



The Impact of Floor Insulation Across 100 Homes

Q-Bot has developed the first affordable and fully accredited solution for the retrofit of insulation to suspended timber floors. The results of this case study across 100 homes show that the measure reduces heat loss by **80%** through the floor and cold draughts by **1/3** for the whole house. Compared with other options to upgrade energy efficiency Q-Bot is the most **cost-effective** solution available, after loft insulation. The average cost was **£2,400** per install, with an improvement of **6 EPC points** per home, resulting in a cost of **£400 per EPC point** gained. All of the customers were satisfied with the install and **9 out of 10** would recommend Q-Bot to their neighbours.

"I am much warmer, and I'm saving £20 per month on bills. I love Q-Bot, it has made a massive difference. There are now no draughts."

– Customer, NW London



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 698607.

w: www.q-bot.co e: info@q-bot.co t: +44 (0) 208 877 2709

q-bot
warmer, better homes

The Impact of Floor Insulation

As part of a drive to improve energy efficiency and reduce fuel poverty, several Housing Associations have worked with Q-Bot to install underfloor insulation across the UK. This case study shows the impact on comfort and energy savings of the service.

100 properties were selected to include a wide range of housing types, different ages and sizes. The energy savings achieved by the upgrades were modelled in SAP using elemental U-values for the individual floors and the airtightness test results of each property. This enabled the energy improvements to be calculated against a range of scenarios with alternative retrofit measures. In addition, a pre and post installation questionnaire provided qualitative feedback from customers.

Impact

The installation of floor insulation significantly improved thermal comfort with fewer cold draughts and much more even temperatures within the house. The results show, on average, a **31%** improvement in airtightness and a **79%** reduction in the heat loss through the floor.

Q-Bot's solution for the insulation of suspended floors was shown to be the most **cost-effective** retrofit measure available, after loft insulation. The average cost was **£2,400** per install, with an improvement of **6 EPC points** per home, resulting in a cost of **£400 per EPC point** gained. In addition, due to the innovative installation process, there was minimal disruption for the Housing Association's customers.



Fig 1. The control system being demonstrated to a customer.

Customer Feedback

100% of the occupants said they were **'Satisfied'**, or **'Very Satisfied'** with the installation and **86%** scored Q-Bot 7 or higher on a survey of how likely would you recommend Q-Bot (where 1 stood for 'not at all' and 10 for 'highly recommend').

Q-Bot's non-disruptive nature has received praise from residents:

"Wow, what a fantastic team you have. I had excellent communication from the start. Great work carried out by a clearly competent team and my house was left better than it was when they came."



Customer, Argyll & Bute

2/3 of respondents have noticed a significant reduction in energy bills of between **£150** and **£240** per year:

"I am much warmer, and I'm saving £20 per month on bills. I love Q-Bot, it has made a massive difference. There are now no draughts."

Customer, NW London.



Summary

Key Outcomes from the pilots

Measurement	Floor heat loss (U-value)	Draughts (Air Permeability)*	Space Heating Requirement
Before (average)	0.90 W/m ² K	16.8 m ³ /m ² .h @50Pa	13,300 kWh/yr
After (average)	0.19 W/m ² K	11.5 m ³ /m ² .h @50Pa	11,100 kWh/yr
Reduction (average)	79%	31%	17%
EPC Points Improvement			6.0
Total Carbon Emissions Savings (all 100 homes, over 42 years)			3,060,000 kgCO ₂ e

*An average was used when specific results were not available.



48 homes now comply with the Part L1A requirement for new build dwellings of **<= 10 m³/ m².hr @50Pa** (there are no regulations covering airtightness in existing properties).

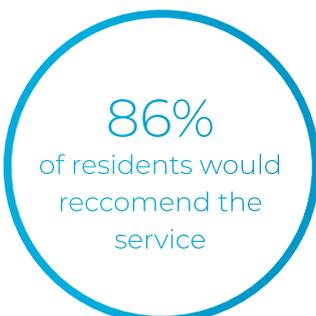
The U-value of the floor in **99** homes now complies with the Part L1B requirement for upgrading retained thermal elements in existing dwellings of **<= 0.25 W/m².K**.



Fig 2. One of Q-Bot robots in action.



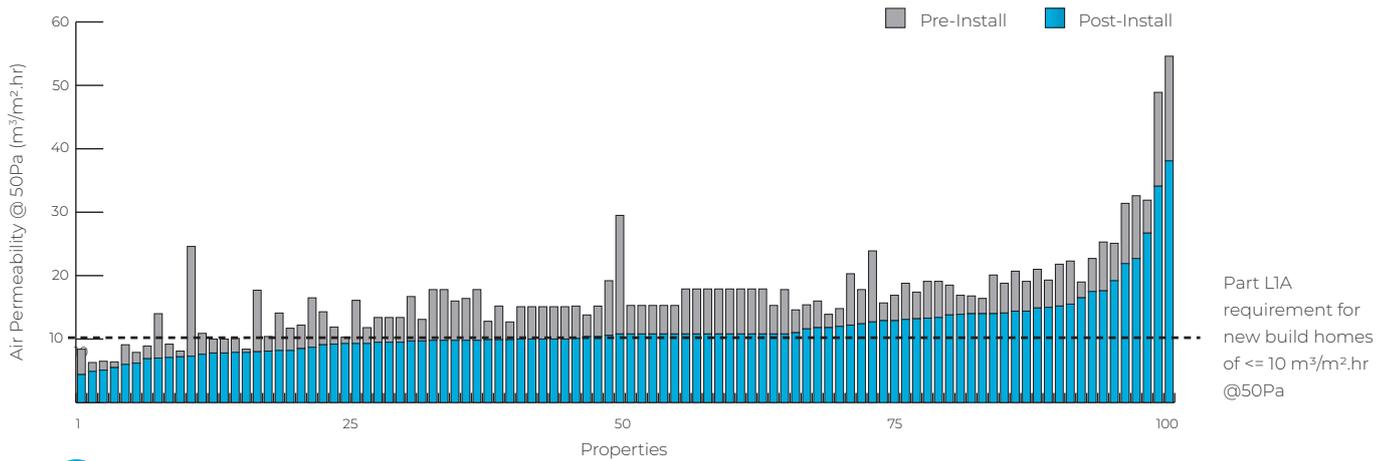
Fig 3. A resident enjoying a warmer home.



Results

Reduction in Air-Permeability

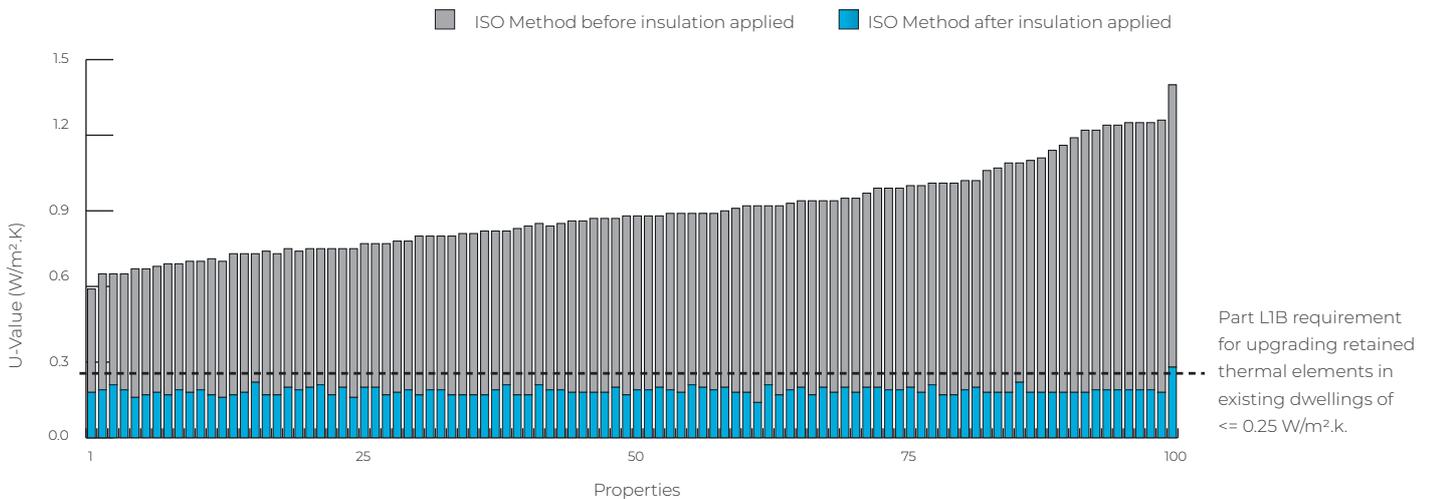
The air-permeability of the properties was tested according to the ATTMA Technical Standard to comply with BS EN 13829:2001. Of the 100 properties with air-permeability results, 45 did not have a pre-installation pressure test (mainly due to being 'too leaky' to pressurise). For these cases, a "pre-install" air permeability was estimated using the average improvement of the other properties for each Housing Association. All the post-installation results were measured directly for each of the 100 properties, with the average of post-installation test results of **11.5 m³/m².hr**. The before and after test results demonstrated an average **30%** improvement in airtightness.



48 homes now meet the building regulations air permeability threshold for new builds.

Improved U-Values

The U-values for both pre- and post-installation conditions, were calculated using actual measurements of the floors, vents, perimeter walls and physical site conditions within 100 homes (in accordance with ISO 13370:2007). The pre-installation U-values for the floors were, on average, **0.90 W/m².K**. The post-installation U-values were, on average, **0.19 W/m².K**, which constitutes a **79%** improvement, and meets the Part L1B requirements for elemental U-values of floors in existing buildings



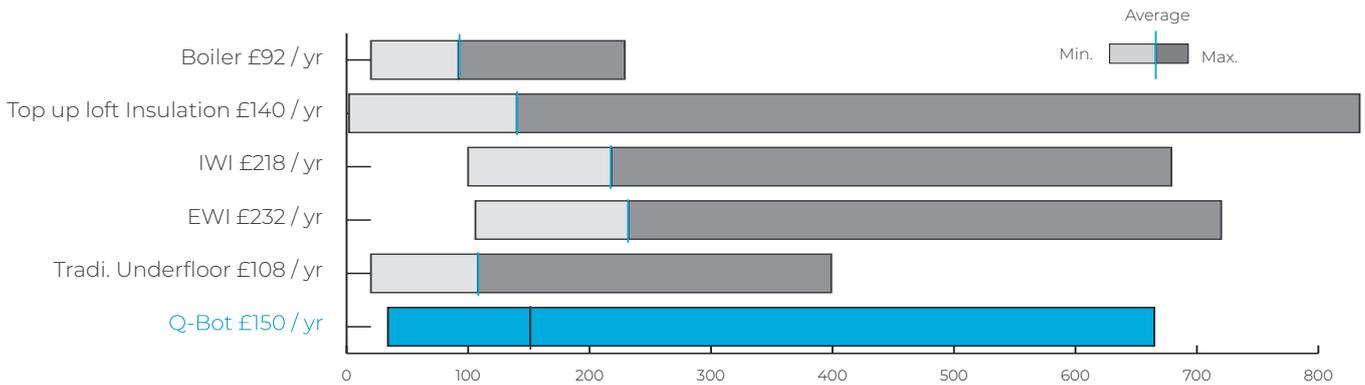
99 homes now meet the requirement of Part L Building Regulations for upgrades to existing buildings.

Energy Savings and Cost Effectiveness

The comparison of annual energy savings of Q-Bot's floor insulation with a range of standard retrofit measures was calculated using SAP. Q-Bot's solution was shown to provide the most cost-effective measure after loft insulation, at an average cost of **£400 per EPC point**. It also produced an average annual energy saving of **£151**, with properties saving up to **£665** per year. The average EPC improvement across the range of properties was **6 points**.

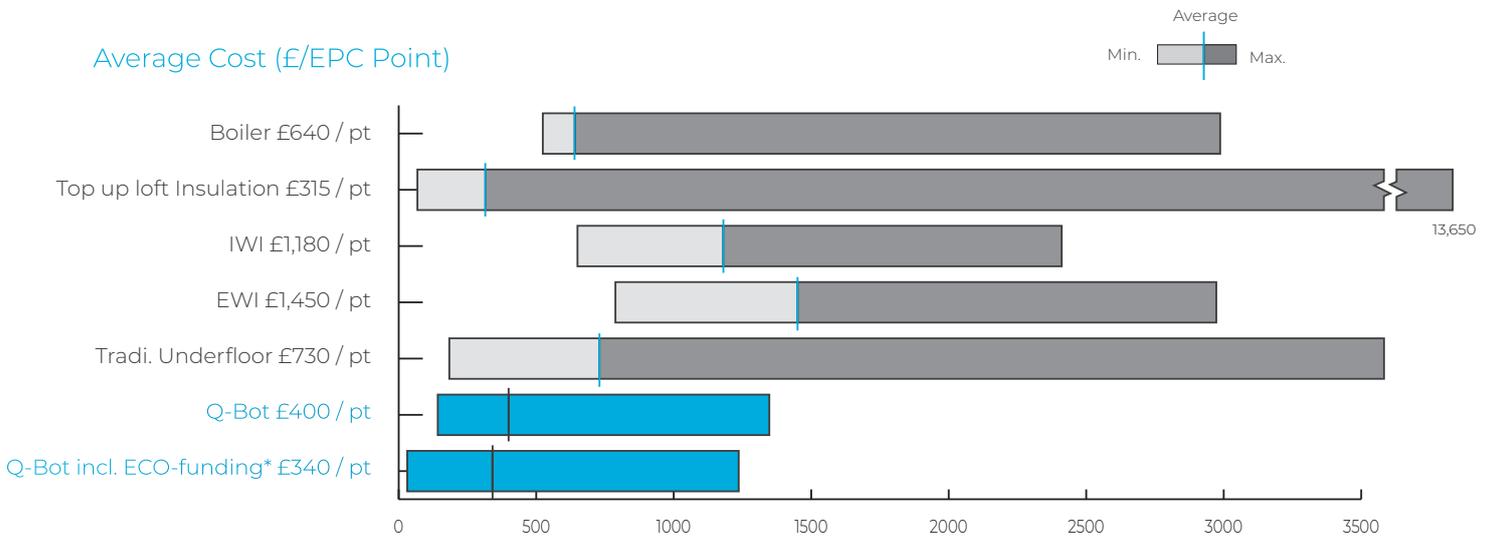
The average sales price for the installs was **£2,400** per property based on a minimum volume per year.

Average Annual Energy Savings (£ saved per year)



Significant energy savings without the disruption of major works.

Average Cost (£/EPC Point)



* Value calculated as at August 2018, subject to change due to new regulations. Assumptions based on a large volume programme.



Q-Bot is the cheapest option per EPC point.

Comparison with Different Measures

When compared with other potential retrofit measures, Q-Bot is approximately half the cost of EWI and IWI. It has a lower calculated cost per EPC point and both of these measures would involve significantly more disruption to those living in the property, as well as enabling works, redecoration and removal/ replacement of furniture (the cost of which is not included in the comparison above). Neither IWI or EWI would remove cold draughts originating from the floor.

Example Semi-Detached House

A three bedroom two storey house in West Scotland was insulated as part of the pilot. The house was a semi-detached house built between 1980 and 2000 and had **40m²** of suspended timber floor. The property was not connected to the national gas grid and had loft and external wall insulation as well as double glazed windows. **150mm** of insulation was installed between the joists and **25mm** below the joists. This resulted in an annual energy saving of **£652** per year and will pay back within 5 years. Q-Bot improved the energy performance rating of the house by two bands, from G to E, and a carbon emissions reduction of **108,000 kgCO₂e** over the 42 year lifespan of the insulation.



Fig 4. Semi-detached house in West Scotland.

Property Details

Suspended floor area:..... 40m²
 Area sprayed:..... 38.7m²
 External wall area: 37m²
 Window area:..... 13m²

The price of the install was **£3,100**.

KPI	Before	After
EPC Score	G 20	E 41
Annual Heat Cost	£1,980	£1,330
Annual CO ₂ e	7,360 kgCO ₂ e/yr	4,790 kgCO ₂ e/yr
Air Permeability	55 m ³ /m ² .h@50Pa	38 m ³ /m ² .h@50Pa
Floor U-Value	1.16 W/m ² .K	0.18 W/m ² .K

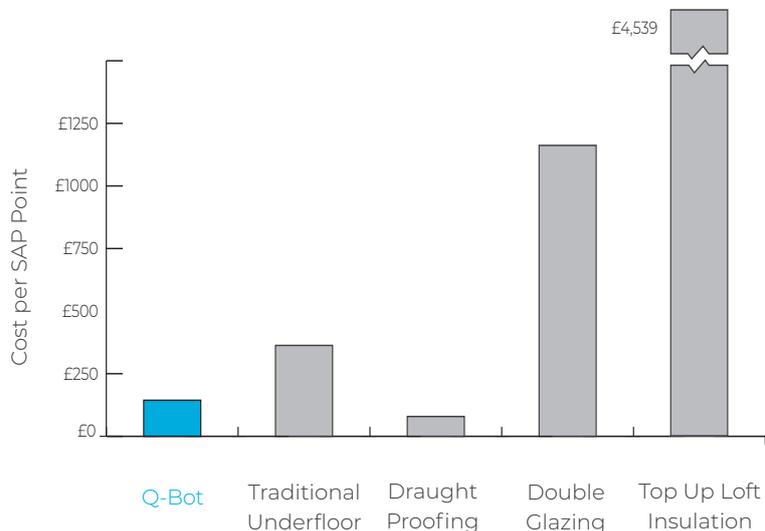


Fig 5. Before the installation.

Pays back
the initial
investment in
5 years



Fig 6. After the installation, showing the insulation now applied.



Example Terraced Ground Floor Flat

A one bedroom, ground floor flat, in Northwest London was insulated as part of the pilot. The flat was built between 1950 and 1980 with solid wall construction and had **40m²** of suspended timber floor. **150mm** of insulation was installed between the joists and **25mm** below the joists. This resulted in an EPC points improvement of **2.8**, and a carbon emissions reduction of **14,200kgCO₂e** over the 42 year lifespan of the insulation.



Fig 7. Terraced ground floor flat in North London.

Property Details

Suspended floor area:40m²
 Area Insulated:36m²
 External wall area: 65m²
 Window area:10m²

The price of the install was **£2,160**.

KPI	Before	After
EPC Rating	D 54.6	D 57.4
Annual Heating Cost	£950	£870
Annual CO ₂ e	4,100 kgCO ₂ e/yr	3,700 kgCO ₂ e/yr
Air Permeability	14.3 m ³ /m ² .h@50Pa	9.1 m ³ /m ² .h@50Pa
Floor U-Value	0.82 W/m ² .K	0.17 W/m ² .K

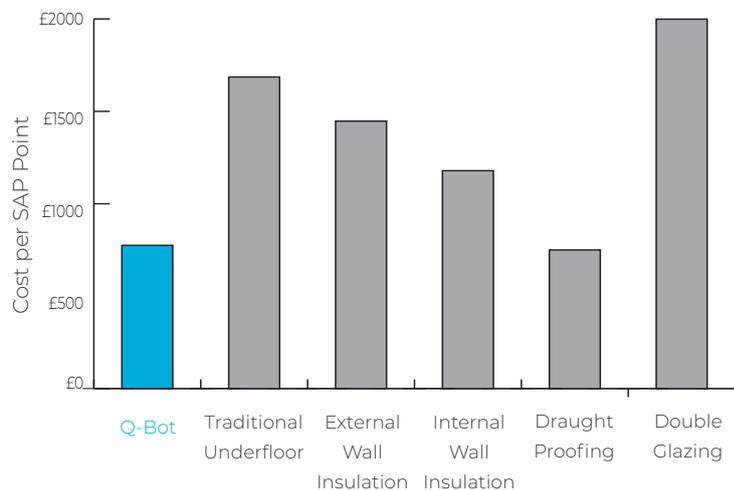


Fig 8. Before the installation.

Reduces cold draughts by 36%



Fig 9. After the installation, showing the insulation now applied.





q-bot

warmer, better homes

Date:

1st of October 2018

Authors:

Audrey Massy, Lisa Pasquale,
Madeleine Clifford, Mathew Holloway

w: www.q-bot.co e: info@q-bot.co t: +44 (0) 208 877 2709

Q-Bot Limited, Block G, Riverside Business Centre,
Bendon Valley, Wandsworth, SW18 4UQ
Reg. No: 07972299



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 698607.

