

Oxypod Trial by the Royal Borough of Greenwich **(with funding from National Energy Action)**

I. Background

- I.1. Fuel poverty is a serious issue in the UK and affects many households in the Royal Borough of Greenwich (a household is considered to be in fuel poverty if it spends more than 10% of its income on heating the home).
- I.2. The Office of National Statistics' 2011 figures stated that more than 17,000 children in the Royal Borough were deemed to be living in poverty (29% of all the children in Greenwich are experiencing poverty as their everyday normal), and fuel poverty is a major contributory factor.
- I.3. Fuel poverty affects significant numbers of low-income households with children, as well as many vulnerable, older residents struggling with the 'eat or heat' dilemma. The Royal Borough's Anti-Poverty Strategy recognises the significance of fuel poverty and targets households living in fuel poverty as one of the three main strands of its anti-poverty approach.
- I.4. With this in mind, Housing Strategy & Partnerships, as well as colleagues in DRES Sustainability, were keen to establish whether there were any innovative, green technologies that might be employed to contribute to the above-stated corporate aim of tackling the causes of poverty in the Royal Borough by targeting households experiencing fuel poverty.
- I.5. The Oxypod device was brought to the attention of Housing Services in 2014 and a decision was made by the Assistant Director of Housing (Strategy) to install the device in Meridian Home Start's stock of 29 houses at that time.
- I.6. Initial monitoring of gas consumption and interviews conducted with the tenants suggested that gas consumption was cut by approximately 20%, and tenants commented that their homes felt warmer than before.
- I.7. However, the small sample size and the short duration of the monitoring did not represent a significant-enough evidence-base upon which to make a recommendation to install Oxypod in the Royal Borough of Greenwich's housing stock.
- I.8. The Director of Housing Services felt that a larger trial with a longer monitoring period should be undertaken so that more-robust evidence could be generated.
- I.9. When National Energy Action (NEA), the fuel-poverty charity, announced in spring 2015 that grant funding would be made available to housing providers willing to trial innovative energy-saving devices, the Royal Borough was successful in attracting funding for the installation of, and NEA's independent monitoring of the effectiveness of, the Oxypod device.

- 1.10. The purpose of the trial was to determine if the fitting of an Oxypod would reduce our tenants' gas bills, allowing them to keep their homes warmer in the winter months, and also whether the reduction in gas consumption was considered significant enough to base any recommendations upon. Housing Strategy & Partnerships carried out a programme of 50 Oxypod installations with NEA's funding.
- 1.11. NEA monitored gas consumption at a number of the addresses where the Oxypod was installed and compared this with averaged gas consumption for the preceding three years. The NEA monitoring covered a period of between 12 and 15 months (from late 2015 to early 2017), and NEA shared their findings with the Royal Borough in late 2017 (see 5.2).

2. What is an Oxypod and how does it work?

- 2.1. The Oxypod device is a de-aerator. It is fitted on the primary flow pipework of central heating systems and removes dissolved air from the water in the system (there is 2.5 litres of dissolved air in 100 litres of water).
- 2.2. Where the Oxypod differs from previous attempts to create an effective de-aerator for heating and cooling systems is in its patented egg shape and, crucially, what this shape does to the water that passes through it.
- 2.3. The shape of the Oxypod causes the water that passes through it to spin. This invokes a phenomenon called *implosion*, which strips the water of its surface tension.
- 2.4. When the spinning water reaches the bottom of the Oxypod there is a massive pressure drop (30,000 Pascal), and it is this pressure drop that allows the dissolved air – including the Nitrogen content – to form large-enough bubbles to escape from the water, exiting through a dip tube in the centre of the Oxypod and an automatic air vent (AAV) situated at the top of the device.
- 2.5. Importantly, the AAV on an Oxypod is not prone to scale or other clogging build-up due to the changed physical nature of fully de-aerated water (see 4.3), which Oxypod keeps permanently clear and clean. This means that Oxypod is a '*fit and forget*' technology.

3. Reduced Maintenance Costs

- 3.1. Dissolved air in the water that enters a heating system, when it is first filled or re-pressurized, is the cause of most of the problems that beset heating systems, shortening the life of the boiler and its parts, and causing breakdowns.
- 3.2. Dissolved air will slowly rust radiators from the inside out, which, in turn, leaves a black sludge (magnetite) in the water and creates cold spots on radiators. The build-up of magnetite causes the system to run less and less efficiently over the lifetime of the heating system.

- 3.3. The Oxypod removes dissolved air from the system very quickly (800ml in just 2 minutes), and will continue to remove dissolved air until it is undetectable; from 12 parts per million when the system was first filled, to less than 1 part per billion (see Fig. 1 below), meaning radiators will not require bleeding in future, and boiler breakdowns due to the associated loss of pressure are eradicated.
- 3.4. Laboratory testing by National Physical Laboratory (NPL) indicate that Oxygen is undetectable in the heating water after 150 minutes (and remained undetectable for a further 12 hours of monitoring). “A dissolved Oxygen concentration of <1 ppb indicates that the Oxygen is, effectively, completely removed from the water” (NPL).

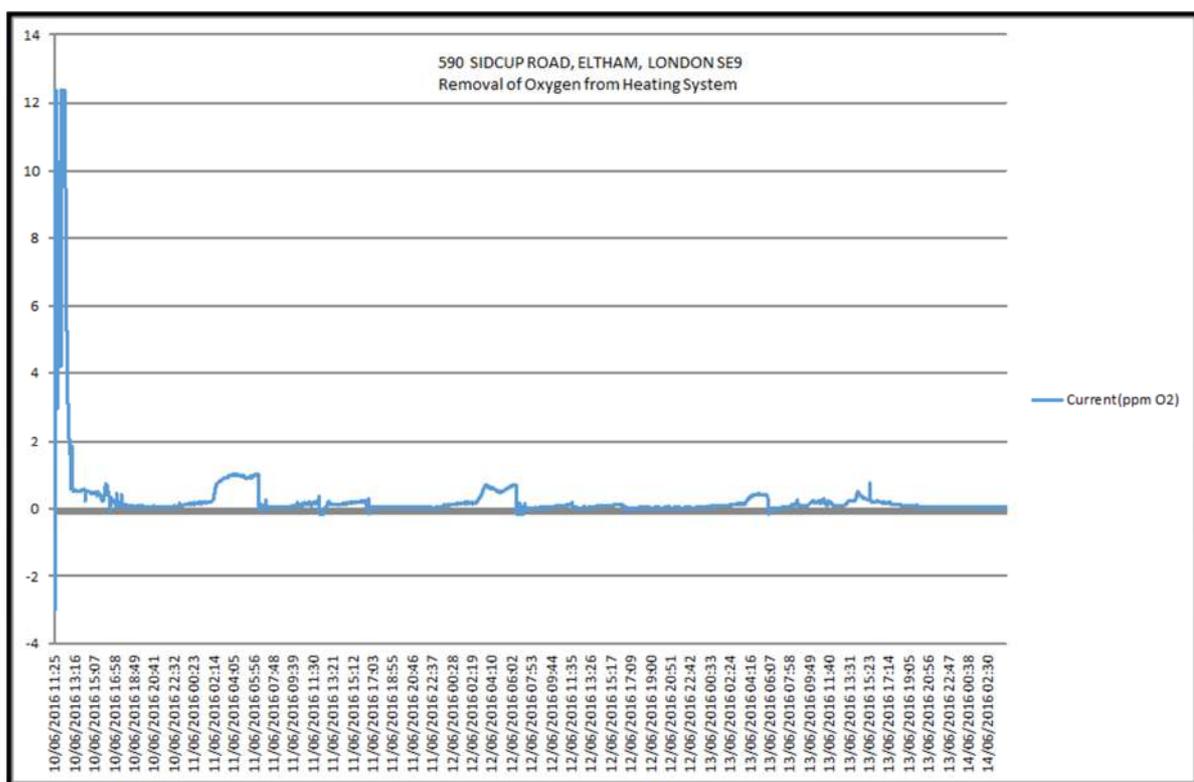


Fig. 1: Removal of Dissolved Oxygen from the Heating System at 590 Sidcup Road

- 3.5. Oxypod eliminates magnetite (black sludge) from domestic copper-piped systems as well as pseudomonas (brown sludge) from larger, commercial systems. As Oxypod removes Oxygen in a closed water heating system to <1 ppb, this ensures that no micro-organisms can exist in the water.
- 3.6. Aggressive and hard water is neutralised, with electrical conductivity reduced by roughly half, and the pH level is raised to above 8 in copper-piped systems (typically to between 8.2 and 8.5).

- 3.7. Oxypod will actually 'clean' the water in a heating system over a reasonably short period of time, and will maintain the water in that condition *indefinitely* (this claim has so far been successfully tested to five years).



Fig. 2: Water samples taken from a 50,000 litre system in a 6-storey building in Gateshead (before and after Oxypod installation).

- 3.8. The water had become brown and sludgy in a period of six months on a newly-installed system (indicating the presence of pseudomonas) but was returned to clear and clean in less than one month after installation of an Oxypod (before and after samples from December 2016 and January 2017).
- 3.9. A third sample of the water was taken two months later in March 2017 and independently laboratory-tested by Aston Environmental Services. The third sample was also clean and clear and was found to be completely free of pseudomonas bacteria.
- 3.10. The pH level of the water was reduced from 10.9 to 10 (the BSRIA guideline pH limit for steel and iron piped systems is 11). Dissolved solids, suspended solids, iron and dissolved iron were all found to have been returned to within BSRIA limits.
- 3.11. Because the Oxypod neutralizes aggressive water and brings pH level, suspended solids, etc. to within BSRIA guidelines, it eliminates the need for inhibitors to be added to the water, or for a *MagnaClean* or similar device to be fitted to the system.

- 3.12. An annual biocide treatment to a larger, commercial system (e.g. district heating) would no longer be required as no micro-organisms can exist in de-aerated water.
- 3.13. Galvanic corrosion on aluminium heat exchangers is virtually eliminated by Oxypod, and pumps run silently without vibration and cavitation.

4. Reduced Carbon Footprint

- 4.1. As well as the harm caused to heating systems by magnetite, pseudomonas, galvanic corrosion, etc., air in the system also causes the heating to run less efficiently.
- 4.2. When there is air in the system, the water does not fully fill the heating pipes or radiators (the internal walls of radiators are lined with bubbles of air), and so heat is lost from the water to heat the 'empty' sections of the system. When there is no air in the water, the de-aerated water fills the whole system and more heat is retained in the water.
- 4.3. Additionally, when there is no longer any dissolved air present, the water is more viscous and, therefore, easier to pump around the system, with reduced friction against parts, but, importantly, the more-viscous water also attains a higher temperature.
- 4.4. A combination of these two - the removal of the dissolved air and the increased viscosity (and higher temperature) of the water - means that the water, when it returns to the boiler, is at a higher temperature when compared to systems without Oxypod fitted.
- 4.5. Because of the higher water temperature achieved by the Oxypod, and because less heat is lost from the water on its journey around the heating system, the boiler does not have to work as hard to heat it back to the set temperature, meaning less gas is used (reduced 'burn time').
- 4.6. Radiators attain higher surface temperatures in a system with an Oxypod fitted, meaning that rooms warm up faster and the room thermostat will stop calling for heat much sooner, again meaning less gas is used.

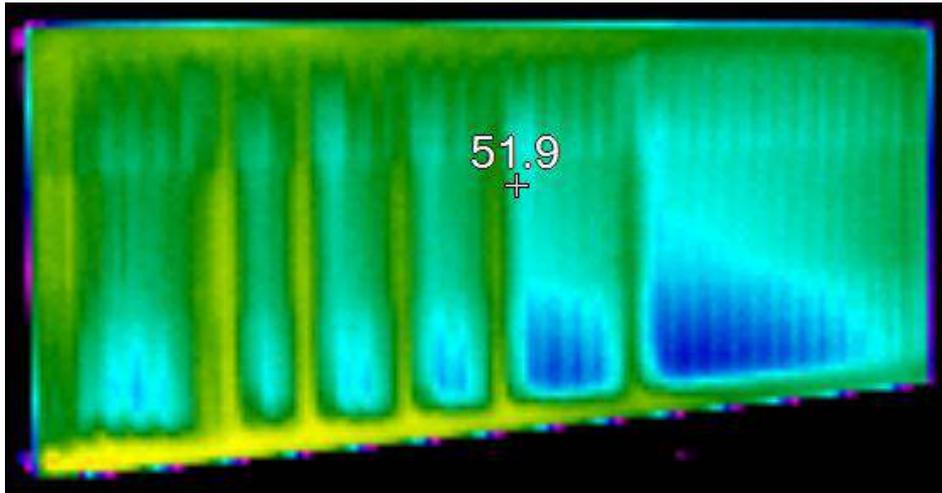


Fig. 3: Infra-red thermal imaging before Oxypod installation

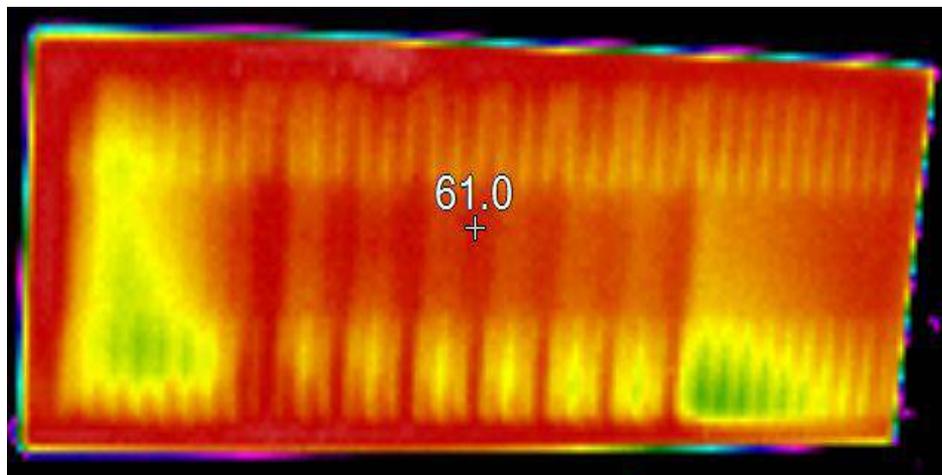


Fig. 4: Infra-red thermal imaging after Oxypod installation

5. Reduced Gas Bills

- 5.1. National Energy Action (NEA) monitored fuel consumption at a sample of the addresses in our Oxypod trial for a period of 12 to 15 months.
- 5.2. A 3-year history of gas consumption was obtained for the addresses and the NEA's findings (adjusted for the Thames Valley region as per the 'weather days' methodology) were as follows:

Property 1 = cost saving of £114.22 per annum or 24.15% reduction in gas consumption

Property 2 = cost saving of £244.01 per annum or 23.57% reduction in gas consumption

Property 3 = cost saving of £159.64 per annum or 24.37% reduction in gas consumption

- 5.3. NEA's independent monitoring shows gas consumption falling by an average of 24%, meaning real cash savings for our tenants.
- 5.4. NEA also conducted interviews with tenants that had benefited from the fitting of an Oxypod.
- 5.5. One tenant said: *"Since the pod was installed, my bills have gone down by £40 per month. For myself, on a low wage, this is a massive help."*

6. District Heating Systems

- 6.1. Due to the positive results achieved by the RBG/NEA Oxypod Trial, it is recommended that a further trial is carried out on 5 or 6 of our small District Heating systems to determine if similar savings can be achieved.
- 6.2. If the District Heating trial is successful and delivers a similar reduction in gas consumption, the on-going saving to our landlord's gas supplies budget could be in excess of £300k per annum (if the Royal Borough fitted Oxypod to all suitable District Heating systems).

7. Intergas Boilers and Oxypod

- 7.1. Intergas (a Dutch boiler manufacturer with a UK operation based in Dudley) is so impressed with the results it has witnessed in a series of laboratory tests that it has now entered into a partnership with Oxypod.
- 7.2. Intergas is so confident in the effectiveness of the Oxypod device in reducing unplanned maintenance and prolonging the life of boilers and heating systems that it is offering the Royal Borough of Greenwich a 15-year warranty on their Combi Compact ECO RF range of boilers, if fitted with an Oxypod.
- 7.3. The Intergas Combi Compact ECO RF (24/30/36) is a *Which?* top five recommended boiler (October 2016) that can be remotely controlled using a free smartphone app. The *Intouch* app allows tenants to turn their smartphone into a smart thermostat and even control their heating when they are not at home (internet connection required in the home).
- 7.4. The new boiler installation regulations (effective from April 2018) require one of a prescribed list of energy-saving technologies to be fitted to a central heating system whenever a new boiler is installed in an existing dwelling (whether as part of a new system or to an existing heating system).
- 7.5. Intergas' 'smart' boiler controls are a qualifying technology, meaning that the Royal Borough does not have to fit an additional technology alongside the ECO RF boiler and Oxypod.

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