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UPDATE ARTICLE

Replacement Project, December 2024

In 2022, the Ibstock Group set out a series of commitments and ambitious targets as part of its ESG 2030 Strategy. One of the strategy pillars focuses on Manufacturing Materials for Life, looking at:

- Product Innovation
- Dematerialisation
- Circular Economy

As part of the Group's ongoing commitment to sustainability and innovation, Ibstock joined forces with the renowned Materials and Engineering Research Institute at Sheffield Hallam University, as part of a knowledge transfer partnership (KTP) funded by Innovate UK. The Ibstock KTP research focused on the replacement of body fuels in the manufacture of multi-coloured bricks, exploring sustainable replacement materials to reduce the use of high carbon fossil fuels and increase circular economy practices.

The team who led the research included experts with decades of experience in both kiln firing processes and materials science. The following provides a high-level summary of their findings. With special thanks to:

- **Knowledge Transfer Partnership - funded by UKRI through Innovate UK**
- **Sheffield Hallam University**

- Dr Hywel Jones, Principal Research in the Materials and Engineering Research Institute
- Dr Gloria Wie-Addo, KTP Research Associate

- **Ibstock**

- Darren Bowkett, Technical and Strategic Projects Director
- Mike Bailey, R&D Manager

Q: Why is Ibstock reducing body fuels?

A: The project is just one example of how Ibstock is actively working to reduce carbon emissions and forms part of the Group's carbon reduction roadmap to become net zero operations by 2040.

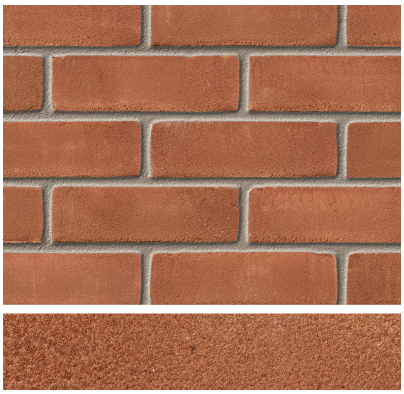
Among the primary objectives of this body fuel replacement project were:

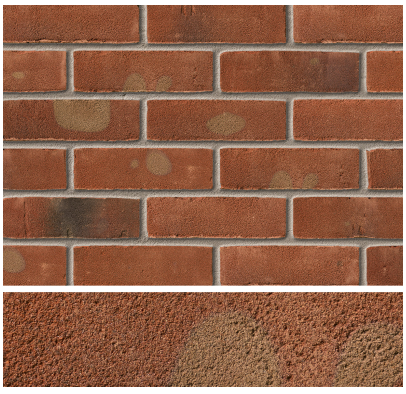
- Reduction of fossil fuel derived body fuels in the firing process
- Retention of the unique aesthetic that body fuel creates (known as hearting)
- Understanding potential replacements from alternative material/waste streams
- Reduction in process emissions leading to a lower carbon product
- Utilisation of waste products that may otherwise have gone to landfill

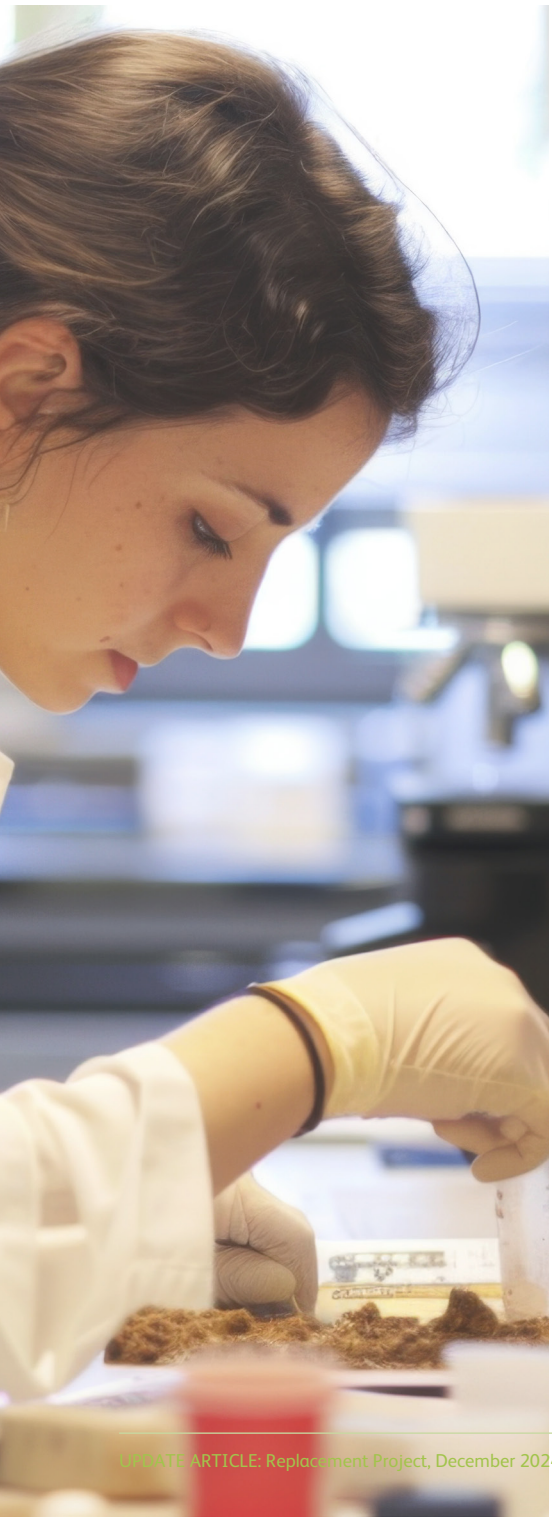
Q: Why are body fuels currently used?

A: Around a third of Ibstock's clay bricks use a technique known as hearting, which creates the unique multi-coloured aesthetic on some clay brick products. In order to achieve this aesthetic, Ibstock, like other manufacturers, use a traditional body fuel such as anthracite, which is derived from fossil fuels and, as such, contributes to carbon emissions during the firing process (you can see the difference in the images below).

There are other benefits to using body fuels, as they have a high calorific value, which contributes to achieving the required firing temperatures and therefore using less gas in the kiln for certain products.







Q: How did the project explore alternative materials?

A: The research trialled a range of alternative replacement materials with the aim of recreating the hearting technique, whilst using non fossil fuel materials.

In order to decide which alternative materials to explore, the project team had to first develop an in-depth understanding of how the existing materials and processes work to create the multi-coloured effects within the kiln. A range of analytical methods were used at the university to study the behaviour of the clay and the fuel as it was heated. This led to an understanding of how the fuel burns and interacts with the clay, creating the conditions that produce the colour change effects. Armed with this knowledge, the team was then able to identify and analyse potential alternatives to the fossil fuel to determine if they could reproduce the required effects.

In total, the team researched and trialled over 30 different alternative compositions – including used coffee grounds, ash from biofuels and steel production waste to name a few. Laboratory based firing trials, along with in-depth materials analysis of the fired products were used to select materials for further study. Some were quickly eliminated, whilst others showed more promise for inclusion in the initial factory trial phase.

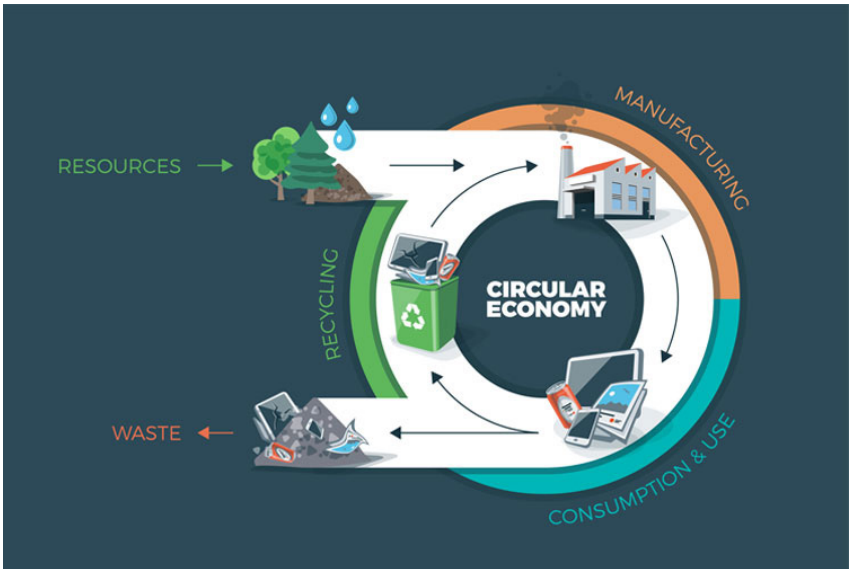
To share some examples:

- The steel waste produced a unique hearting effect that was different from normal due to its complex chemical reactions during firing
- Used coffee grounds and bio ashes have lower calorific values and a lower burning temperature of <600oC. Bio-ashes created the hearting effect but were not limited to the midsections of the bricks, and higher additions also reduced density and increased water absorption to unacceptable levels

Q: What are the results of the project so far?

A: We are delighted to confirm that we are in advanced commercial trials with an identified replacement material. The findings have the potential to make a significant contribution to the goal of reducing greenhouse gas emissions by moving away from fossil fuels and promoting circular use of materials contributing to more sustainable manufacturing practices in the industry.

For the scope of products included, the replacement material is potentially expected to save around 30 % to 50 % less CO2 emissions versus the solid fossil fuels. This could make a significant contribution to Ibstock's carbon transition plan when rolled out across the factories making multi-coloured products.



Q: What is the replacement material?

A: We can share a further update on the replacement material when commercial trials conclude. What we can share at this stage is that the replacement material could potentially save around 25,000 tonnes of waste going to landfill and therefore enabling circular economy principles in our process.

Q: Any challenges or learnings from the research?

A: The supply of materials was an unexpected challenge. The KTP research took place over a two-year period and, in that time, the demand for some industrial waste streams increased significantly, making them either too expensive or more difficult to obtain in the required quantities.

As manufacturers like Ibstock look to innovate away from virgin and non-renewable material streams, and move to recyclable and circular sources, the availability and cost of these materials is an important consideration that needs to be taken in to account before changes are made.

A further challenge was in the replication of the real-world conditions of the large, fired kiln, in a smaller electrically fired laboratory furnace. While laboratory-based results were helpful in making decisions, the final proof of concept relied upon the use of trial batches being fed through the production kilns alongside real products. Doing this alongside production while not affecting the production itself was a challenge.

Q: What's next?

A: At this stage all we can say is watch this space! Plus, we are already progressing other research projects with the potential for further ground-breaking results that will support Ibstock's journey to net zero.