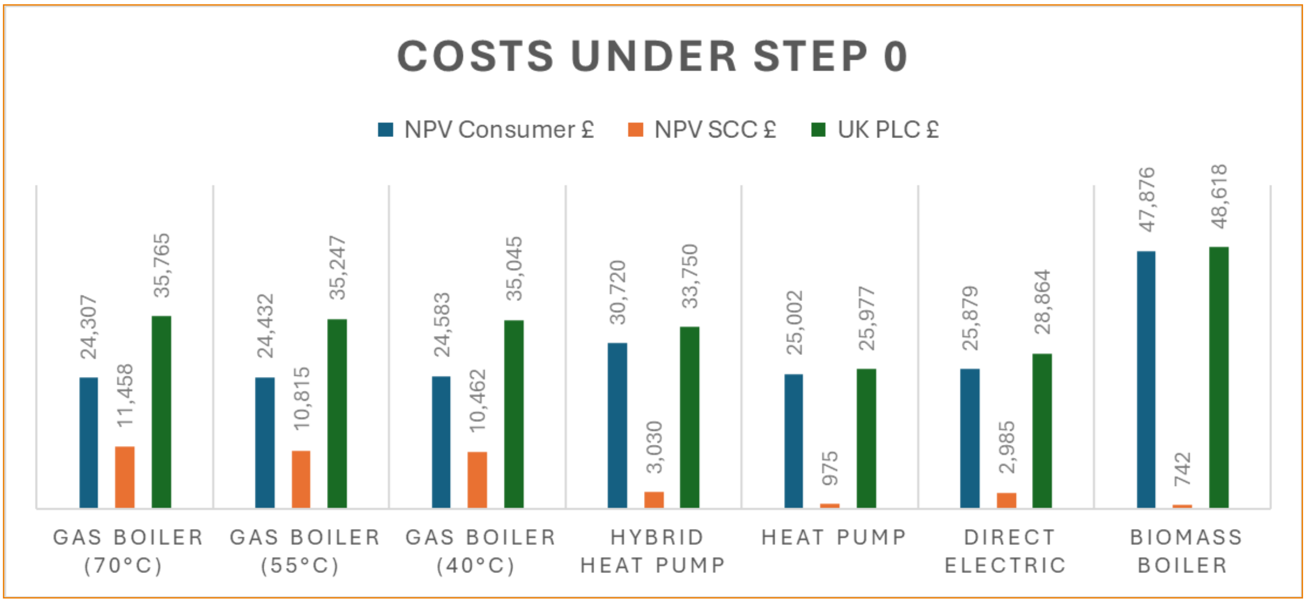


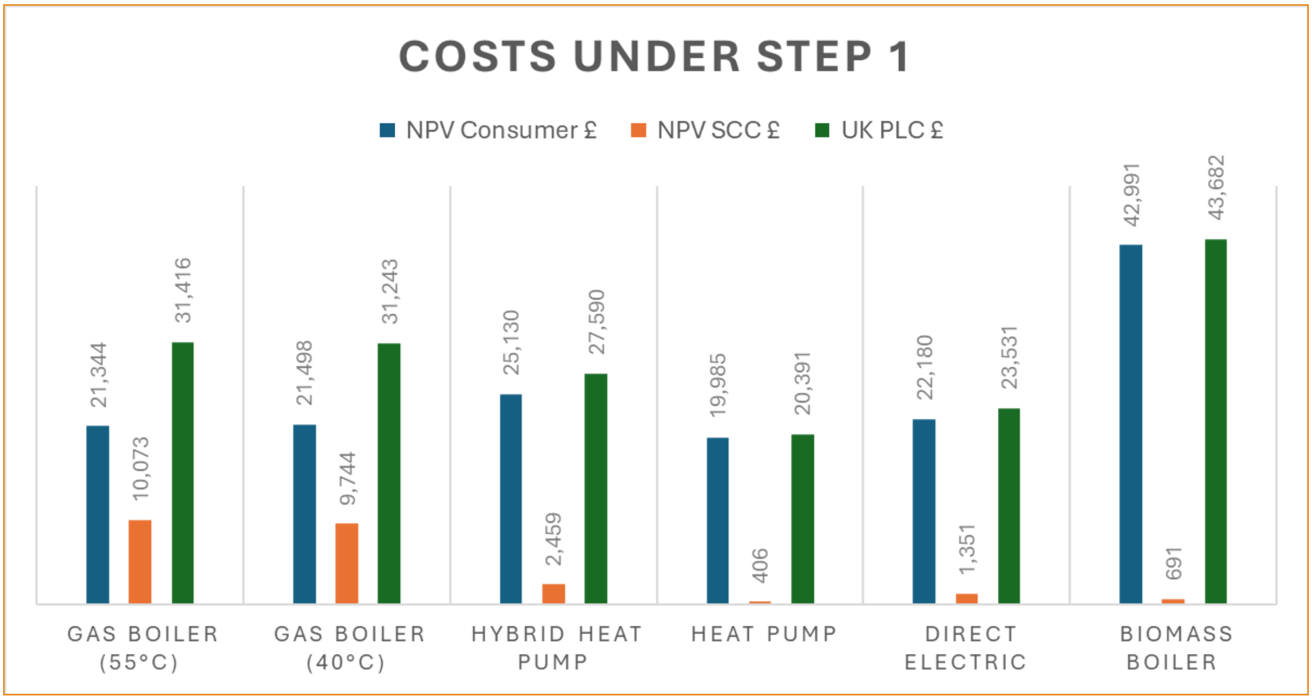

COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
20,021
7,299
27,319
24,684
2,231
26,914
20,145
243
20,388
25,360
243
25,603
40,285
659
40,944
GAS BOILER (40°C)
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

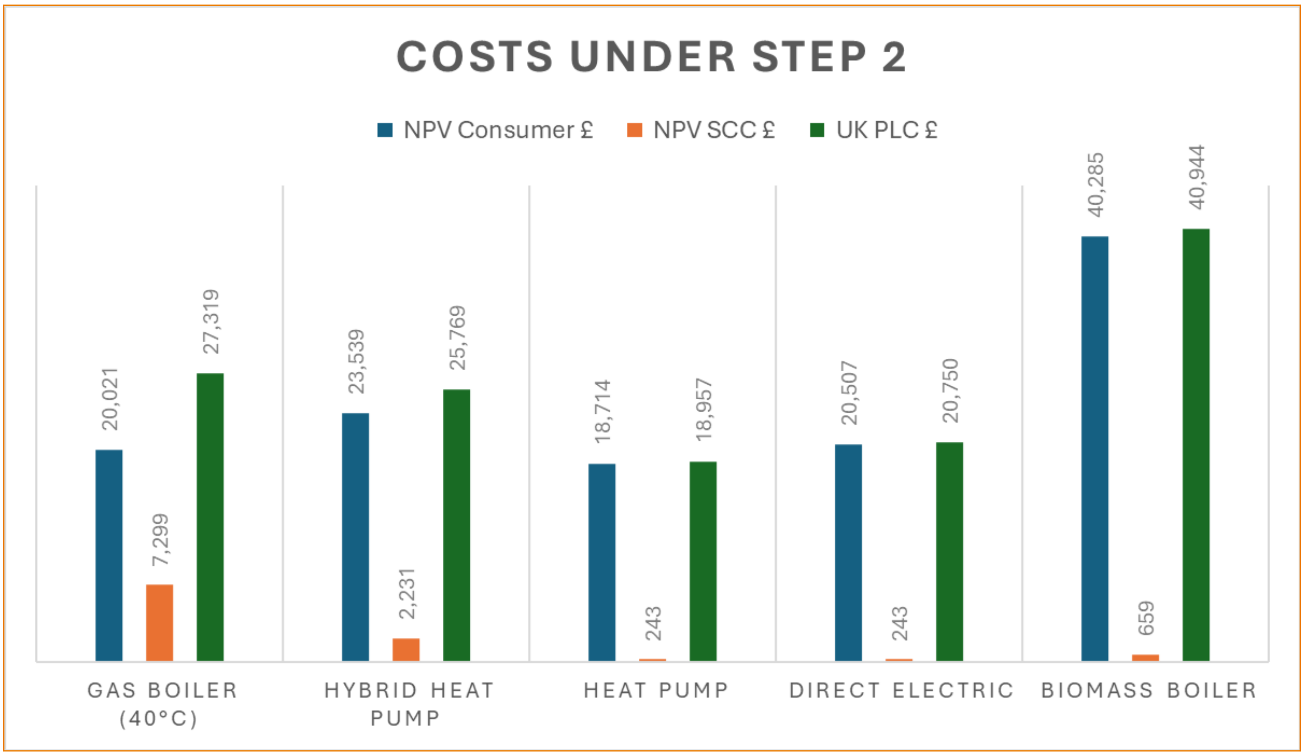

COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
19,908
1,954
21,862
15,854
116
15,970
22,274
393
22,668
32,493
602
33,095
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

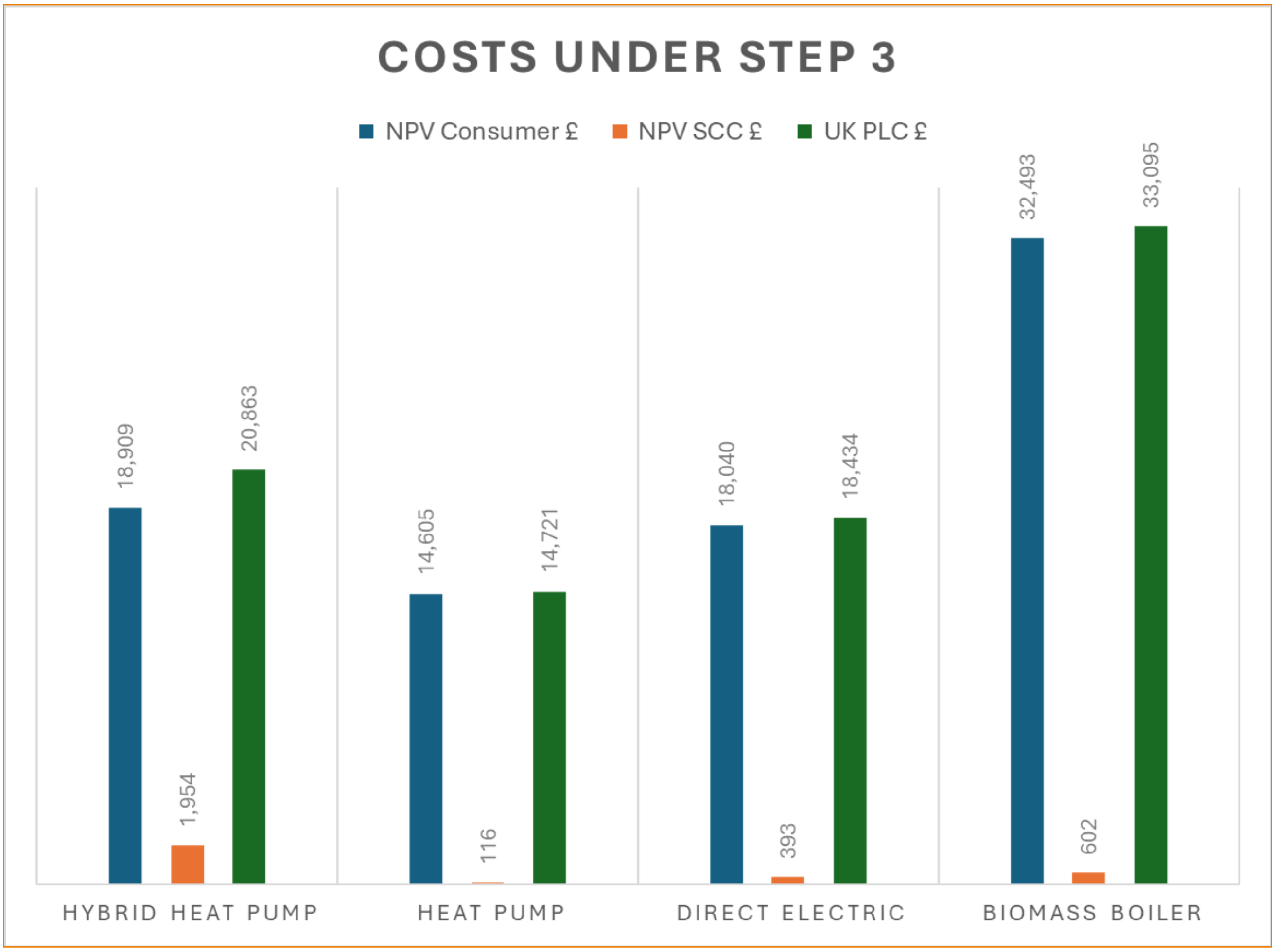


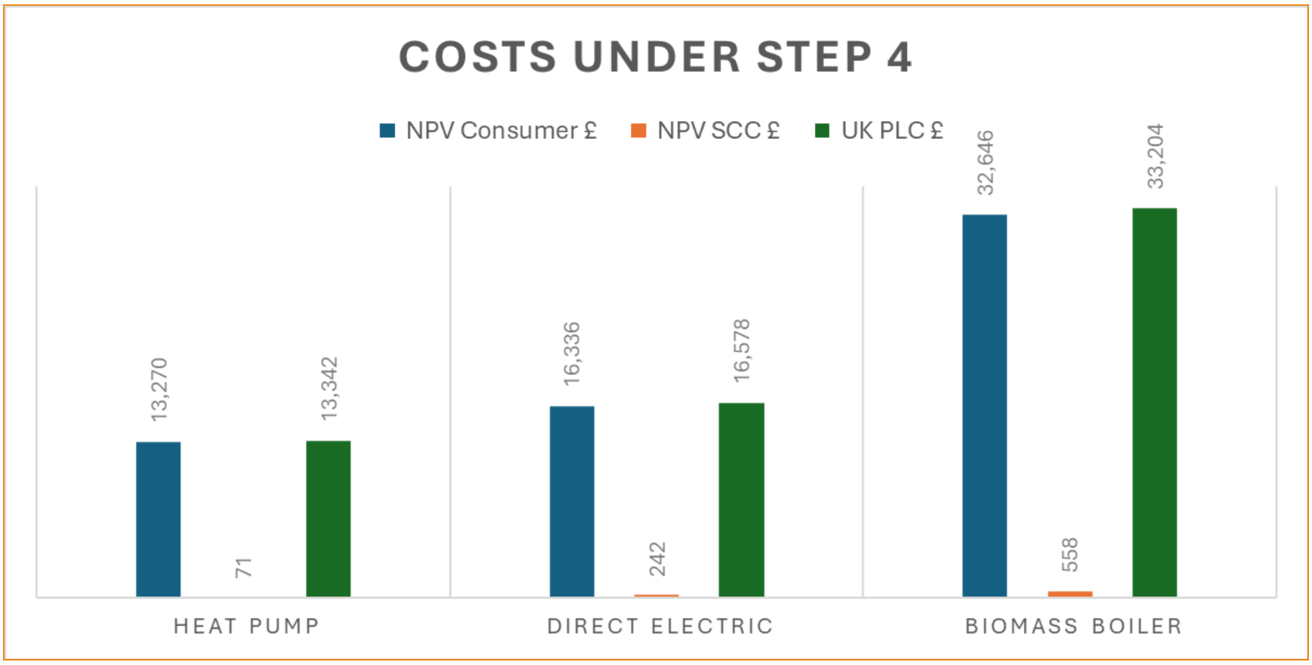
6. SPACE HEATING NO LEVIES, 50% DSR




COSTS UNDER STEP 1
NPV Consumer £
NPV SCC £
UK PLC £
21,344
10,073
31,416
21,498
9,744
31,243
25,130
2,459
27,590
19,985
406
20,391
22,180
1,351
23,531
42,991
691
43,682
GAS BOILER (55°C)
GAS BOILER (40°C)
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

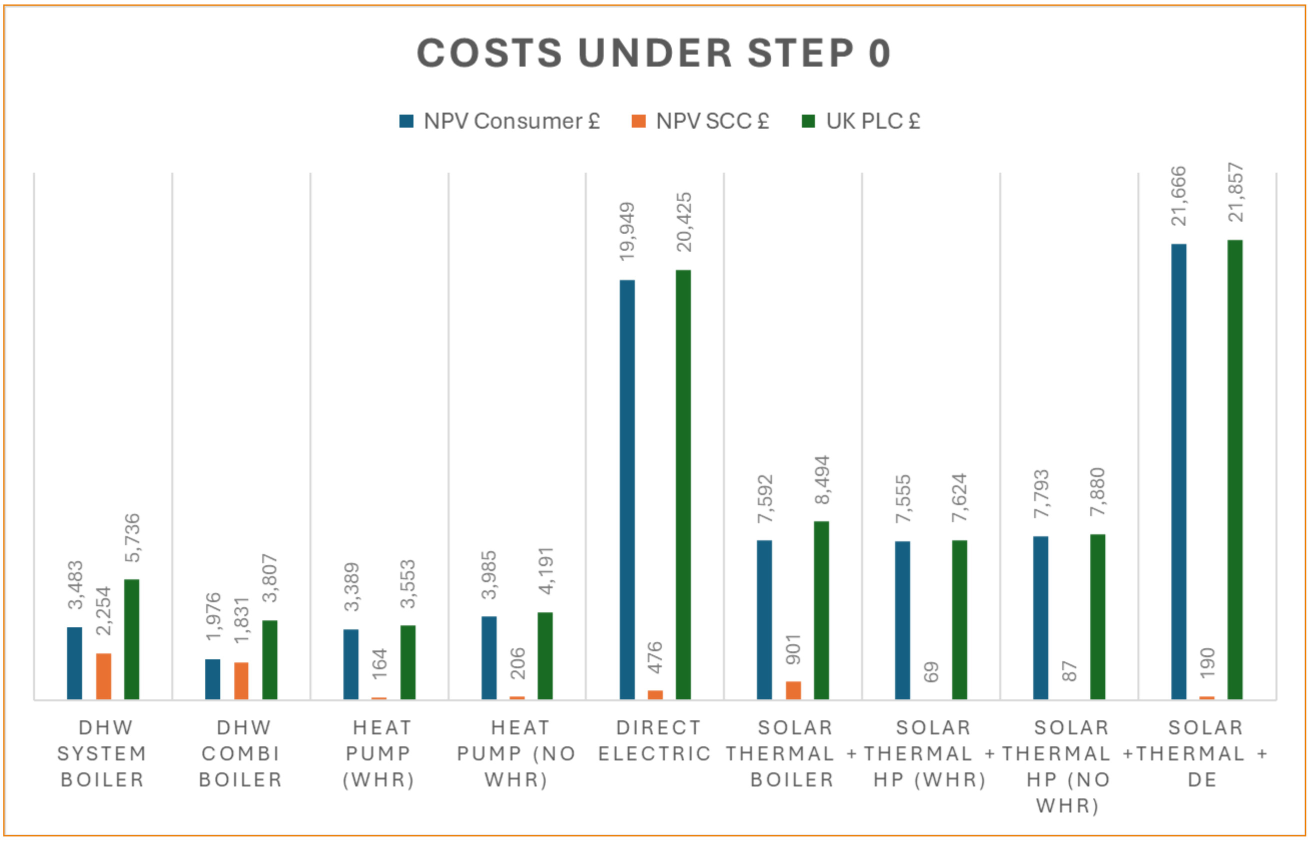

COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
20,021
7,299
27,319
23,539
2,231
25,769
18,714
243
18,957
20,507
243
20,750
40,285
659
40,944
GAS BOILER (40°C)
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

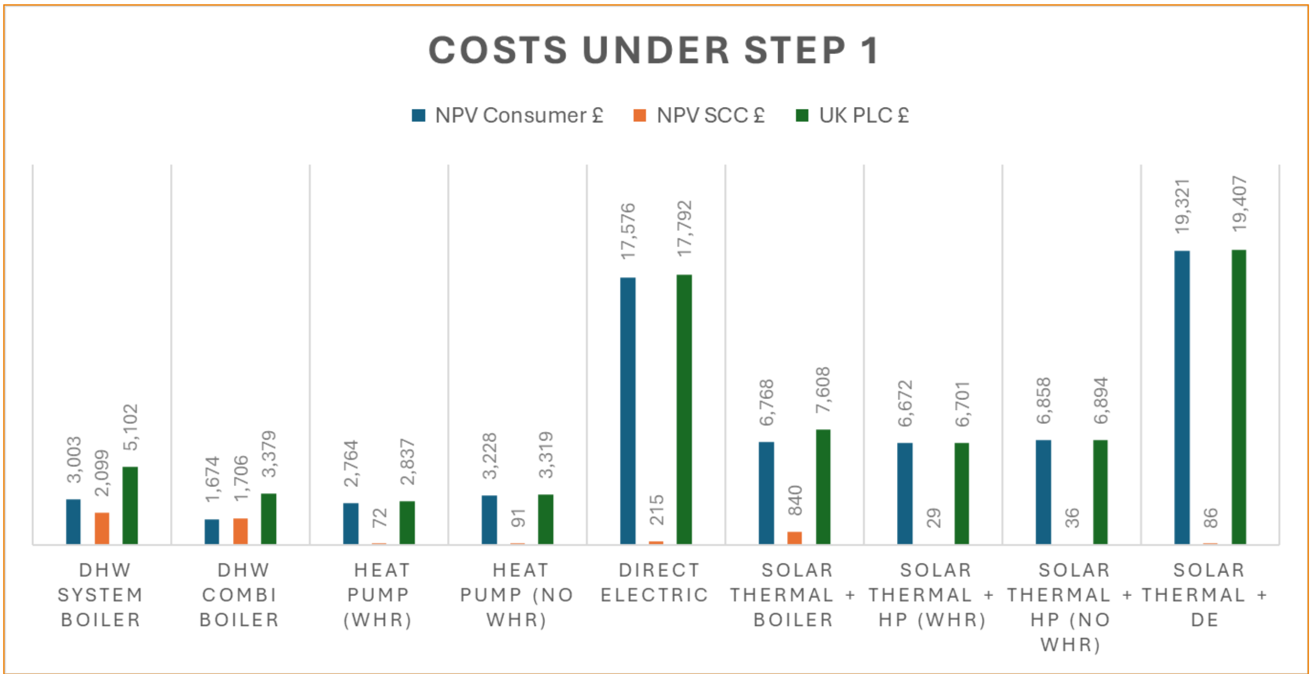

COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
18,909
1,954
20,863
14,605
116
14,721
18,040
393
18,434
32,493
602
33,095
HYBRID HEAT PUMP
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

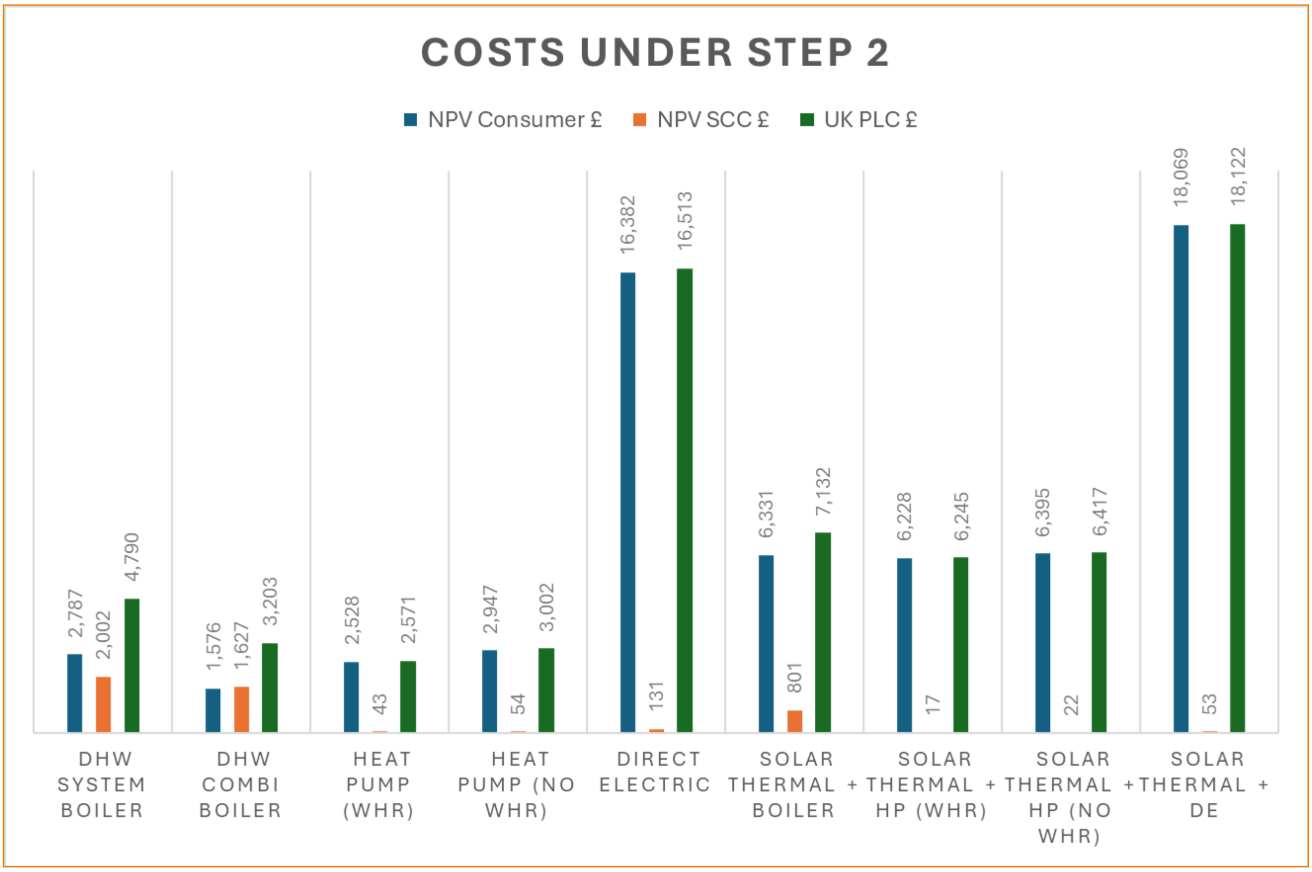

COSTS UNDER STEP 4
NPV Consumer £
NPV SCC £
UK PLC £
13,270
71
13,342
16,336
242
16,578
32,646
558
33,204
HEAT PUMP
DIRECT ELECTRIC
BIOMASS BOILER

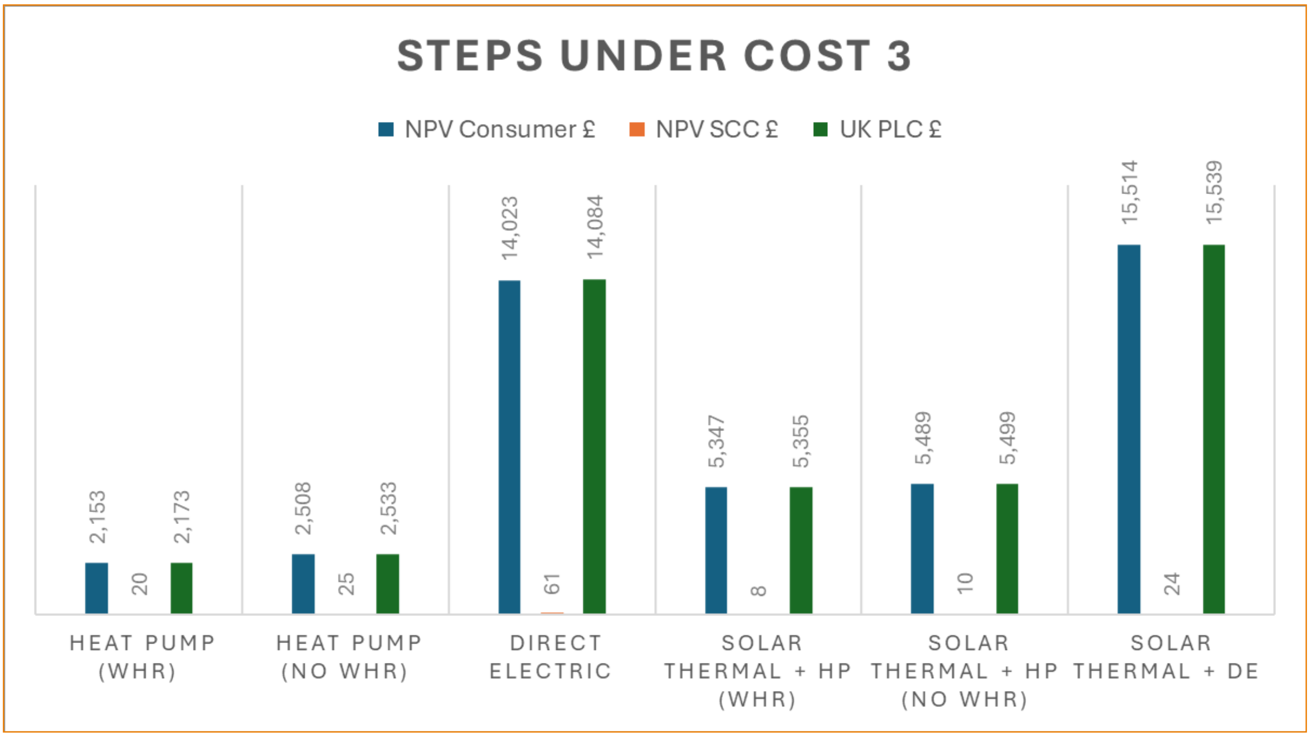
DOMESTIC HOT WATER ANNEX

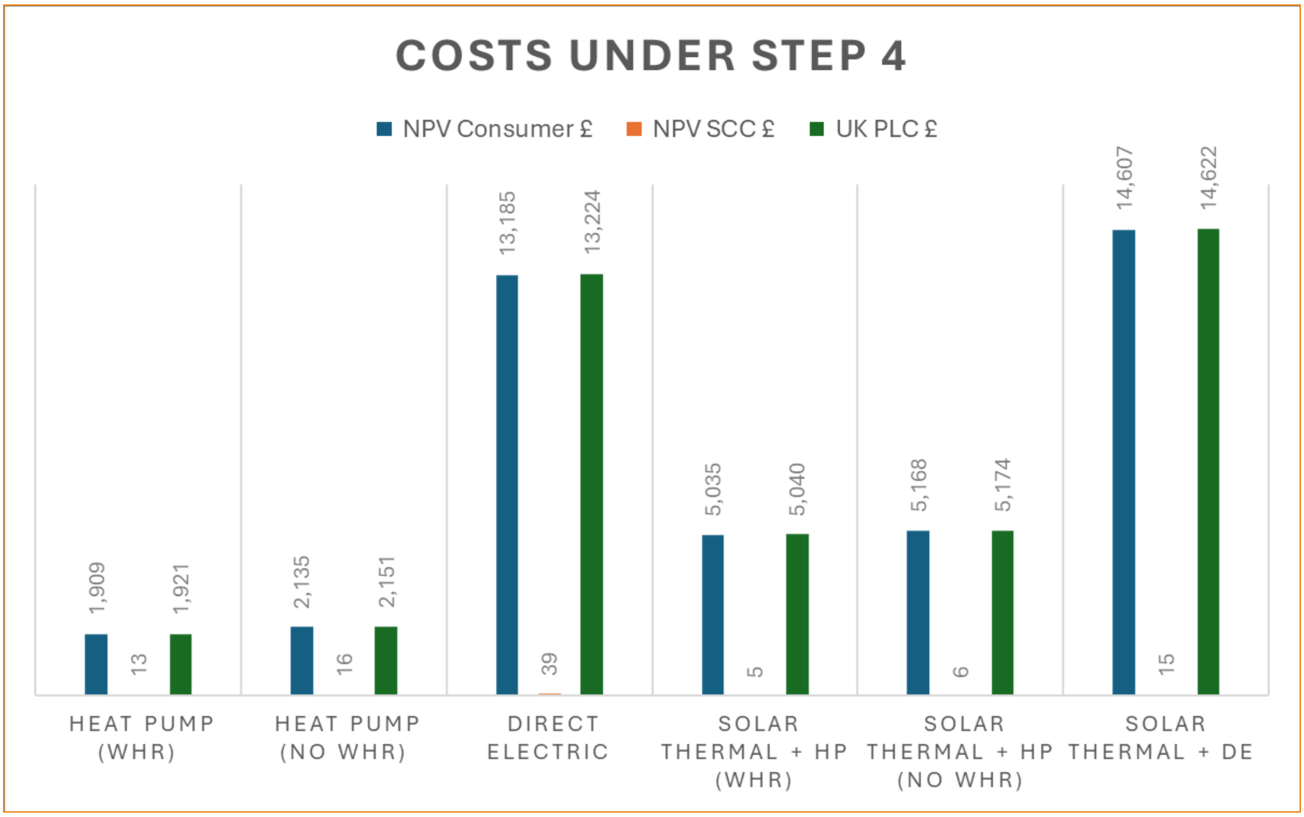
7. DOMESTIC HOT WATER WITH LEVIES, NO DSR



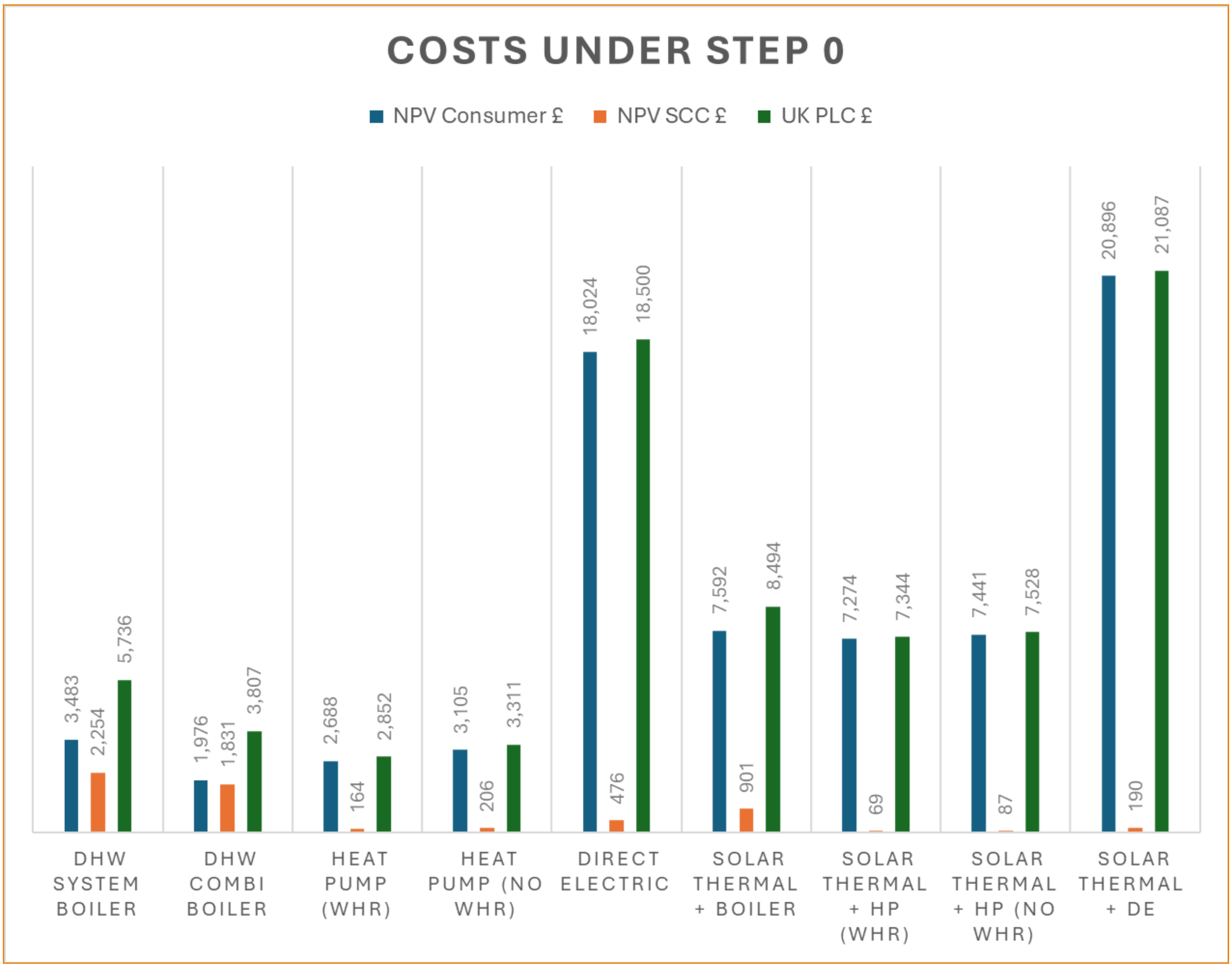


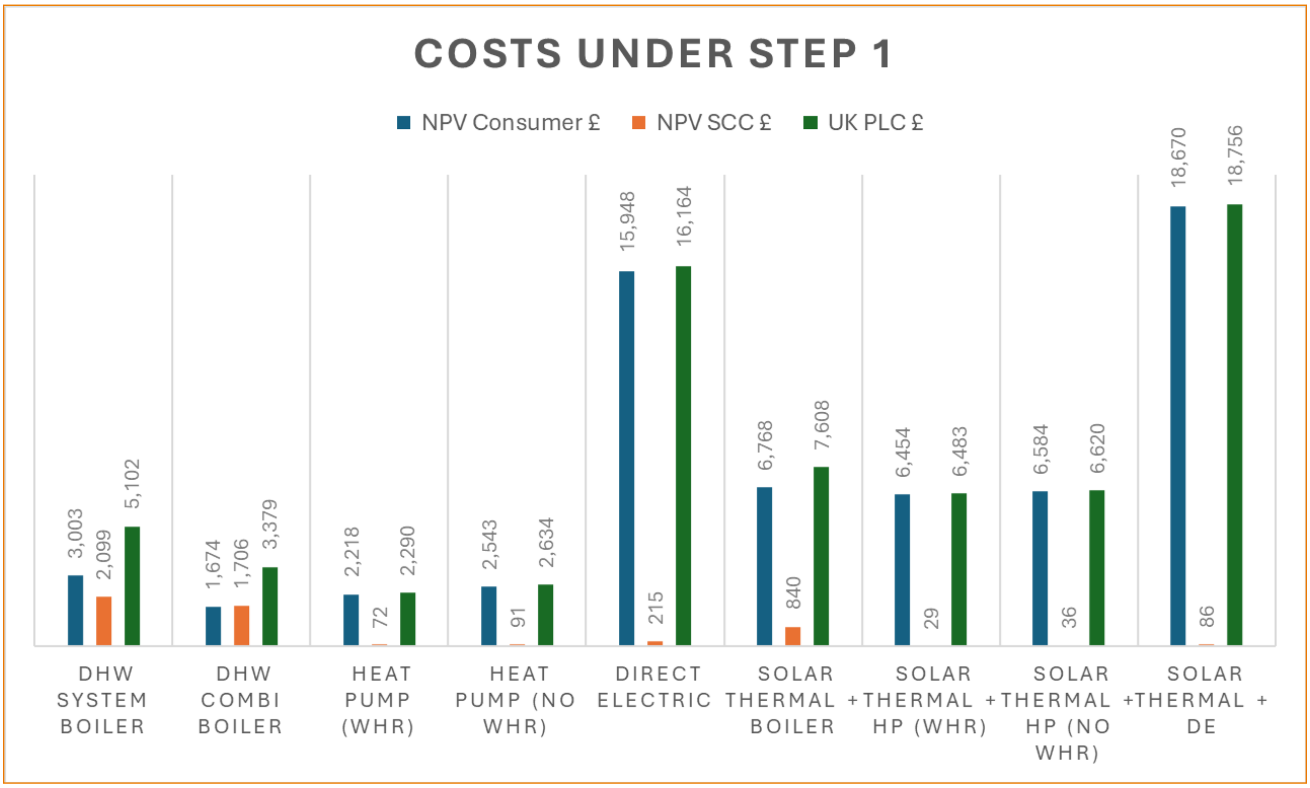

COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
2,787
2,002
4,790
1,576
1,627
3,203
2,528
43
2,571
2,947
54
3,002
16,382
131
16,513
6,331
801
7,132
6,228
17
6,245
6,395
22
6,417
18,069
53
18,122
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

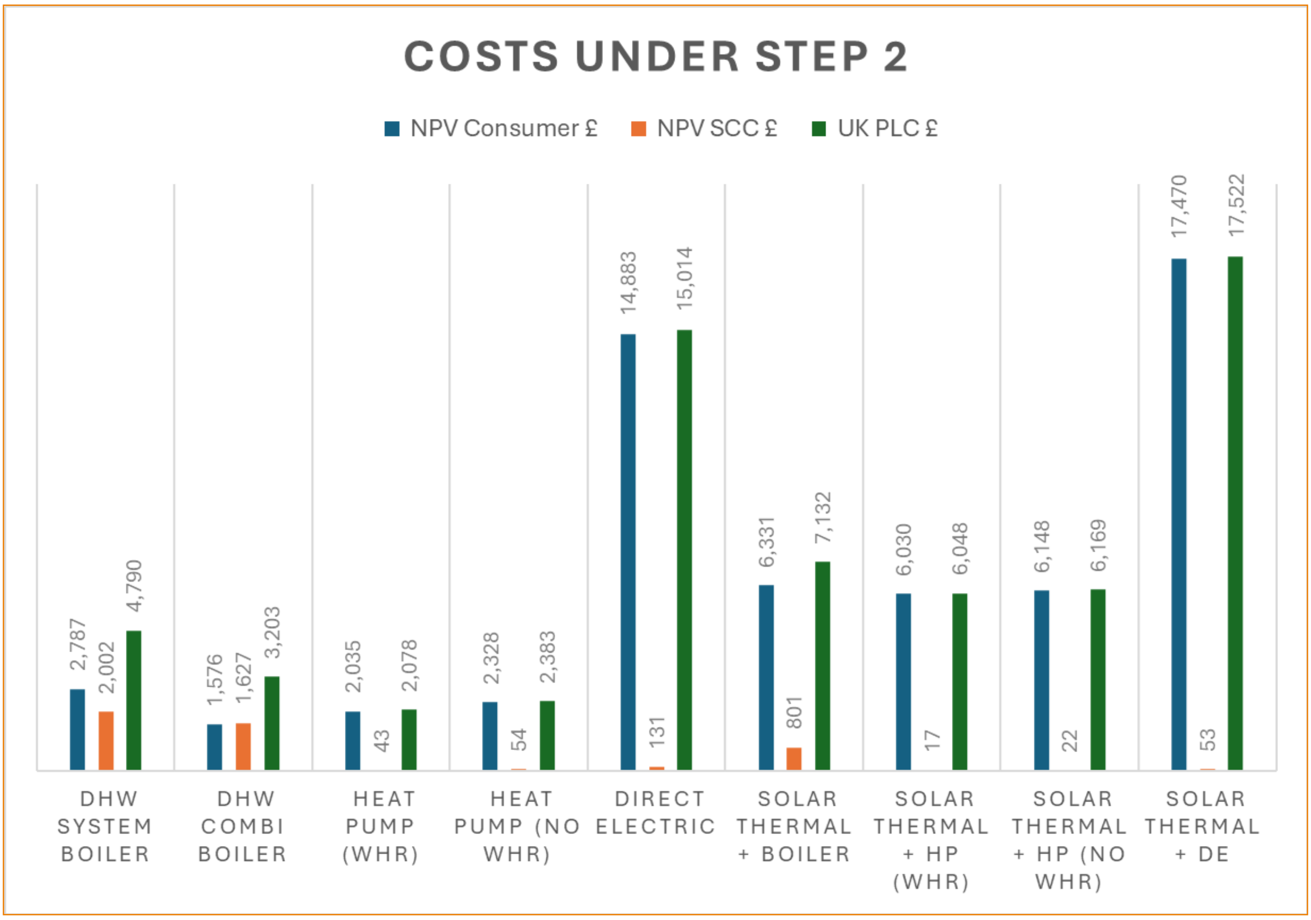

STEPS UNDER COST 3
NPV Consumer £
NPV SCC £
UK PLC £
2,153
20
2,173
2,508
25
2,533
14,023
61
14,084
5,347
8
5,355
5,489
10
5,499
15,514
24
15,539
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

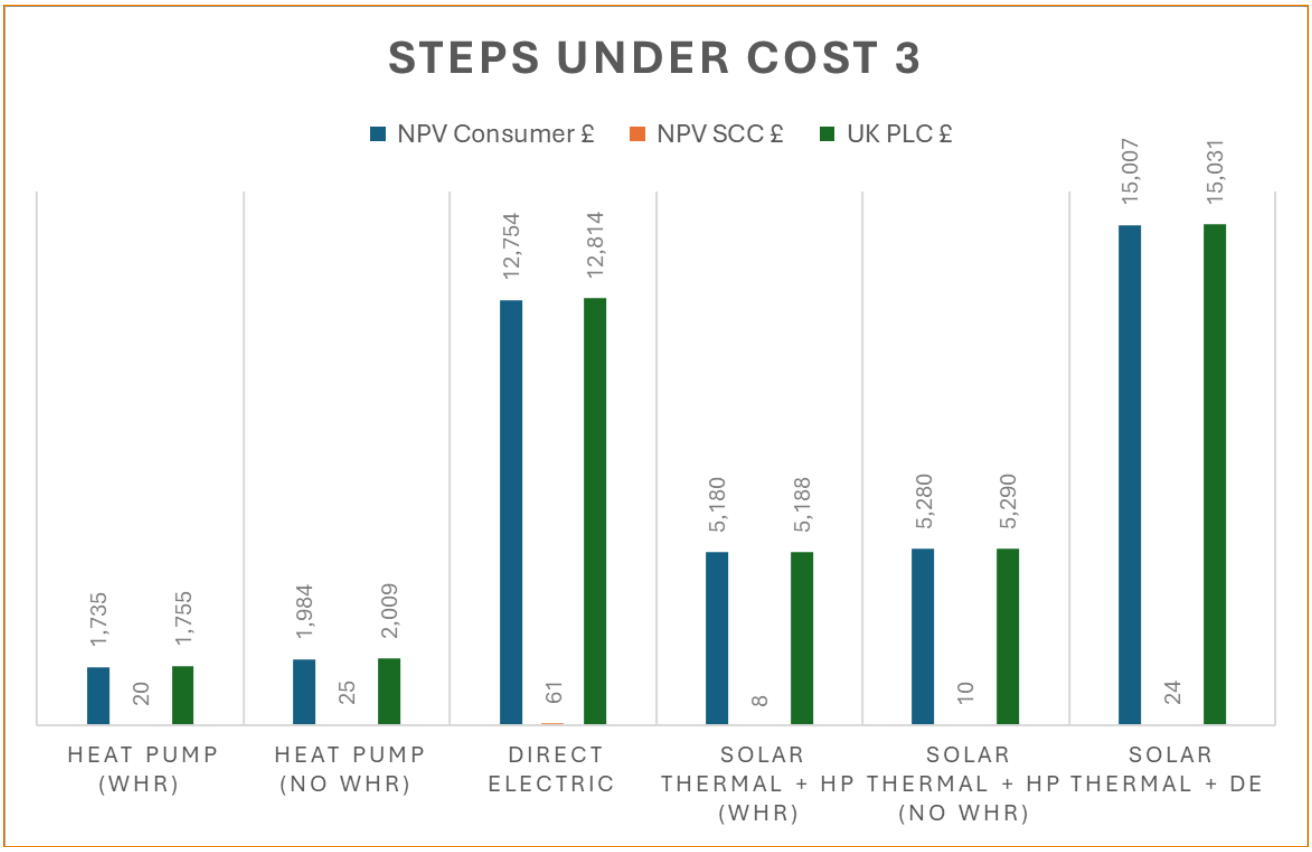


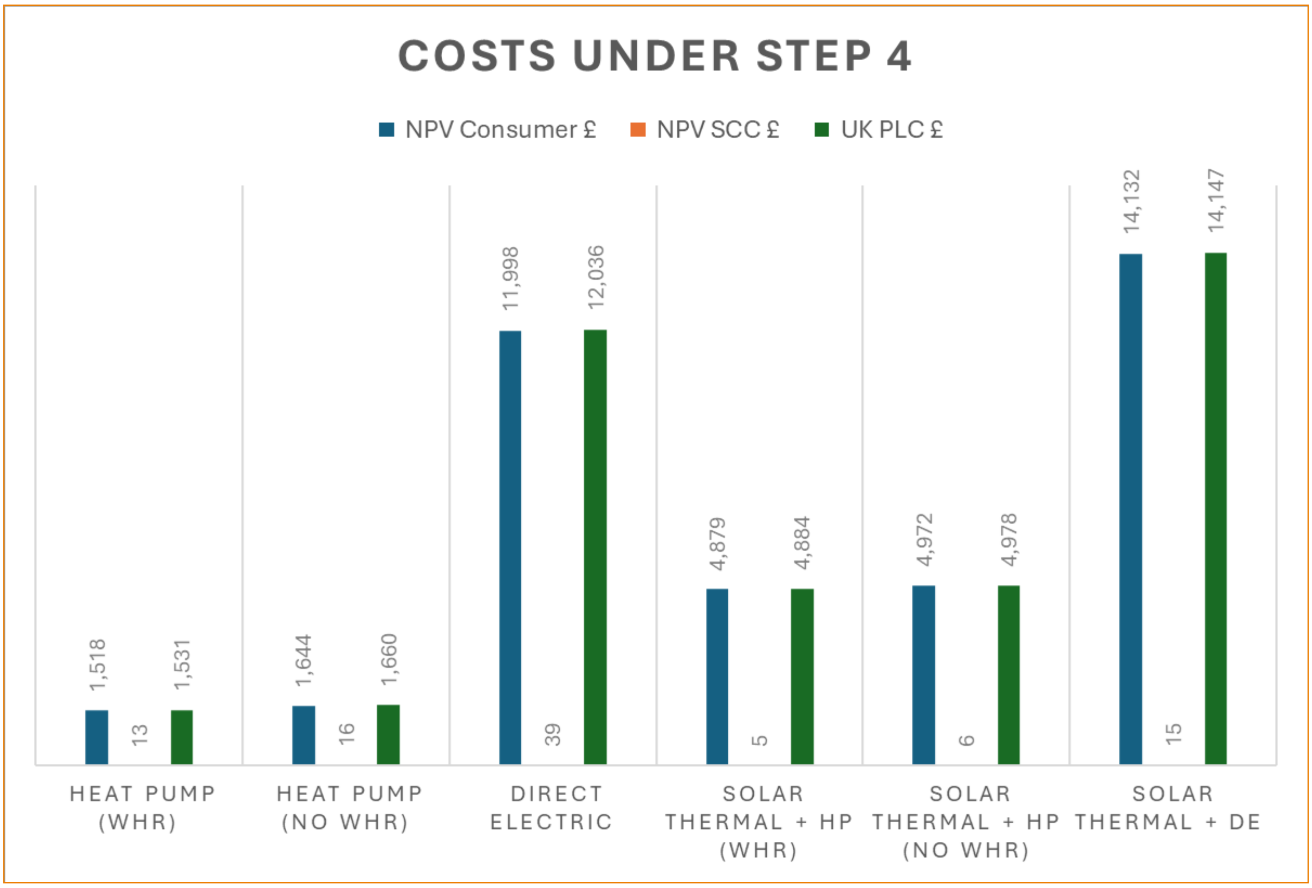
8. DOMESTIC HOT WATER WITH LEVIES, 30% DSR



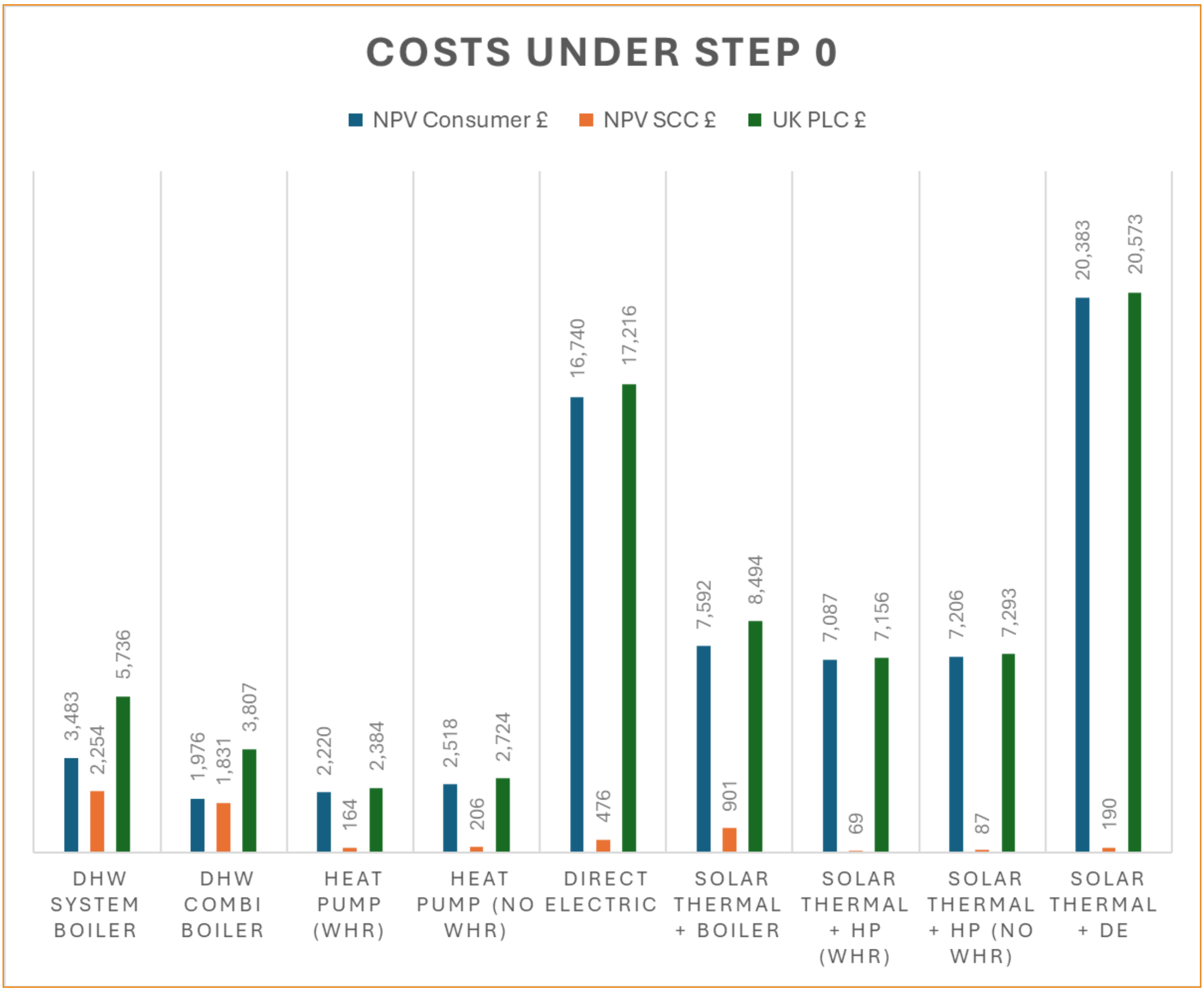

COSTS UNDER STEP 1
NPV Consumer £
NPV SCC £
UK PLC £
3,003
2,099
5,102
1,674
1,706
3,379
2,218
72
2,290
2,543
91
2,634
15,948
215
16,164
6,768
840
7,608
6,454
29
6,483
6,584
36
6,620
18,670
86
18,756
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

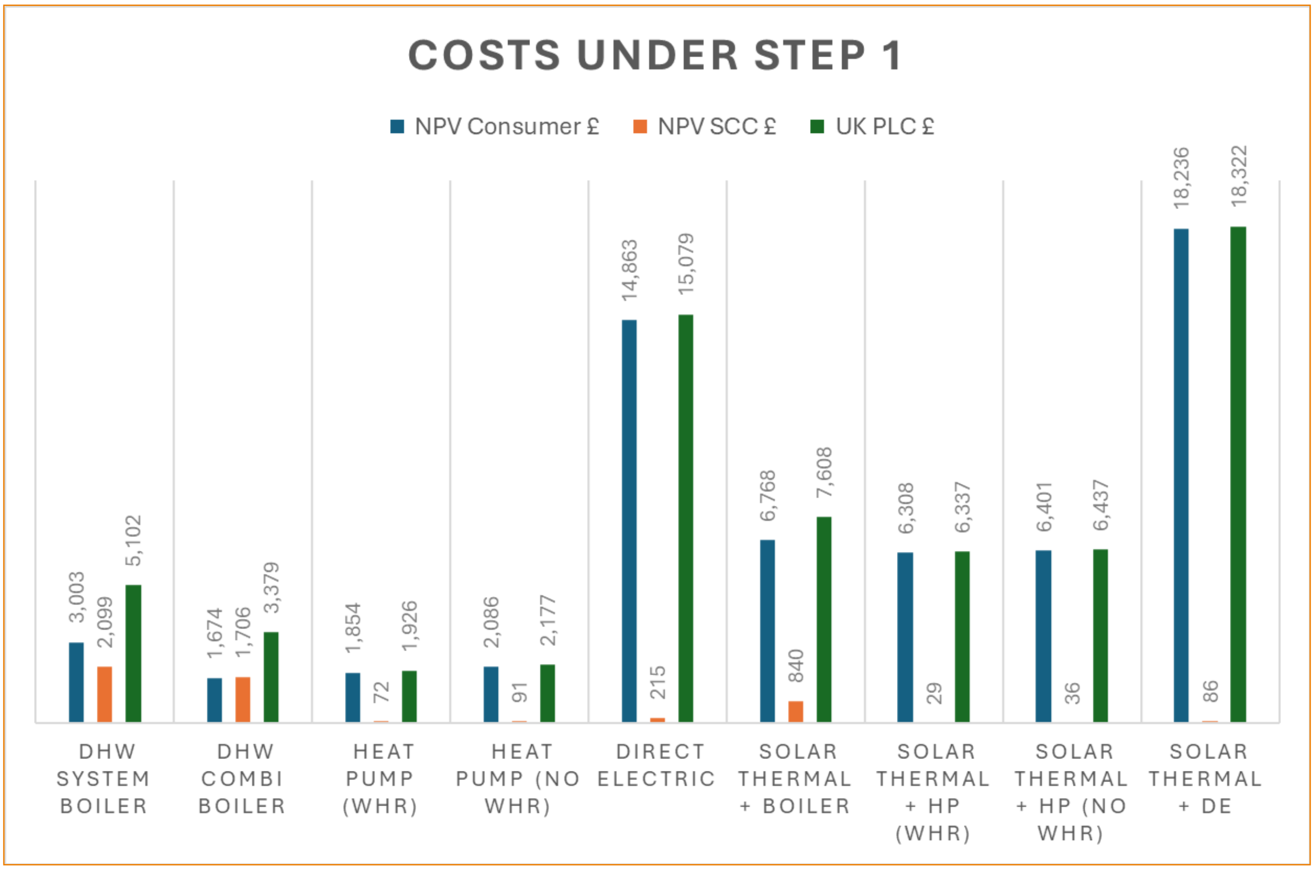

COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
2,787
2,002
4,790
1,576
1,627
3,203
2,035
43
2,078
2,328
54
2,383
14,883
131
15,014
6,331
801
7,132
6,030
17
6,048
6,148
22
6,169
17,470
53
17,522
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

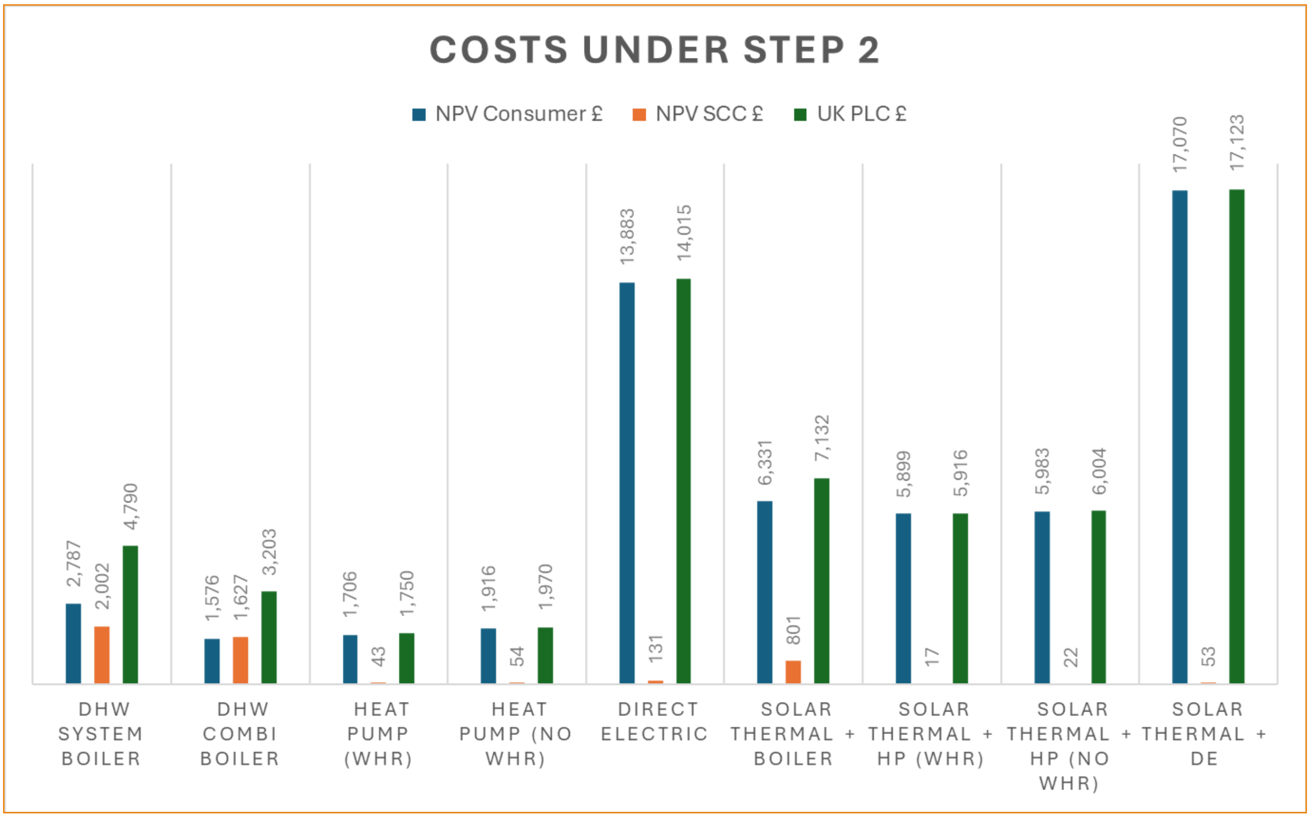

STEPS UNDER COST 3
NPV Consumer £
NPV SCC £
UK PLC £
1,735
20
1,755
1,984
25
2,009
12,754
61
12,814
5,180
8
5,188
5,280
10
5,290
15,007
24
15,031
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

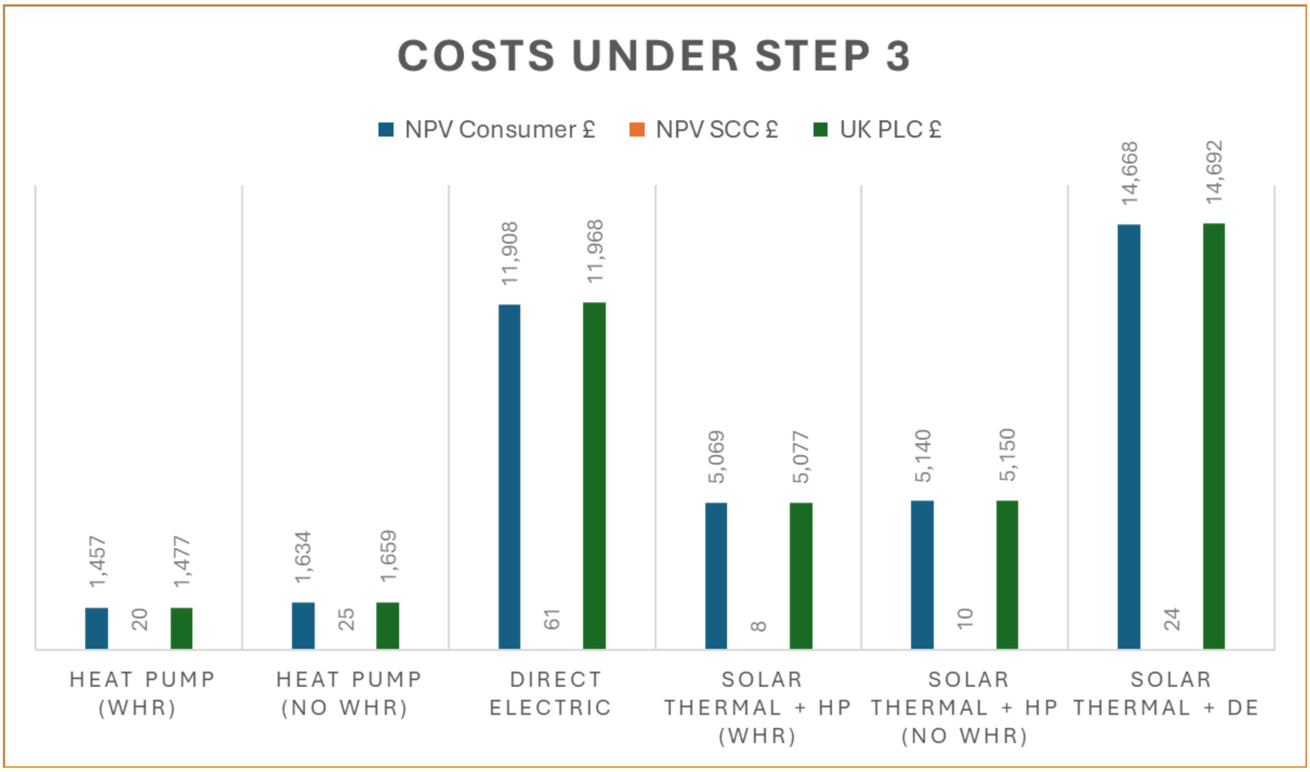

COSTS UNDER STEP 4
NPV Consumer £
NPV SCC £
UK PLC £
1,518
13
1,531
1,644
16
1,660
11,998
39
12,036
4,879
5
4,884
4,972
6
4,978
14,132
15
14,147
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

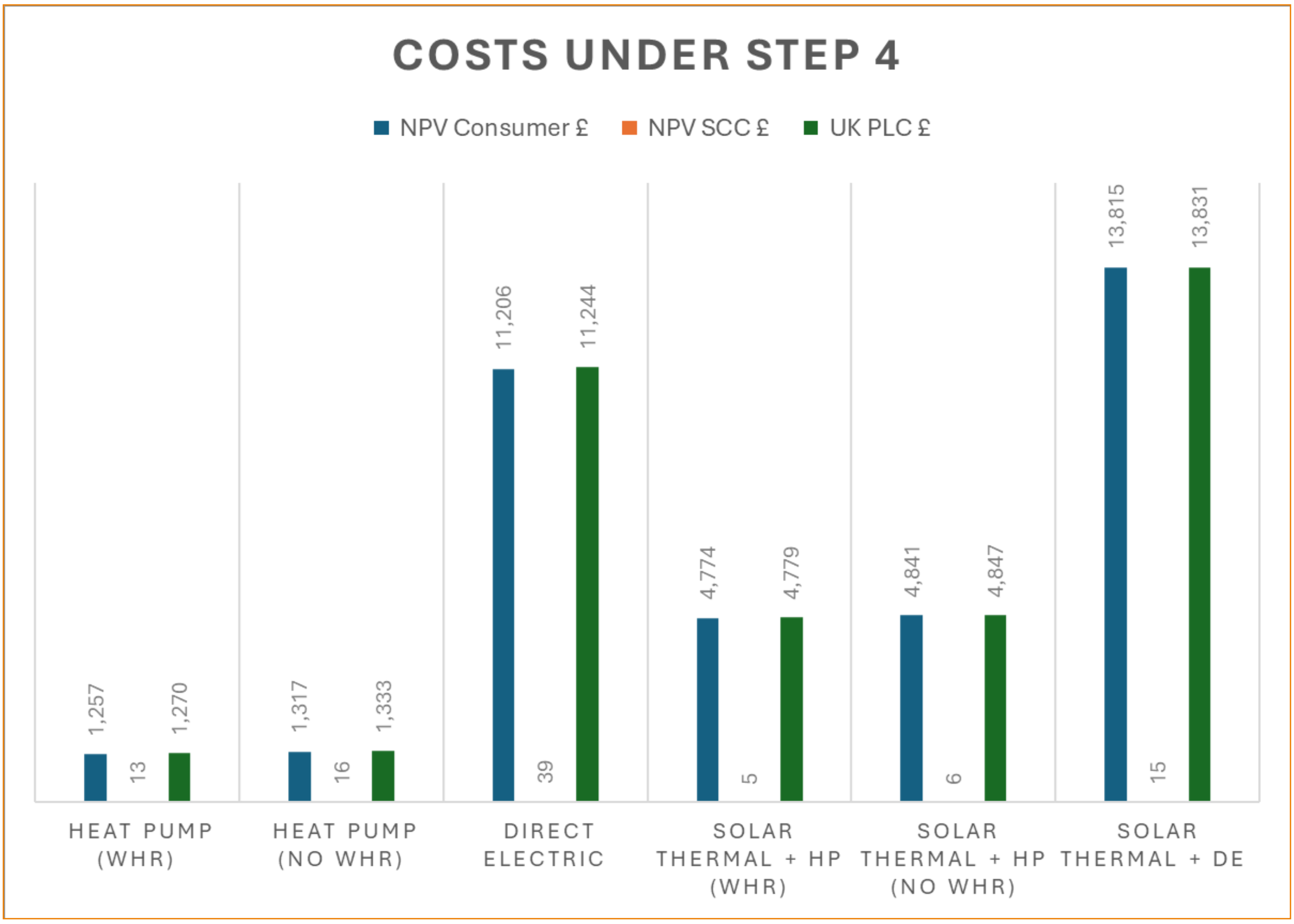
9. DOMESTIC HOT WATER WITH LEVIES, 50% DSR



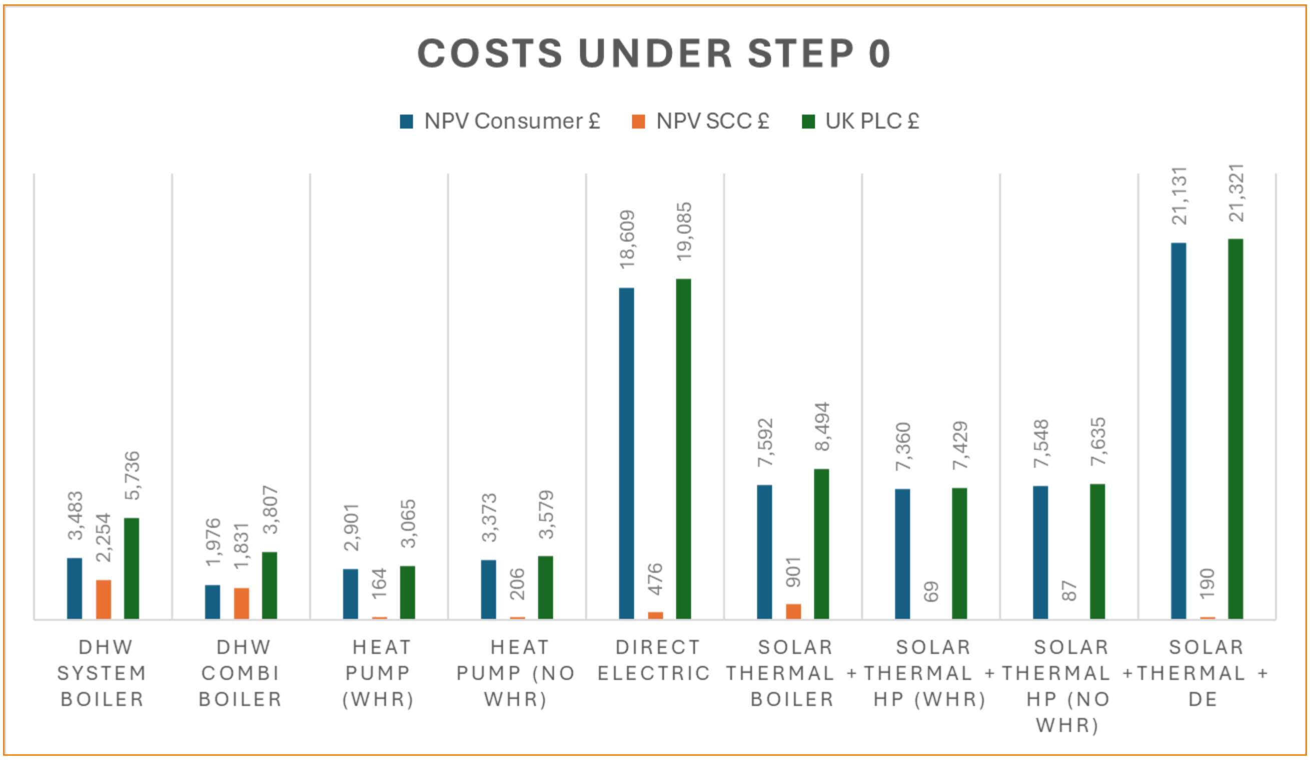

COSTS UNDER STEP 1
NPV Consumer £
NPV SCC £
UK PLC £
3,003
2,099
5,102
1,674
1,706
3,379
1,854
72
1,926
2,086
91
2,177
14,863
215
15,079
6,768
840
7,608
6,308
29
6,337
6,401
36
6,437
18,236
86
18,322
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

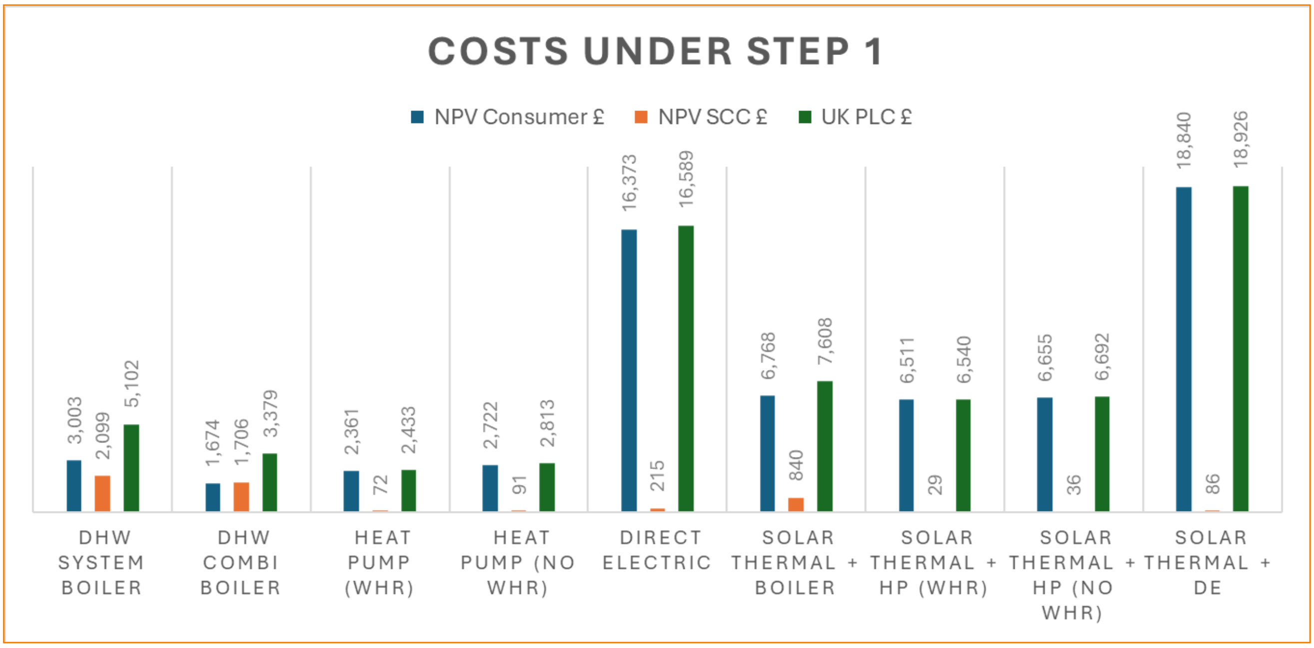

COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
2,787
2,002
4,790
1,576
1,627
3,203
1,706
43
1,750
1,916
54
1,970
13,883
131
14,015
6,331
801
7,132
5,899
17
5,916
5,983
22
6,004
17,070
53
17,123
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

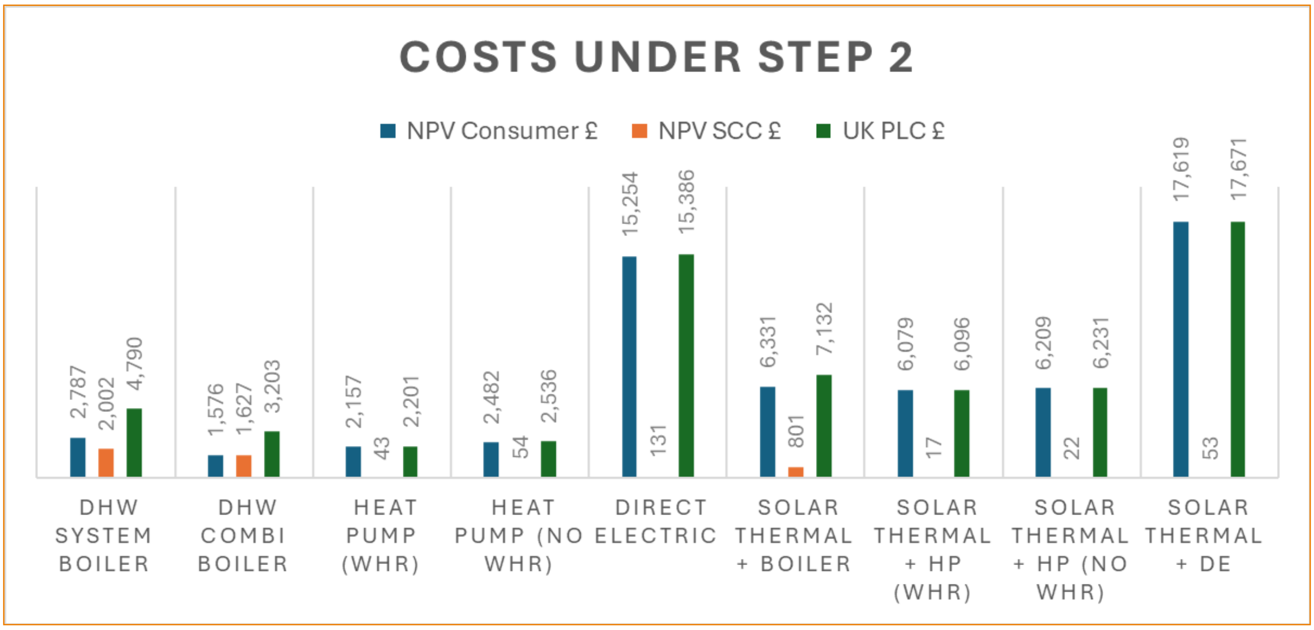

COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
1,457
20
1,477
1,634
25
1,659
11,908
61
11,968
5,069
8
5,077
5,140
10
5,150
14,668
24
14,692
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

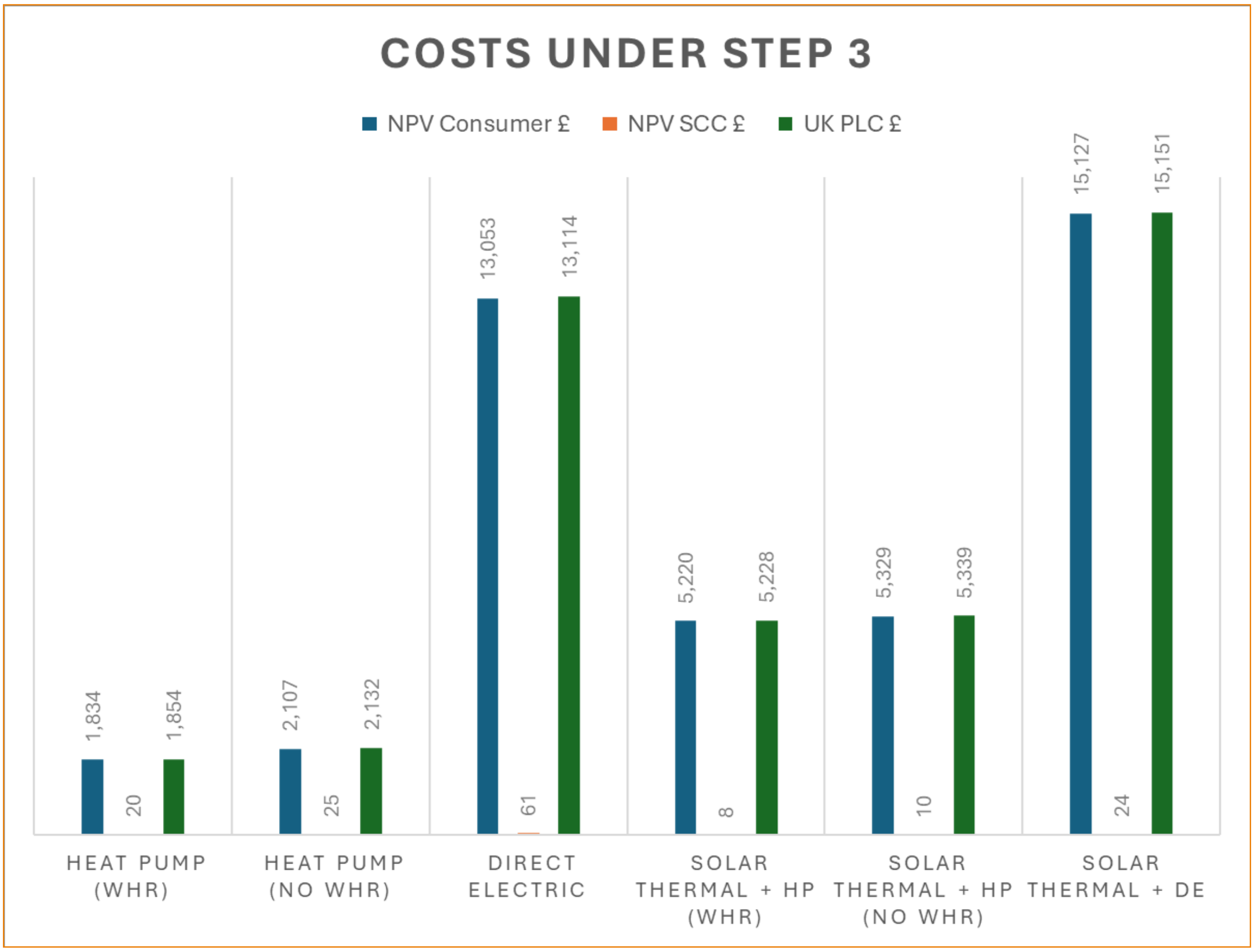

COSTS UNDER STEP 4
NPV Consumer £
NPV SCC £
UK PLC £
1,257
13
1,270
1,317
16
1,333
11,206
39
11,244
4,774
5
4,779
4,841
6
4,847
13,815
15
13,831
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

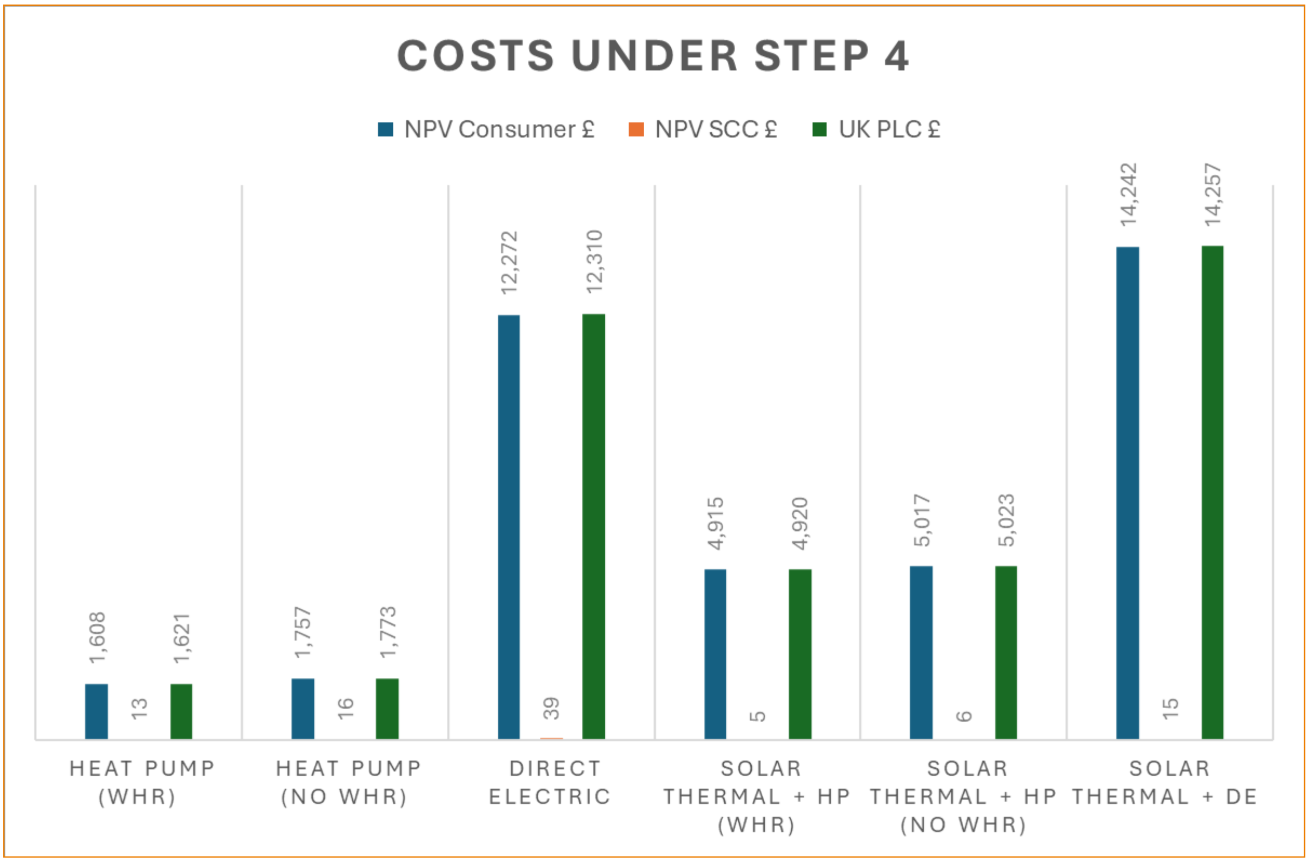
10. DOMESTIC HOT WATER NO LEVIES, NO DSR



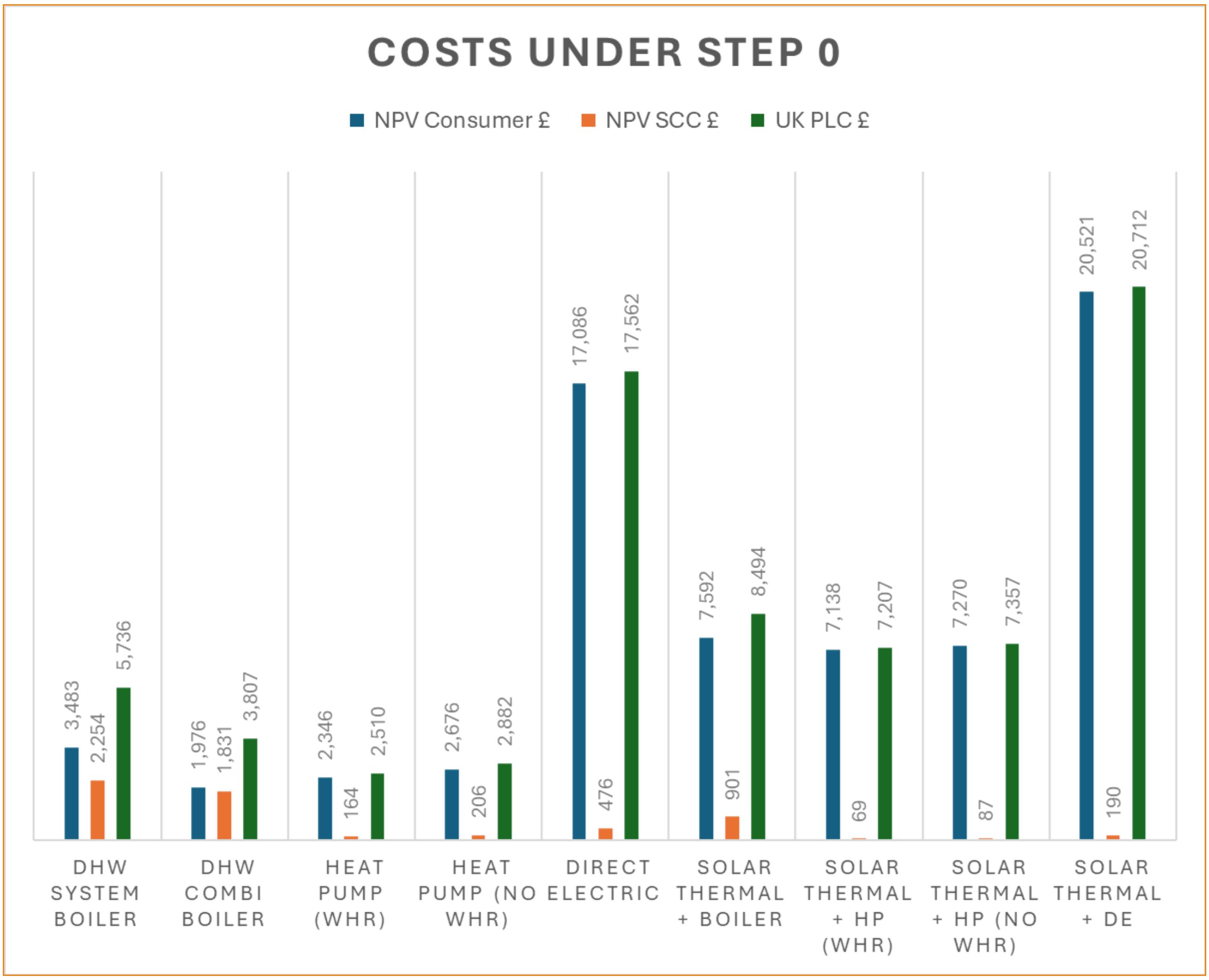

COSTS UNDER STEP 1
NPV Consumer £
NPV SCC £
UK PLC £
3,003
2,099
5,102
1,674
1,706
3,379
2,361
72
2,433
2,722
91
2,813
16,373
215
16,589
6,768
840
7,608
6,511
29
6,540
6,655
36
6,692
18,840
86
18,926
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

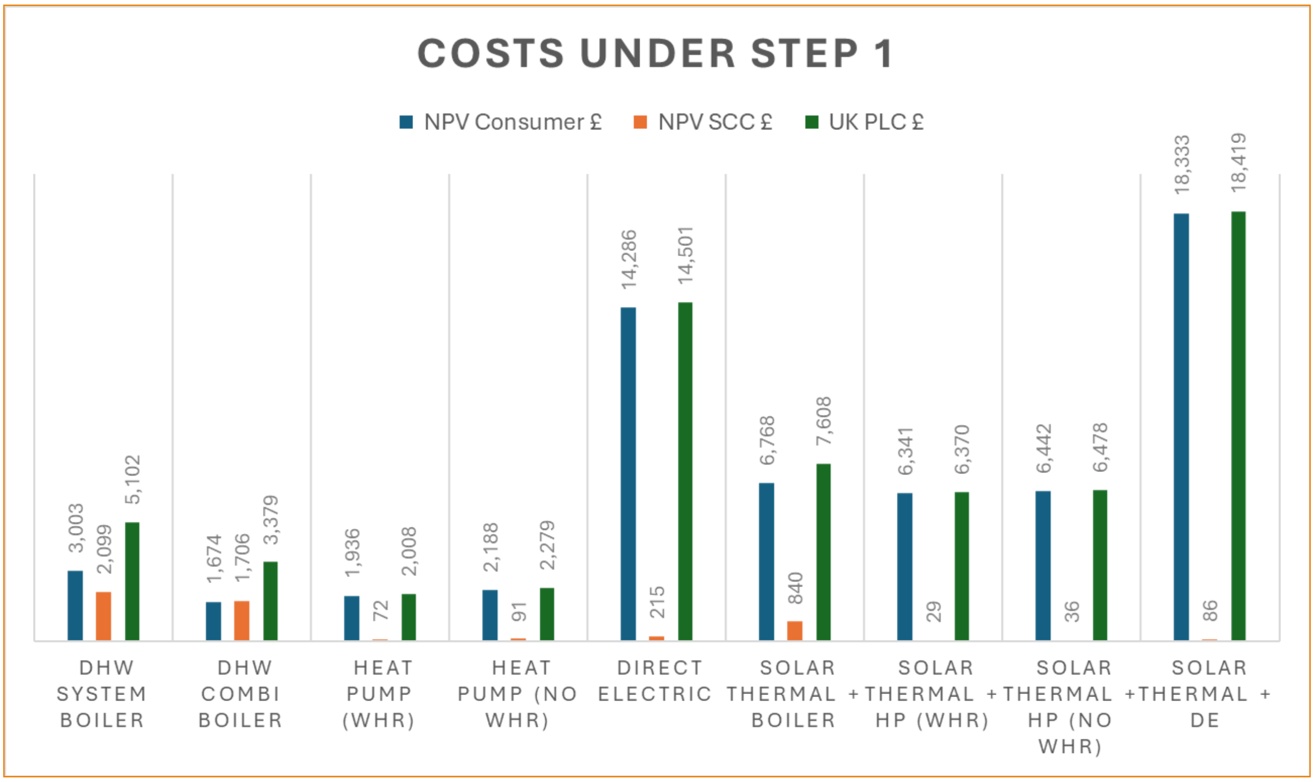

COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
2,787
2,002
4,790
1,576
1,627
3,203
2,157
43
2,201
2,482
54
2,536
15,254
131
15,386
6,331
801
7,132
6,079
17
6,096
6,209
22
6,231
17,619
53
17,671
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

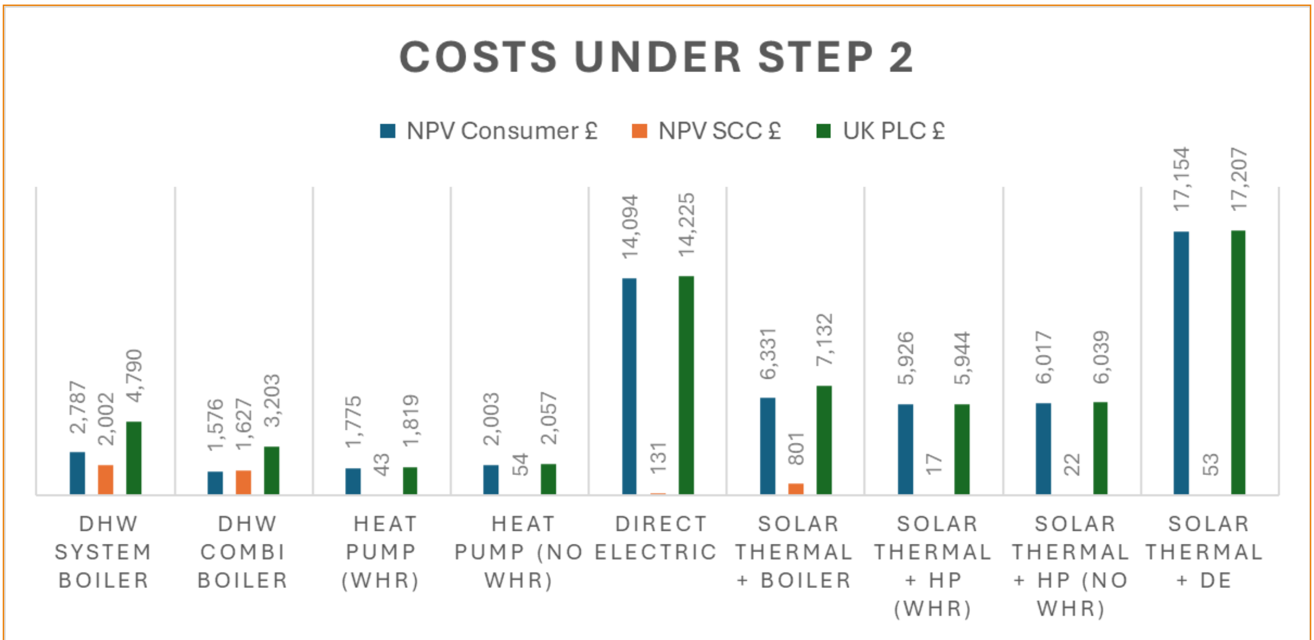

COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
1,834
20
1,854
2,107
25
2,132
13,053
61
13,114
5,220
8
5,228
5,329
10
5,339
15,127
24
15,151
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

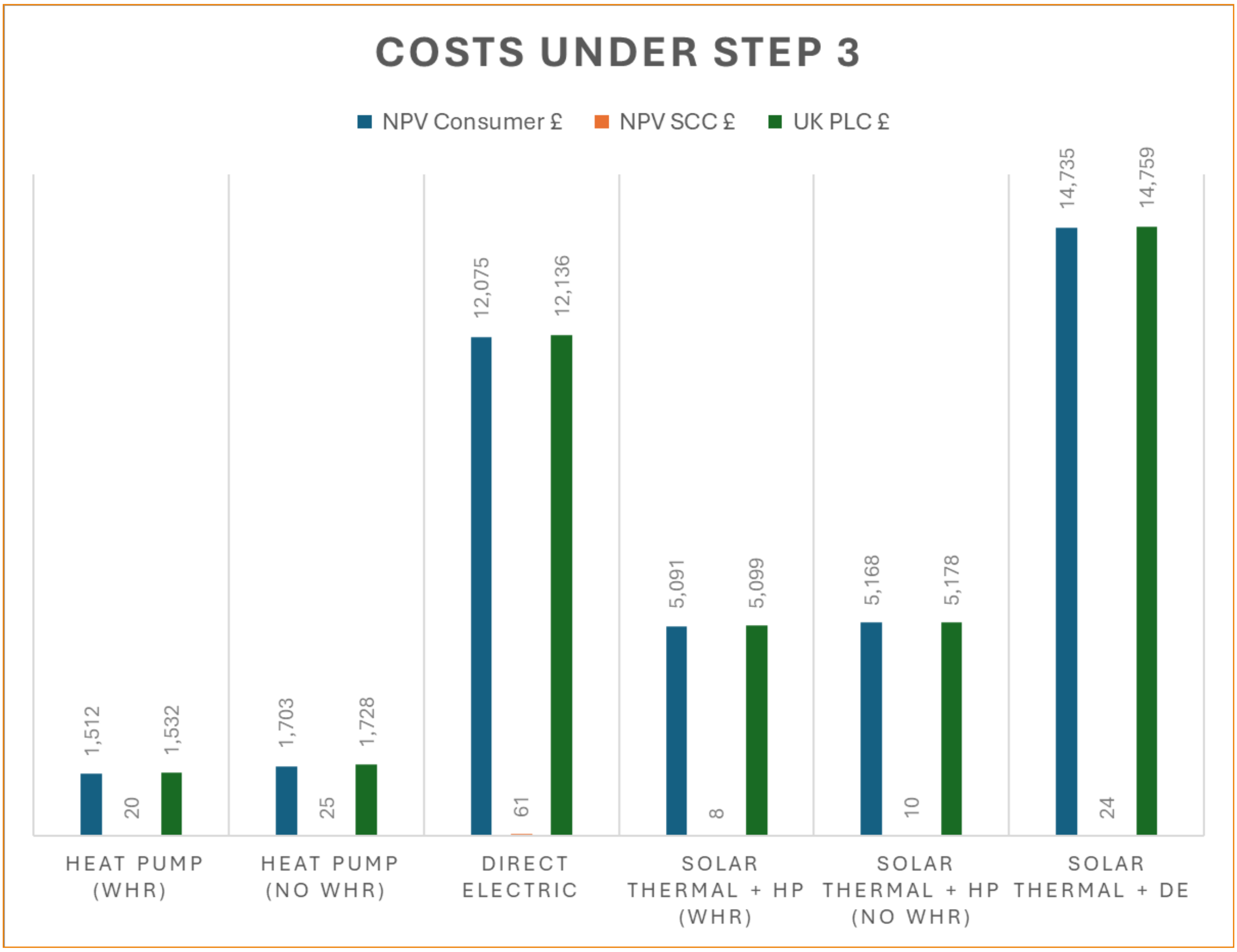

COSTS UNDER STEP 4
NPV Consumer £
NPV SCC £
UK PLC £
1,608
13
1,621
1,757
16
1,773
12,272
39
12,310
4,915
5
4,920
5,017
6
5,023
14,242
15
14,257
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

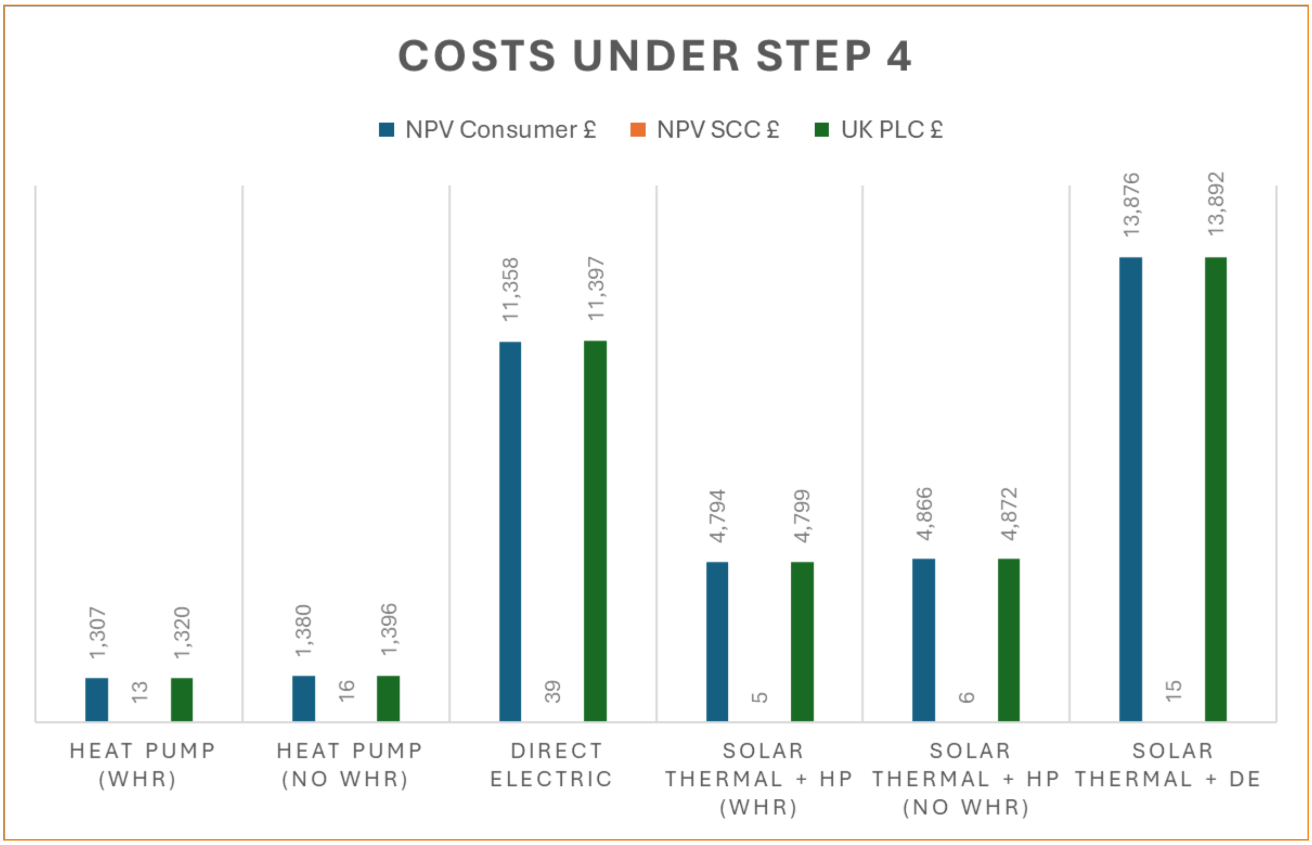
11. DOMESTIC HOT WATER NO LEVIES, 30% DSR



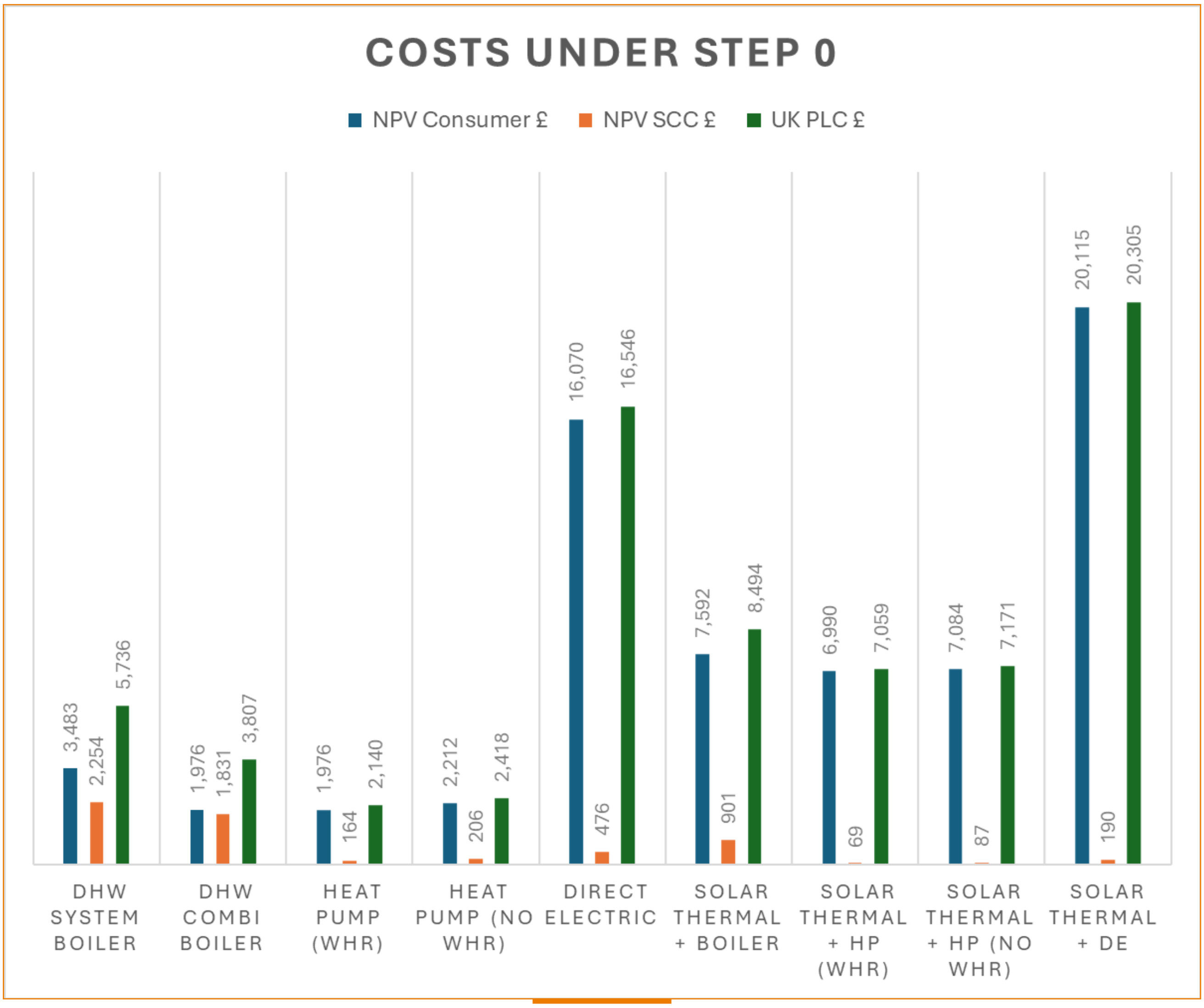

COSTS UNDER STEP 1
NPV Consumer £
NPV SCC £
UK PLC £
3,003
2,099
5,102
1,674
1,706
3,379
1,936
72
2,008
2,188
91
2,279
14,286
215
14,501
6,768
840
7,608
6,341
29
6,370
6,442
36
6,478
18,333
86
18,419
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL BOILER
SOLAR + THERMAL HP (WHR)
SOLAR + THERMAL HP (NO WHR)
SOLAR + THERMAL + DE

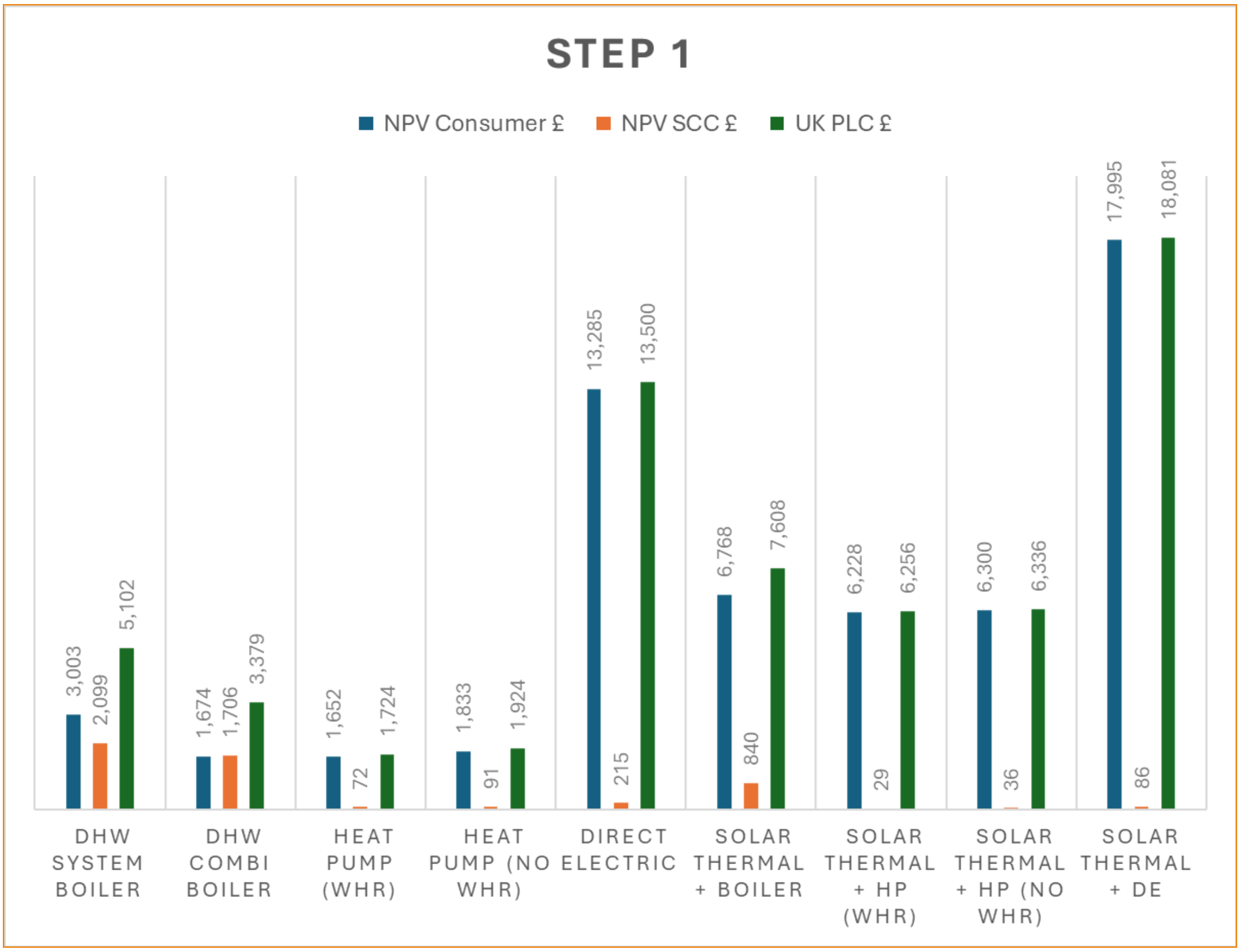

COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
2,787
2,002
4,790
1,576
1,627
3,203
1,775
43
1,819
2,003
54
2,057
14,094
131
14,225
6,331
801
7,132
5,926
17
5,944
6,017
22
6,039
17,154
53
17,207
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

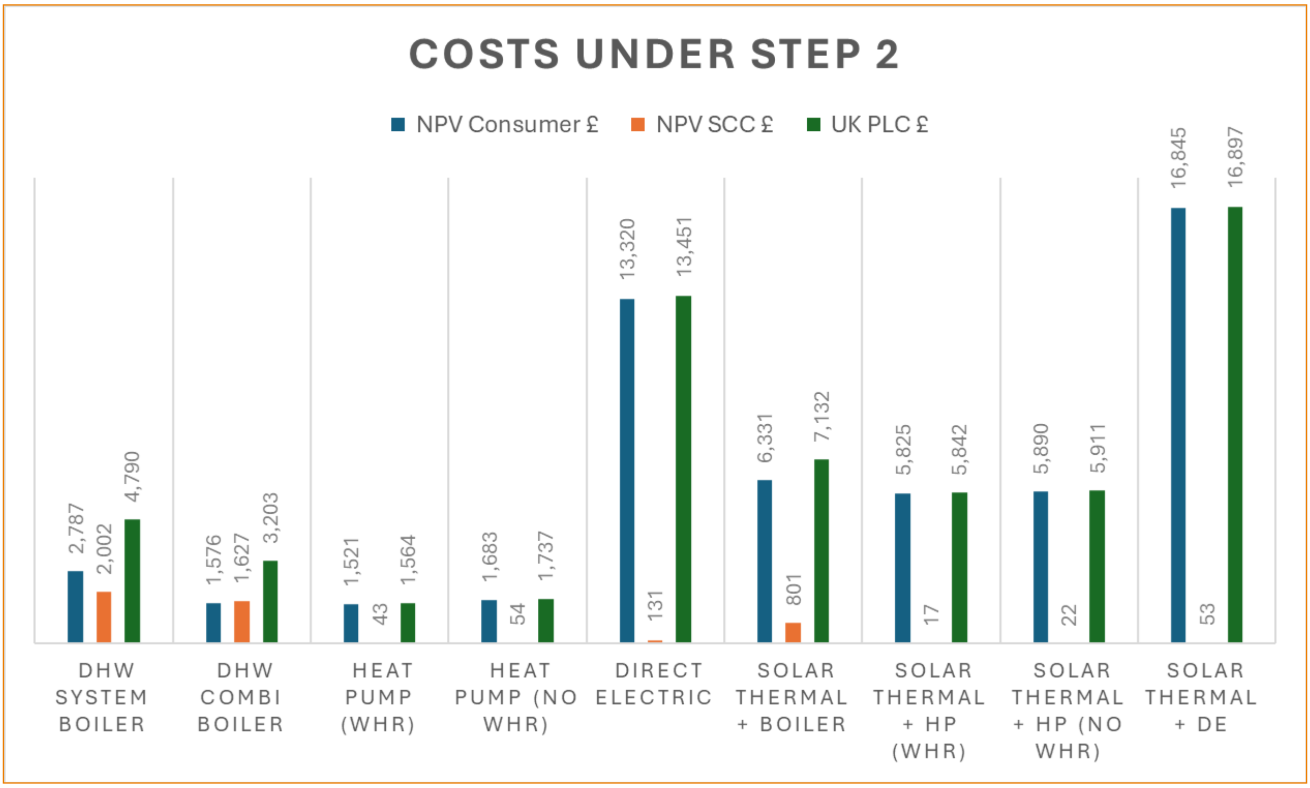

COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
1,512
20
1,532
1,703
25
1,728
12,075
61
12,136
5,091
8
5,099
5,168
10
5,178
14,735
24
14,759
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

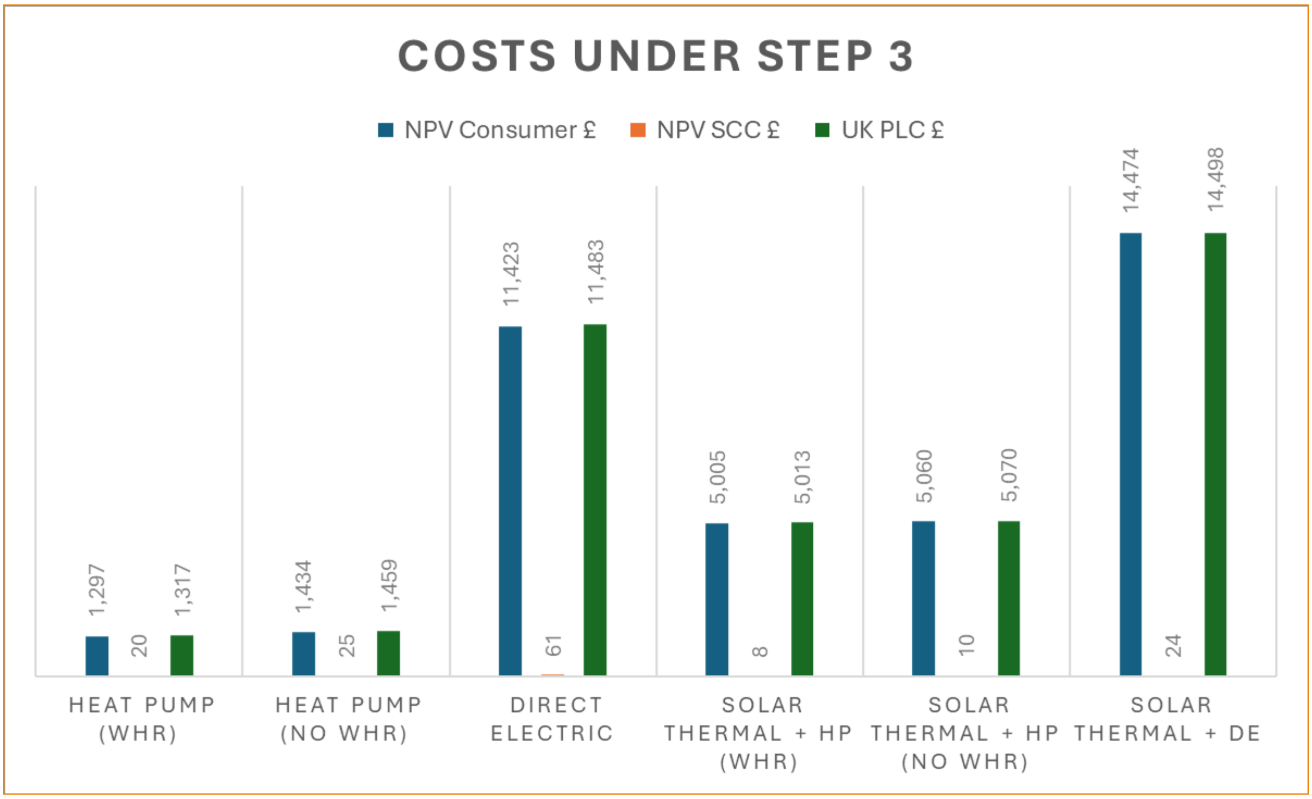


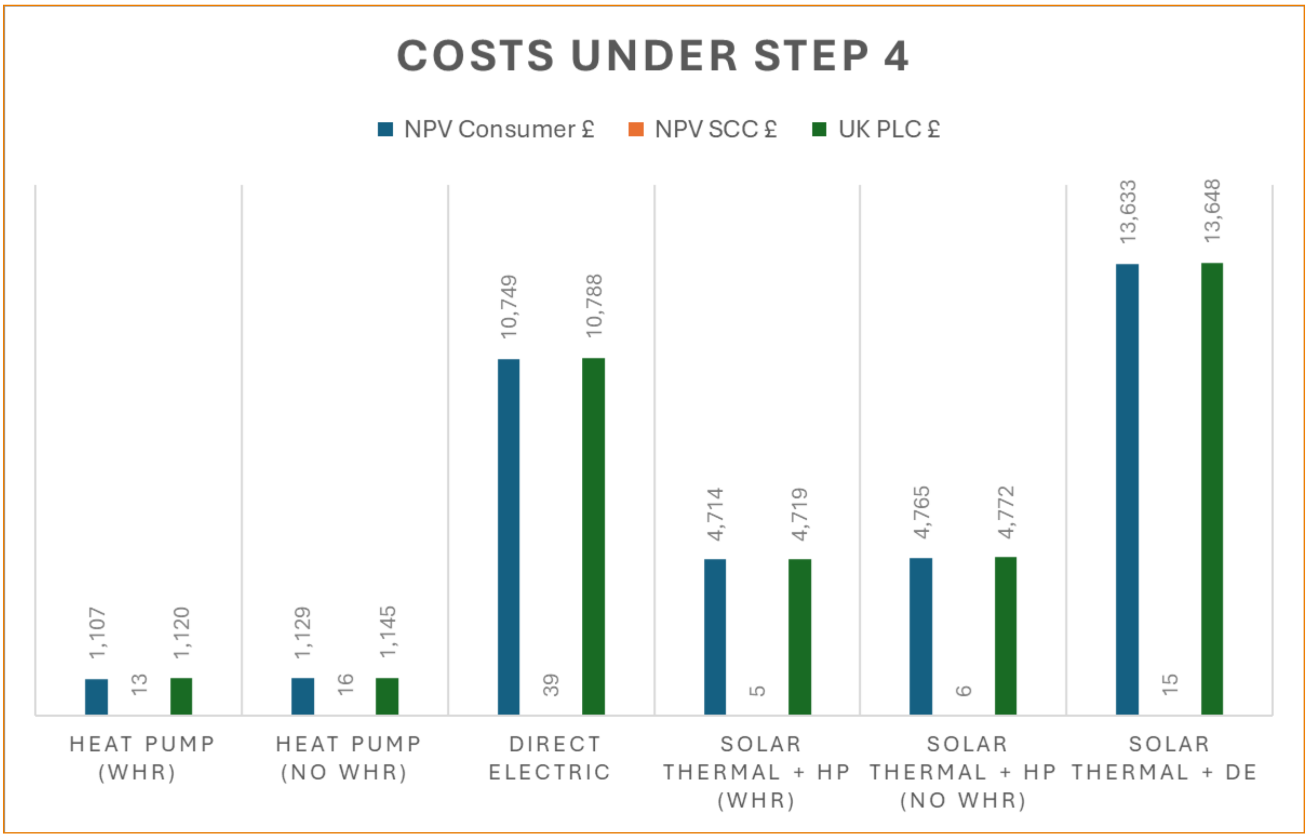
12. DOMESTIC HOT WATER NO LEVIES, 50% DSR




STEP 1
NPV Consumer £
NPV SCC £
UK PLC £
3,003
2,099
5,102
1,674
1,706
3,379
1,652
72
1,724
1,833
91
1,924
13,285
215
13,500
6,768
840
7,608
6,228
29
6,256
6,300
36
6,336
17,995
86
18,081
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE


COSTS UNDER STEP 2
NPV Consumer £
NPV SCC £
UK PLC £
2,787
2,002
4,790
1,576
1,627
3,203
1,521
43
1,564
1,683
54
1,737
13,320
131
13,451
6,331
801
7,132
5,825
17
5,842
5,890
22
5,911
16,845
53
16,897
DHW SYSTEM BOILER
DHW COMBI BOILER
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + BOILER
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE


COSTS UNDER STEP 3
NPV Consumer £
NPV SCC £
UK PLC £
1,297
20
1,317
1,434
25
1,459
11,423
61
11,483
5,005
8
5,013
5,060
10
5,070
14,474
24
14,498
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE


COSTS UNDER STEP 4
NPV Consumer £
NPV SCC £
UK PLC £
1,107
13
1,120
1,129
16
1,145
10,749
39
10,788
4,714
5
4,719
4,765
6
4,772
13,633
15
13,648
HEAT PUMP (WHR)
HEAT PUMP (NO WHR)
DIRECT ELECTRIC
SOLAR THERMAL + HP (WHR)
SOLAR THERMAL + HP (NO WHR)
SOLAR THERMAL + DE

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