Summary Report

Sponsoring Supplier	Innovator	Demonstration action product
EDF	Vestemi Limited	Radbot

Description of measure

Radbot is a smart thermostatic radiator valve that incorporates environmental sensors and embedded AI algorithm intelligence in order to detect and predict room occupancy and automatically regulate radiators. This aims to provide radiator by radiator zoning, allowing temperatures in unoccupied spaces to be reduced and thus reducing fuel bills and saving energy.

Sample size and composition

In total, monitoring equipment was installed in 125 properties. Of these 125, 6 households withdrew from the project during the monitoring. 545 Radbot devices were installed across the 125 properties, with 21 of those in the 6 households that withdrew.

Data collection issues were experienced for both temperature and gas consumption data which reduced the sample of dwellings for which data was successfully collected, they are detailed in the table below.

Measurement	Dwellings with Equipment Installed	% of Target Sample of 125	With-drew	Data Collection Issues	Successful Data Collection	% of Target Sample with Data
Internal Temperature & RH	125	100%	6	4	115	92%
Gas Consumption	83	66%	1	25	57	46%
- Of which optical meter reader or pulse logger	*74*	*59%*	*1*	*24*	*49*	*n/a*
- Of which smart meter data	*9*	*7%*	*0*	*1*	*8*	*n/a*

The sample contains a good mix of building tenure, age and built form. Compared to the UK housing stock the sample:

- Closely matches in the mix of tenures
- Is slightly skewed to have fewer older buildings, containing more buildings from the period between 1945-1980
- Is skewed in the breakdown of built forms, with fewer detached and more semi-detached properties.

The sample includes buildings from a wide range of locations, with a wide spread across England and Wales with 5 distinct clusters.

Parameters monitored

Monitoring and subsequent data analysis has been carried out to determine the difference in internal temperature, relative humidity and gas consumption from Radbot operating in smart mode by looking at the average changes on a property by property basis. This comparison helps to mitigate the impact that changes in households and buildings could have on the changes in conditions, by controlling these to be as similar as possible during the monitoring in Radbot smart mode smart and manual modes.

Occupant thermal comfort surveys were also carried out by Vestemi at the start, in the middle, and at the end of trial; in 97 properties with usable data the surveys were completed for all three stages.

Main findings

There was a mean change in internal temperature of **0.16°C decrease** (all zones), split by **0.05°C decrease** in Zone 1 (main living room) and **0.20°C decrease** in Zone 2 (all spaces other than main living room). This was across 105 properties, split by 84 locations in Zone 1 and 229 in Zone 2. The spread of observed change across this same sample was from a 2.01°C decrease to a 1.98°C increase in internal temperature. The mean change in internal temperature was small and similar in magnitude to the accuracy of the sensors used. As for the relative humidity, the mean change in was found to be small, with a **0.55% increase** in Zone 1 and **1.02% increase** in Zone 2. The change in average relative humidity across the sample is less than the uncertainty of the sensors used.

After processing, there were 37 properties where the heating system was known to be active and for which sufficiently granular gas data was available. Here, the mean change in gas consumption was found to be a decrease of 0.20 kWh/HDD equivalent to a **2.8% decrease** in gas use. With a spread of change of -1.87 to +1.93 kWh/HDD. Of these, it was possible to obtain a sub-sample of 13 properties for which the floor area was known as well, which resulted in a mean change per square metre of floor area of **4.2% decrease** when Radbot was in smart mode**.**

With respect to the sample size and its statistical significance, temperature analysis has been reported for 105 homes (84%) and 37 of these have accompanying gas data (30%). Of this gas sub sample, there was a statistically significant difference in the mean gas consumption with the Radbot in smart and manual modes (p-value of 0.04). Despite the reduced sample size, therefore, the sample is sufficient to prove the hypothesis that the properties had lower gas consumption with the Radbots in smart mode compared to manual mode. The observed saving of 2.8%, however, is significantly lower than the expected saving of around 8%.

The observed mean difference in gas consumption is rather small, and only slightly larger than the mandated accuracy of a gas service meter of ±2%. While gas consumption per HDD day was lower on average with the Radbots in smart mode, there were also 12 (of 37, 32%) properties where gas consumption per HDD was higher. There are lots of reasons beyond the performance of the Radbots why gas consumption could change, such as changes in heating and hot water use behaviour or solar gains, so the mean saving will not be achieved in every case. The reduction in mean gas use is consistent with an observed small reduction in internal temperature which further supports that the Radbots did reduce overall heating use, with no observed difference in thermal comfort and with only a very small impact on the internal relative humidity (which is as expected given the small change in internal temperature).

The data shows a mean average reduction in gas use of 2.8% as a result of Radbot being in smart mode. If applied to the Ofgem medium Typical Domestic Consumption Value of 12,000kWh/year this would result in a saving of 336kWh/year. At the per unit gas price used in SAP9.92, 3.48p/kWh, this reduction in gas consumption relates to a cost saving of **£11.69/year**. Based on a measure lifespan of 12 years, this equates to a lifetime fuel bill saving of **£140.28** for a whole home installation. These calculations are based on a statistically significant observed difference in gas consumption when the Radbots were in smart mode, but care should be taken in their interpretation as the mean change in gas consumption was quite small and of the same order of magnitude to the uncertainty in a single measurement of gas consumption.

Summary of costs				**Total Cost: £318,950.47 (inc VAT)**		
Recruitment	Product/ installation	Performance monitoring	Analysis / reporting	Technical monitoring	Supplier administration	Aftercare
£25,866.03	£47,052.60	£59,643.40	£170,441.44	£0	£15,947.00	£0