

Working together for a sustainable future

Innovation Lab Case Study

Leaving a lighter *footPrint* across the Water Sector



Key Findings

Use Case: Distribution Chamber – an integral asset within water treatment works, and widely used across the Water industry.

Benefits [compared to traditional design]



Safety Enhancement



Social Value for UU Customers

- ✓ Printed and installed in 48hrs (pending full-scale demo).
- ✓ Ability to innovate across the whole design and build process as a result of flexibility achieved through printing onsite or offsite.
- ✓ The Lab has enabled UU to become the **first UK water industry provider to successfully showcase a low carbon 3D printed design.**

“Our decisions are shaped by material issues for stakeholders, risk assessments, a commitment to environmental, social and governance (ESG) matters and our pioneering Systems Thinking approach. This integrated approach helps us create sustainable long-term value.”

United Utilities



Overview of the Lab

United Utilities [UU]

United Utilities – Corporate is responsible for water and wastewater services in the North West of England. UU is driven to deliver its services in an environmentally-sustainable, economically beneficial and socially responsible manner. Innovation is central to fulfilling this purpose, and as part of the UU company-wide innovation strategy, it delivers a 12-week Innovation Lab, facilitated by L Marks ([Home - L Marks](#)).

The Lab has a global remit and provides successful applicants with the opportunity to test their solutions in a live environment. During the Lab, suppliers gain access to and build relationships with senior United Utilities executives, with the potential to lead to longer-term commercial partnerships.

UU and Cohort#3 undertook to deliver the Lab against the constraints imposed by Covid-19, moving everything online, whilst finding ways to remain connected and energised. CM3D was selected from 124 global applicants to take its place on the Lab, alongside 7 other suppliers. This case study shares the journey through the Lab and the outcomes that demonstrate why low-carbon 3D concrete printing can:

“leave a lighter footprint on the Water Sector.”

ChangeMaker 3D [CM3D]

ChangeMaker 3D is a UK based SME that is on mission:

“to create a built environment that delivers value for society and leaves a lighter footprint for our planet.”

Since launching in 2017 CM3D has developed its approach to working across the housing and infrastructure sectors to embed low carbon 3D construction printing [3DCP]. It is also the UK Representative for the Global ISO Standard for Additive Manufacturing.



Globally 3D Construction Printing is gaining momentum, demonstrating sustainability benefits underpinned by **carbon reduction, less waste and enhanced safety**. ChangeMaker3D is working with infrastructure clients from the Rail and Water Sectors and the United Utilities innovation lab has acted as the platform and catalyst to demonstrate why low carbon 3DCP is here to stay.

Objective of the Lab

ChangeMaker 3D was selected for the Sustainability Category of the Lab. Chosen because of the significant potential to support the United Utilities **Carbon Net Zero 2030 goal**, and to move towards a circular economy.

The ChangeMaker 3D team entered into the Lab with the objective to undertake a concept appraisal. To understand the best fit for the 3D innovation, rather than presenting a set of pre-determined assumptions and designs.

This approach enabled CM3D, UU and its Construction Delivery Partners (CDPs) to fully collaborate and innovate throughout the Lab.



“The lab is our most successful way of bringing new innovators to the UK and the global water industry, it remains unique in the our sector. Changemaker is a great example of how the lab reaches different industries and scale of company, and levels the playing field for small start-ups to large corporates – the focus is always on the potential of the innovation and the team behind it. Changemaker have been a fantastic team to work with, and have successfully identified the value their innovation can achieve, we are looking forward to continuing our work together.”

United Utilities

Technology and Process

Low carbon 3DCP explained

The technology is digitally driven by design software that converts design files into a 3D printing code, which enables the 3D robot to extrude quick drying mortar and build sustainable structures. The digital capability of the technology supports both BIM and Digital Twin functionality.

Sustainability Benefits of the Technology:



Reduce waste by printing on demand



Print with less material



Rapid and flexible printing onsite or offsite



Quick drying mortar which does not use portland cement



Potential to reduce steel reinforcement within structures



Local supply chain that supports the reduction of the overall carbon footprint

The concept appraisal process consisted of 4 stages:

- 1) Review of UU existing datasets on concrete structures.
- 2) Select the structures which play to the strengths of the 3D printing technology.
- 3) Select one use case to take forward, whilst capturing a wider pipeline of structures and maintenance potential applications.
- 4) Complete a business case analysis that aligned with multi-capital principles and set out the benefits across **sustainability, cost, time, safety and social value**. The distribution chamber was selected for the use case and underwent technical review by UU engineers.



The distribution chamber could be printed onsite or offsite to provide the greatest flexibility for UU and its CDPs

The Team

ChangeMaker 3D delivered the Lab with its core team that also incorporated strategic input from Automutatio Home - AutoMutatio - Every Change Matters with over 30 years combined experience in the sector, and two senior structural engineers from Constructure | Welcome.

Learning

CM3D and UU have worked collaboratively to identify where the technology has the greatest impact. UU and its Construction Delivery Partners [CDPs] have gained first-hand experience of working within the design principles of low carbon 3D printing. Collectively this has led to greater trust in the technology, both the hardware and the materials.

Outcome

CM3D and the CDPs are continuing to work collaboratively to move towards fulfilling UU's objective of increasing its sustainability, and the CM3D vision to leave a lighter footprint.

The Lab has provided a positive working relationship with all of the CDPs, who in turn have the opportunity to connect with and integrate the technology into their supply chain, via CM3D.

Next Steps

It is the collective desire to move from concept appraisal to full scale demonstration of the distribution chamber, alongside expanding upon the pipeline of products and maintenance services that ChangeMaker 3D can develop ahead of AMP 8.

And the aspiration of fully maximising low carbon 3D printing into the UU programme, alongside showing the wider water sector how it can also adopt 3DCP.