The insulating robot

A system that uses autonomous robots to crawl under the floorboards of old houses, squirting insulation where humans can't reach, has been highly commended in the Innovation Achievers category

Q-Bot

The Q-Bot is sent into the under-floor void through a hole drilled by a technician, or through a vent. It scans the area to build a picture of what's there and then squirts insulation fed by an umbilical cord, sealing any cracks.

Trials of this autonomous robot showed that heat loss can be reduced by as much as 86%. London-based start-up Q-Bot, developer of the scanning-and-squirting bot of the same name (pictured), told CRI that the system, which does away with the need to rip up floorboards, could save more energy than replacing single glazed windows with double glazing, and replacing a 15-year-old central-heating boiler with a brand new one.

"The trials showed what an impact the technology has – a massive impact on comfort," said Q-Bot managing director, Mathew Holloway. "The amount of heat lost through the floor is actually far greater than people might realise."

Mathew Holloway

Engineer and entrepreneur Mathew Holloway, Q-Bot managing director since 2013

London's Camden Borough Council and residential property manager CityWest Homes trialled the Q-Bot at two period properties: a 72-sq-m ground floor flat, and a 69-sq-m terraced house, last year. In Camden heat-loss through the floor was cut by 78%, while cold air infiltration was eradicated, reducing infiltration into the house by over 60%, the test results showed.

In the CityWest trial the total heat loss through the floor was reduced by 86% and a 45% reduction in cold air infiltration was achieved despite the single-glazed sash windows the property had.

Cosy homes

"I am absolutely delighted," said one resident, whose comments Q-Bot recorded. "My flat has never been described as cosy before. It is warm, quieter and there are less cold draughts."

Peter Armfield, the Sustainability Manager of CityWest Homes said: "Most importantly the tenants are comfortable and happy as it makes an immediate difference to their comfort as well as the energy cost. This is why we intend to look at how we can apply the treatment across our portfolio."

> ***"In the UK we're slightly less gung-ho about things than maybe in the US, where you can have an idea and someone will throw $10m at it"***
>
> Mathew Holloway, Q-Bot

Peabody said: "As part of Peabody's commitment to energy efficiency and tackling fuel poverty, we are trialling innovative products and services such as Q-Bot. We hope the robot will help us reduce disruption to residents, whilst allowing us to insulate their homes, keep them warm, and help to save them money on their energy bills."

The judges in this year's International Innovation & Research Awards were impressed, and believed the market for Q-Bot could be big. "Q-Bot's innovative robotic solution recognises the need for a non-intrusive method of improving under-floor insulation

in existing properties," they said in their citation. "It is an exciting and innovative product which has great potential for improving the energy efficiency of the UK's housing stock."

Holloway, an engineer, entrepreneur and tutor at Imperial College London, joined architect Tom Lipinski at the new company in 2013. Q-Bot had earlier been started by Lipinski and Imperial College professor, Peter Childs. They are now targeting owners of large pre-1919 property portfolios in the hope that their stealth-insulating method will appeal to landlords and tenants.

Holloway wouldn't disclose the size of the company but insisted that it was in a high-growth stage and had deals now with Camden Council, CityWest Homes and Peabody, all sizeable London housing providers. A team of electrical, mechanical and software engineers was busy developing the technology, he said.

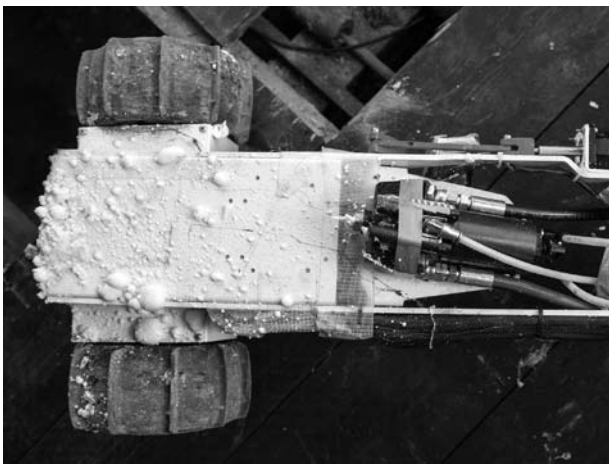
Q-Bot has won seed funding from the UK government's Emerging Entrepreneurs Fund, its Technology Strategy Board, and from the EcoMachines Incubator Accelerator programme, but Holloway said real sales now contribute to Q-Bot's revenue.

Ready for take-off?

Holloway believes the market will respond not just in the UK but in Northern Europe, too, where there is a large stock of homes with suspended timber floors needing insulation.

"We have backers who can scale up manufacture of the robots in a very large and quick way," he told CRI, "but we need to show that we have some traction that makes it worthwhile doing. So it is a bit of a chicken-and-egg situation, which many companies face.

"But we're lucky to be working with councils and housing associations because they do plan ahead and are a bit more consistent in their thinking. We are already delivering and our delivery capability is scaling up all the time in response to customer demand."



The Q-Bot is sent into the under-floor void in older homes to scan the area and squirt insulation

As an entrepreneur – he was the driving force between the Cool-Phase low-energy ventilation system, which was later acquired by Monodraught – Holloway said things were a little different in the UK for start-ups, compared to the US.

"In the UK we're slightly less gung-ho about things than maybe in the US, where you can have an idea and someone will throw $10m at it," he said. "You have to take things a bit further, push things a bit further but, if there is a strong potential, there is no reason it won't take off, and there is a lot of support for start-up and early stage companies to grow in the UK." ❑

Q-Bot on trial

Camden Council and CityWest Homes trialled Q-Bot's solution at two of their properties: a 72m2 ground floor period flat, and a 69m2 terrace house. The results demonstrated a considerable efficiency improvement in insulation as well as substantially reduced air permeability.

The objective of the trial was to investigate: Energy savings (with monitored indoor/outdoor temperatures, heat loss through floor, walls and ground, air tightness testing, airflow at vents, fuel usage and / or thermal imaging); Impact on the occupant (with before and after questionnaires, temperature stratification, humidity, monitored concentrations of CO2 and air quality before, during and after install); Impact on the building (with monitored moisture content of timber joists, timber wall plates, brickwork below and above the DPC, the void base and the void humidity)

Results:

Following installation the total loss of heat through the floor was reduced by 86% for a home with exposed timber floorboards and by 72% for a home with timber floorboards and carpet. The combined U-Value for floor and ground was reduced from 2.1 W/m2.K to 0.28 W/m2.K and 1.0 W/m2.K to 0.28 W/m2.K respectively.

Sealing a floor reduced the air permeability by 45% from 16.4 m3/hr/m2 to 9.6 m3/hr/m2 (at 50PA). This is a very significant result when considering a floor has contributed to nearly half the leaks and draughts for a whole house with wooden single glazed sash windows. The difference in temperature from floor to head height was more than halved, reduced from an average of 4°C to 2°C.

Energy savings of £150-215/yr were shown using SAP (improvement from 34F to 43E). When compared to other measures for hard-to-treat homes and capital costs, Q-Bot's payback times and cost per tonne of CO2 saved is less than half that of other improvements.

Glossary:

The U-Value is the rate at which energy flows through a given material, it is normally given in Watts per metre squared of floor, per degree of temperature difference between the inside and outside. Air permeability is the rate at which air can escape from the building, typically it is given as a flow rate, per metre squared of envelope area (ie the area of external walls, roof, etc). In essence it is a measure of how leaky or draughty a property is, the maximum allowed value for a new build is 10 m3/hr/m2 (at 50PA). SAP (Standard Assessment Procedure) is a government backed software application used to model the energy efficiency of buildings and the i mpact of possible interventions.