Heat Pumps Set to Increase Home Heating Costs by 400%

Microwave boilers offer a cheaper alternative as gas boilers are phased out

UNITED KINGDOM, 25 JUNE 2021; Heat pumps will be unaffordable for many consumers, warns a new report commissioned by Heat Wayv, a UK energy technology company.

With gas boilers due to be banned in new homes from 2025 to help cut CO2 emissions, the proposed introduction of heat pumps as a low-carbon alternative will be too costly, according to the company's Home Heating Total Cost of Ownership (TCO) analysis. This concludes that the installation and use of heat pumps would cause a 400% increase in home heating costs for the average consumer. The promised reductions in annual fuel costs are overwhelmed by high acquisition and installation costs, with the total consumer expenditure set to be in excess of £45,000 over a ten-year period.

The cost of installing heat pumps, at between £10,000 and £14,000, would severely impact the budgets of local authorities, housing trusts and other housing stock providers. New house builders, who will legally be forced to install zero-carbon alternatives to gas boilers from 2025 will face major cost increases if using heat pumps.

The Home Heating TCO report has been published by Heat Wayv, a UK engineering company that is developing a cheaper and more environmentally-friendly microwave boiler. The cost analysis report examines annual operating costs and amortised capital costs over 10- and 20-year periods, and includes costings based on standard electricity tariffs, off-peak tariffs and a blended tariff rate that reflects typical usage.

Hydrogen Boilers

For comparison, the analysis also includes hydrogen boilers. High hydrogen fuel costs mean that these boilers would cost consumers £79,000 over a 20-year period. Hydrogen boilers have been proposed as a direct replacement for gas boilers, but serious challenges in the national distribution of hydrogen and annual fuel costs of over £3,200 would make them both unavailable and unaffordable to most consumers.

Electrical Panel Radiators

Home heating using electrical panel radiators also showed a three-times increase in cost compared to today's gas boilers. While purchase and installations costs are relatively low for

electrical panel heating, the high annual electrical bill given that they tend to be used at peak periods pushes the total cost up to up to £3,200 per year.

Microwave Boilers

The lowest cost alternative to gas is the microwave boiler, which has an annualised cost of £1,883 over 10 years when used across both standard and off-peak rates and reduces further to £1,645 over its full 20-year lifetime. When used exclusively on off-peak electricity tariffs, microwave boiler costs are lower than gas boilers, with annual costs over a 20-year period of £972 for microwave compared to £1,185 for gas.

"The need to replace CO_2 belching gas boilers is beyond question, but we need to find solutions that are affordable for average families," explains Paul Atherton, CTO of Heat Wayv. "From the analysis, there are clearly very different levels of costs for the different proposed solutions, but these costs are often not understood and not being debated. Some are simply unaffordable, and we need to prioritise the solutions that will prove cost effective for British homes."

Heat Wayv has developed the world's first microwave boiler, which provides home heating solutions with similar installation and running costs to existing gas boilers, (using twilight off-peak tariffs) but with zero carbon emissions. The company is currently in pre-production development for trial units in 2022 with full product manufacturing forecast for 2023. The replacement of UK gas boilers with microwave boilers would lead to a 14%* reduction in the UK's greenhouse gas carbon emissions.

"The microwave boiler completely removes the burden on central government and tax-payers for massive additional budgets to transition the UK by 2035," says Phil Stevens, CEO of Heat Wayv. "For local authorities and housing trusts, it also means they can transition the home heating of their housing stock from gas to zero-carbon with no impact on their scheduled maintenance budgets."

Microwave boilers would eliminate up to 54 million tons of CO_2 emissions that are currently created annually by gas boilers in the UK, representing 14%* of the total CO_2 emissions in the UK and 29%* of the UK's greenhouse gas emissions that come from homes. Heat Wayv's microwave boilers are also designed to be networked into an IoT (Internet of Things) configuration where they could collectively be used as a national battery at times of over-supply from renewable energy such as wind, where excess electrical energy could be stored as hot water for later use.

*** Sources:** Department of Energy and Climate Change (DECC), the Office of National Statistics (ONS), Committee on Climate Change (CCC).

Summary Results from Heat Wayv Home Heating TCO Analysis:

PARAMETERS
- Space and Hot Water only
- Energy Usage – 12,800 kWh
- Energy Cost – 0.19 kWh
- All-in Cost includes servicing

COST COMPARISON MATRIX - STANDARD

	AIR SOURCE HEAT PUMP	HYDROGEN BOILER	ELECTRIC PANEL SYSTEM	HEAT WAYV ONE	GAS BOILER
PURCHASE PRICE	£8000 - £10,000	£3,500	£4,050	£3,500	£3,500
INSTAL COST	£10,000 - £14,000	£750	£1,000	£750	£750
LIFE EXPECTANCY	10 YEARS	10 YEARS	10 YEARS	20 YEARS	10 YEARS
AVERAGE FUEL COST PA	£1,045	£3,200	£2,432	£2,432	(12,800 x 0.05) £640
SECONDARY SYSTEM	£1,000	NA	NA	NA	NA
LIFE EXPECTANCY	5 YEARS	NA	NA	NA	NA
AVERAGE FUEL COST PA	£1,216	NA	NA	NA	NA
TOTAL RUNNING COST PA	£2,321	£3,350	£2,507	£2,432	£760
1ST YR PURCHASE & INSTAL	£20,000	£4,250	£5,050	£4,250	£4,250
10YR ALL-IN COST	**£46,110**	**£37,750**	**£30,120**	**£28,570**	**£11,850**
20YR ALL-IN COST	**£106,220**	**£79,000**	**£64,290**	**£52,890**	**£23,700**

PARAMETERS
- Space and Hot Water only
- Energy Usage – 12,800 kWh
- Energy Cost – 0.05 kWh
- All-in Cost includes servicing

COST COMPARISON MATRIX – OFF-PEAK

	AIR SOURCE HEAT PUMP	HYDROGEN BOILER	ELECTRIC PANEL SYSTEM	HEAT WAYV ONE	GAS BOILER
PURCHASE PRICE	£8000 - £10,000	£3,500	£4,050	£3,500	£3,500
INSTAL COST	£10,000 - £14,000	£750	£1,000	£750	£750
LIFE EXPECTANCY	10 YEARS	10 YEARS	10 YEARS	20 YEARS	10 YEARS
AVERAGE FUEL COST PA	£1,045	£3,200	£2,432	£640	(12,800 x 0.05) £640
SECONDARY SYSTEM	£1,000	NA	NA	NA	NA
LIFE EXPECTANCY	5 YEARS	NA	NA	NA	NA
AVERAGE FUEL COST PA	£1,216	NA	NA	NA	NA
TOTAL RUNNING COST PA	£2,321	£3,350	£2,507	£640	£760
1ST YR PURCHASE & INSTAL	£20,000	£4,250	£5,050	£4,250	£4,250
10YR ALL-IN COST	**£46,110**	**£37,750**	**£30,120**	**£11,850**	**£11,850**
20YR ALL-IN COST	**£106,220**	**£79,000**	**£64,290**	**£19,450**	**£23,700**

PARAMETERS
- Space and Hot Water only
- Energy Usage – 12,800 kWh
- Energy Cost – 0.11 kWh
- All-in Cost includes servicing

COST COMPARISON MATRIX – BLENDED

	AIR SOURCE HEAT PUMP	HYDROGEN BOILER	ELECTRIC PANEL SYSTEM	HEAT WAYV ONE	GAS BOILER
PURCHASE PRICE	£8000 - £10,000	£3,500	£4,050	£3,500	£3,500
INSTAL COST	£10,000 - £14,000	£750	£1,000	£750	£750
LIFE EXPECTANCY	10 YEARS	10 YEARS	10 YEARS	20 YEARS	10 YEARS
AVERAGE FUEL COST PA	£605	£3,200	£1,408	£1,408	(12,800 x 0.05) £640
SECONDARY SYSTEM	£1,000	NA	NA	NA	NA
LIFE EXPECTANCY	5 YEARS	NA	NA	NA	NA
AVERAGE FUEL COST PA	£704	NA	NA	NA	NA
TOTAL RUNNING COST PA	£1,559	£3,350	£1,558	£1,408	£760
1ST YR PURCHASE & INSTAL	£20,000	£4,250	£5,050	£4,250	£4,250
10YR ALL-IN COST	**£36,590**	**£37,750**	**£20,630**	**£18,830**	**£11,850**
20YR ALL-IN COST	**£87,180**	**£79,000**	**£45,310**	**£32,910**	**£23,700**

*** Sources:** Department of Energy and Climate Change (DECC), the Office of National Statistics (ONS), Committee on Climate Change (CCC).

Note on gas boiler phase out

Gas boilers will be phased out sequentially in the UK starting with a ban on installation in new homes from 2025, progressing to a ban on replacements in 2030 and a planned elimination of all gas boilers by 2038. The EU and other countries that have a substantial installed base of gas boilers are also in the process of their elimination.

About Heat Wayv Microwave Boilers

Using technology similar to that found in kitchen microwave ovens throughout the world, the microwave boiler uses a specific frequency to transfer energy to individual water molecules and so heat up the volume of water.

The Heat Wayv microwave boiler design uses a combination of sequential pulse-width modulation and specialist materials to provide what is effectively continuous heating but at reduced power settings. This means that the water can be heated more efficiently with lower energy required. The microwave boilers are designed and shielded in a far superior way to regular microwave ovens so that they do not and can never interfere with household electronic equipment such as Wi-Fi routers.

The design created by Heat Wayv uses multi-blade assembly to heat the water through a proprietary system where flow rates are determined by sensors and AI-based controllers. This ensures that a consistent water temperature is reached in the most efficient way possible. Where energy is inevitably lost to the surroundings, a turbo charge approach recycles this energy back into heating the water. Through this conservation of energy an overall efficiency of 96% has been achieved for the Heat Wayv microwave boiler.

About Heat Wayv

Heat Wayv is based in the United Kingdom and is an energy technology company that specialises in the use of solid-state RF for heating applications. The founders, Paul Atherton and Phil Stevens, previously started and ran Wayv Technologies where they designed and developed the world's first handheld portable microwave. This robust heat-food-anywhere product was designed to meet the needs of defence users, but with additional applications in the recreational consumer market.

The founders successfully developed the Wayv Technology Stack (WTS); a solid-state, robust, RF framework that utilises configurable and controllable vario-power, high-performance, long-life amplifiers to generate energy. With Patents, Registered Design and Copyright protection, the WTS forms the operating foundation for the portable appliance and continues to evolve as the development platform for other products in the Heat Wayv portfolio.

*** Sources:** Department of Energy and Climate Change (DECC), the Office of National Statistics (ONS), Committee on Climate Change (CCC).

Addendum: Notes on Home Heating TCO Calculations

1. For consistency in deployable technology, the analysis is based on 12,800kWh as the medium energy usage for a medium sized household.
2. Throughout the analysis, energy consumption per annum is shown by tariff using Peak, Off-peak and Blended rates. The Off-peak tariff isn't available to all proposed technologies today, but it is highly likely to be available in the future. The Blended tariff is being proposed by the large REP's for space and hot water heating only and would be the Off-peak tariff plus 3 hours during the Peak tariff.
3. Not all of the proposed technologies would benefit from having access to Off-peak tariffs because of their method of operation, for example:
    a. **The Heat Pump** needs to operate for up to 12 hours to generate sufficient heat and hot water, it is not an "on-demand" system, and consequently would likely be running through the day when the Peak tariffs are in operation. Additionally this system will require a secondary immersion type hot water booster.
    b. **The Electric Panel System** is primarily space heating technology and is more frequently operated during Peak tariff hours. Additionally, this system has a secondary immersion type hot water heater to complete the demand cycle.
    c. **The Hydrogen Boiler** is shown for comparison purposes. Domestic hydrogen is not readily available for purchase and the practicality of deploying these boilers in a UK consumer wide gas-grid network has been deemed as impractical and unfeasible.
4. The Heat Wayv One, space and hot water heater has a 40L hot water tank and a recycling space heating system. The system is an all-in-one appliances and would be able to take advantage of the Off-peak tariff.
5. No electrical based technology is comparable to a gas boiler on cost alone, given that all the current green initiatives are levied on electricity generation. However, if the blended tariffs were levelled then electric powered appliances win hands-down on zero CO2 and lethal CO emissions alone.

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*** Sources:** Department of Energy and Climate Change (DECC), the Office of National Statistics (ONS), Committee on Climate Change (CCC).