



**cheaper, better, faster insulation with robots**

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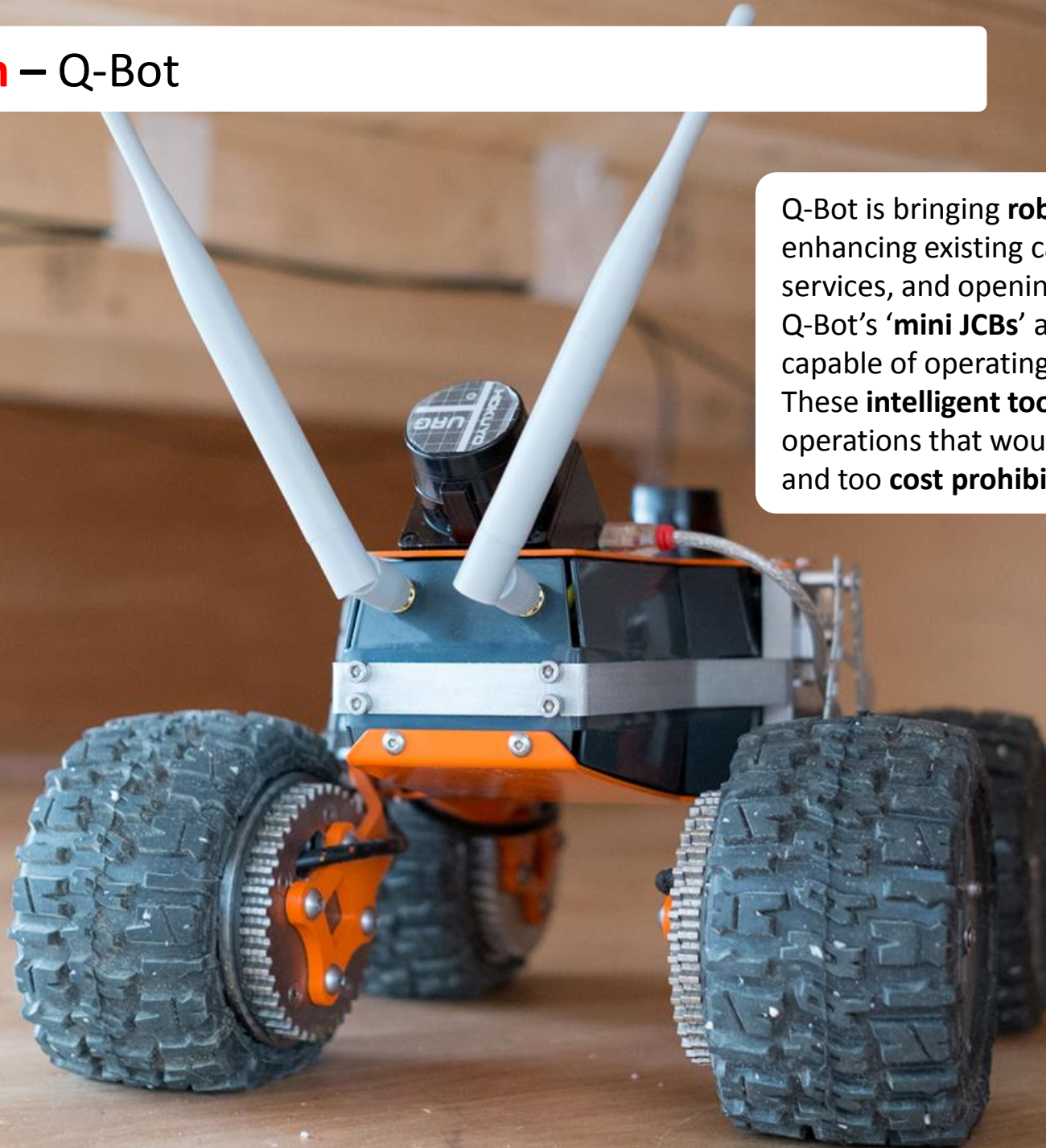
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## 0. Introduction – Q-Bot



Q-Bot is bringing **robotics** to the **built environment**: enhancing existing capabilities, creating new services, and opening up enormous new markets. Q-Bot's '**mini JCBs**' are compact, powerful and capable of operating in hazardous environments. These **intelligent tools** can remotely carry out operations that would otherwise be **impractical** and too **cost prohibitive** for humans to do so.



## 1. Problem – The UK's housing is energy inefficient



1/4

OF THE UK's HOMES ARE  
>100 YEARS OLD

THE UK HAS

6.5m

'HARD TO TREAT' HOMES

These older properties are difficult and expensive to bring up to modern standards. This means they are often:

- **energy inefficient**;
- **difficult to heat**; and
- suffer from **cold draughts** and uneven temperatures.

1. DECC, Digest of UK Energy Statistics, 2012

2. I. A.Rock, I.R.Macmillan, The Victorian House manual. Care and repair for all popular house types, Somerset, Haynes Publishing, 2005.



## 1. Problem – The ‘easy’ treatments have been done



A recent survey by the **Department of Energy and Climate Change (DECC)** indicated that a high proportion of cavity walls and lofts have been treated, but very few walls or floors have been tackled. Across the UK's homes insulation has been applied to:

**99%**

OF LOFTS

**70%**

OF CAVITY WALLS

BUT ONLY

**3%**

SOLID WALLS & FLOORS

1. DECC, Digest of UK Energy Statistics, 2012
2. I. A.Rock, I.R.Macmillan, The Victorian House manual. Care and repair for all popular house types, Somerset, Haynes Publishing, 2005.



## 1. Problem – Underfloor insulation is disruptive & expensive



Recent retrofit studies have shown that the installation of under-floor insulation is one of the most challenging aspects of upgrading the UK's older properties and is:

- **time-consuming** (up to 2 weeks);
- **expensive** (up to £10k per installation) with a long payback (>20 years); and
- **hugely disruptive** to occupants.

### 1. Remove floor



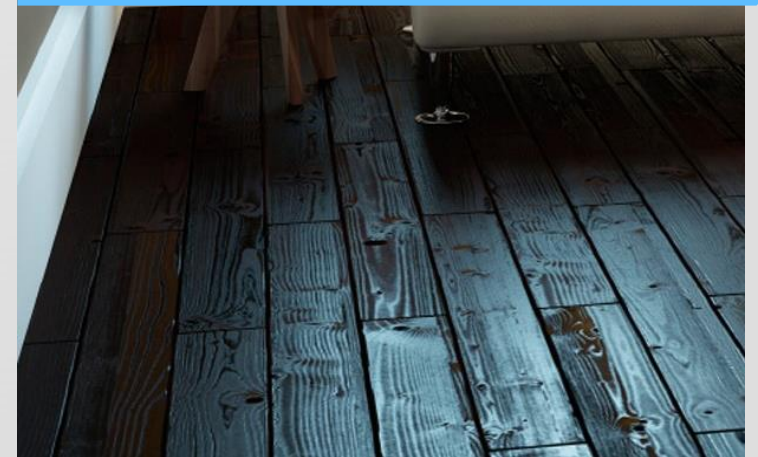
Furniture, fixtures and carpets are removed before floor boards are lifted.

### 2. Fit insulation



Insulation is cut to shape by hand and an airtight membrane fitted.

### 3. Make good



Floors and skirting boards are refitted, sanded and redecorated.

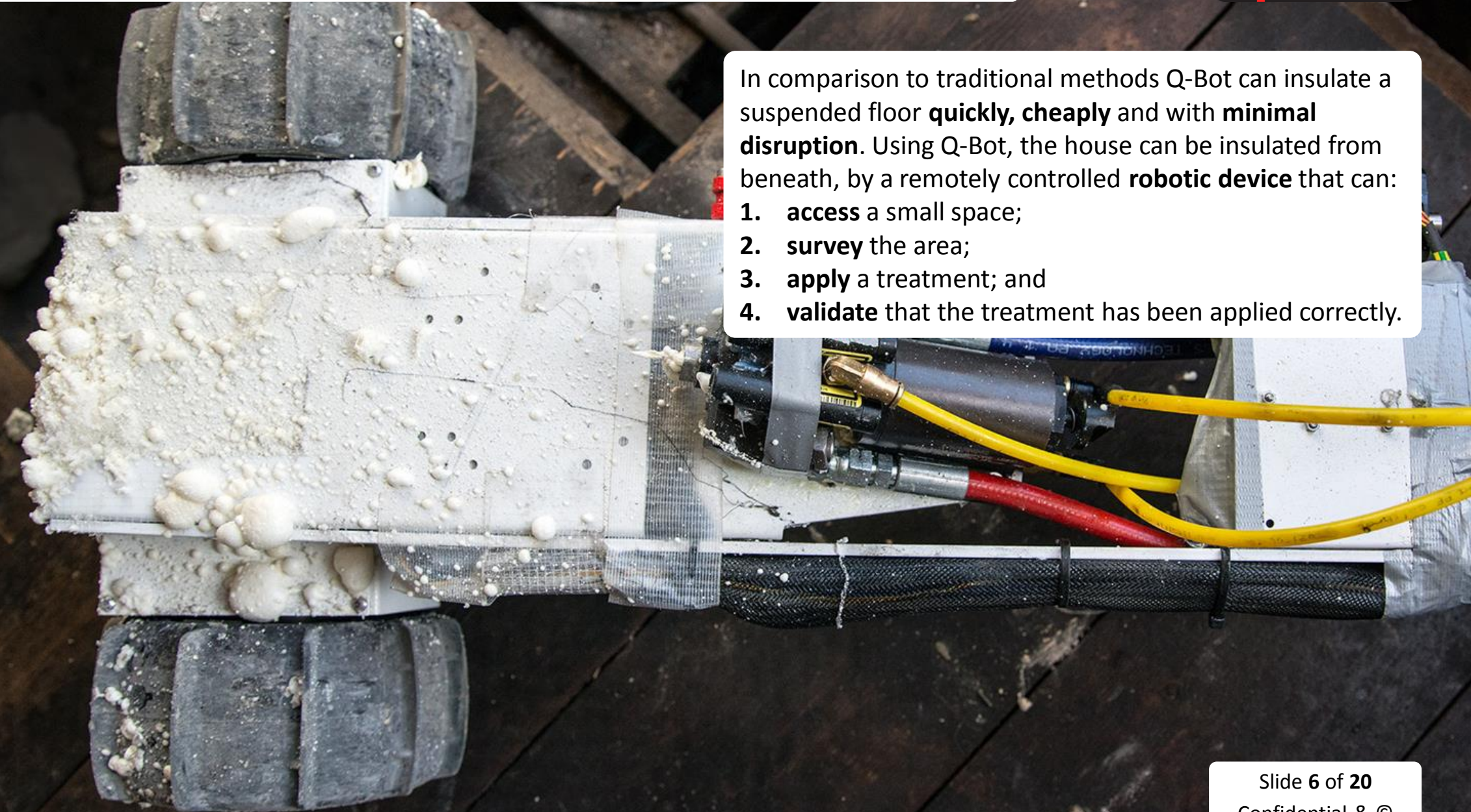


## 2. Q-Bot – Introduction to SprayBot



In comparison to traditional methods Q-Bot can insulate a suspended floor **quickly, cheaply** and with **minimal disruption**. Using Q-Bot, the house can be insulated from beneath, by a remotely controlled **robotic device** that can:

1. **access** a small space;
2. **survey** the area;
3. **apply** a treatment; and
4. **validate** that the treatment has been applied correctly.





## 2. Q-Bot – Access, Survey, Apply and Validate



**Stage 1. Access** – Because of the small and compact size of the robot, in many cases the installation can be achieved without even entering the property. Uniquely, this means the service is **less disruptive** to occupants than other energy efficiency measures.

The robot can be inserted through an **external air vent** or internal access hatch, deploy within the void and apply insulation to the floor boards in situ.



## 2. Q-Bot – Access, Survey, Apply and Validate



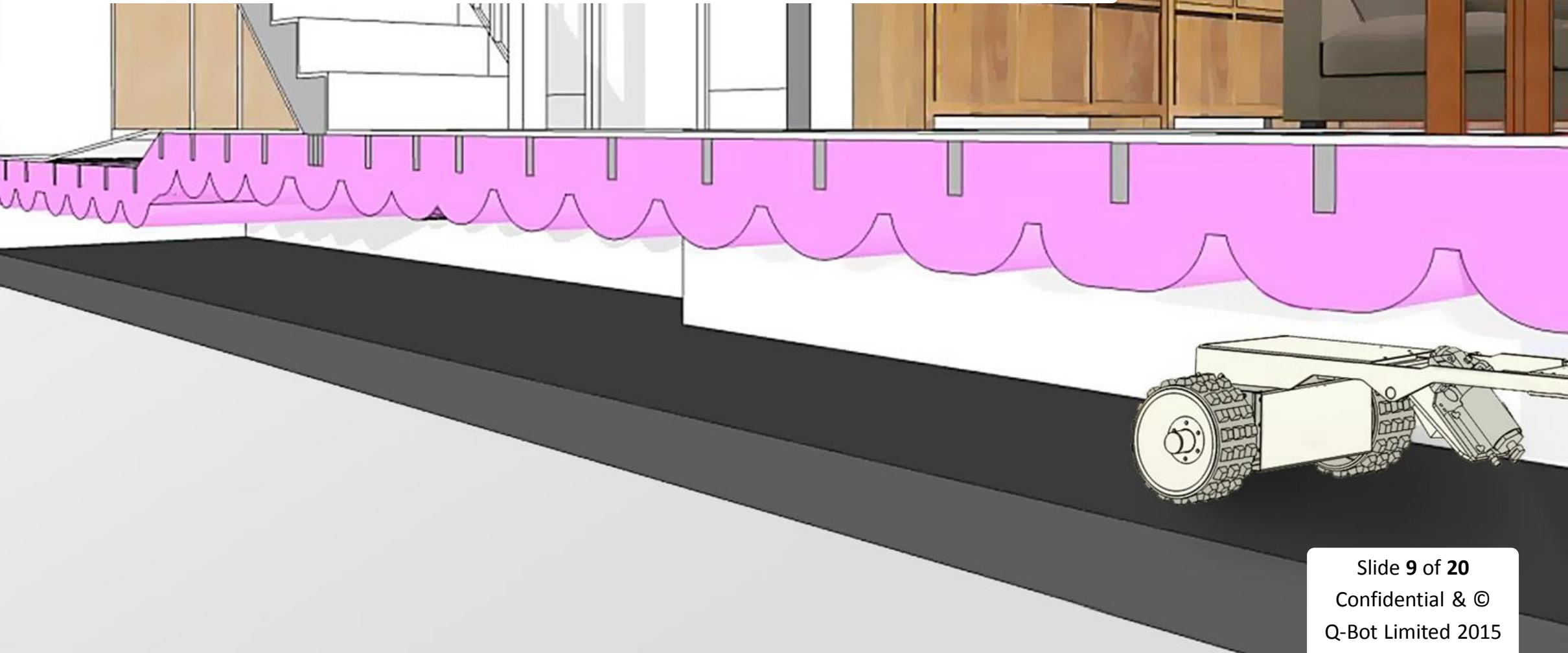
**Stage 2. Survey** – As the robot traverses along the void a detailed 3D map is built up of the underfloor space, allowing the operator to assess the installation and identifying any obstacles or other work that might be required, and the robot to control the application.



## 2. Q-Bot – Access, Survey, Apply and Validate



**Stage 3. Application** - Insulation is applied in controlled layers to form the required profile, but typically to an average depth of 125mm. The insulation is applied to the underside of the floorboards, keeping them on the warm dry side and maintaining the ventilation space of the ground below. Q-Bot uses industry standard polyurethane spray foam (BASF's Walltite or Icynene).

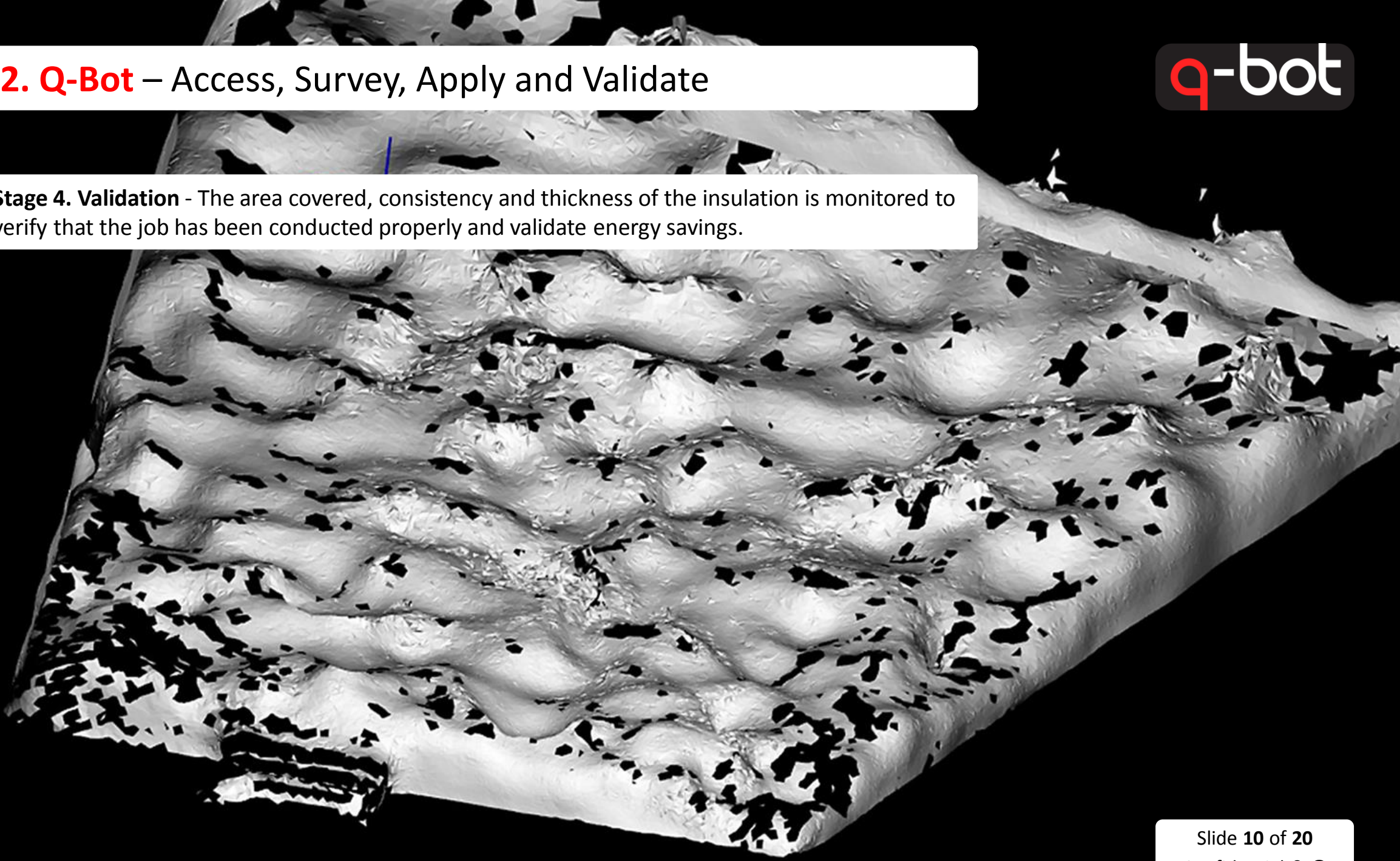




## 2. Q-Bot – Access, Survey, Apply and Validate



**Stage 4. Validation** - The area covered, consistency and thickness of the insulation is monitored to verify that the job has been conducted properly and validate energy savings.





## 2. Q-Bot – Benefits of Q-Bot



Compared to **traditional methods** for under floor insulation, Q-Bot is:

- **Faster** (1 day rather than 10).
- **Cheaper** (less than half the cost).
- **Better** (as applied in situ).
- Much less **disruptive**.

Compared to **‘hard to treat’** measures, Q-Bot is generally:

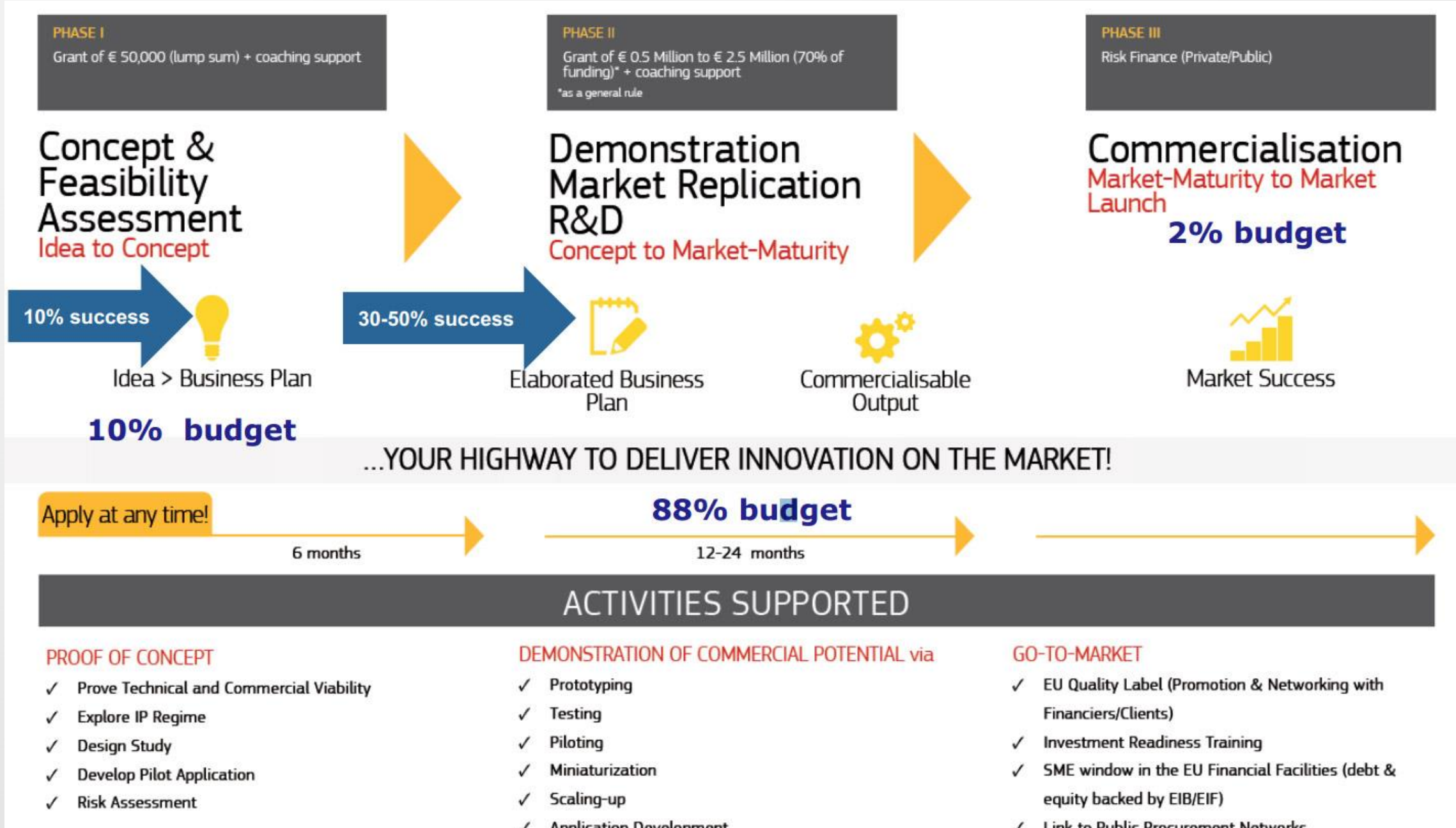
- **Cheaper** with a **shorter payback**.
- Less **disruptive** to occupants.
- Does not **impact** the building.
- Does not require **access**.
- Improves **comfort** (draughts).

	Cost	Savings	Payback	Life	Install
Loft Insulation	£300	£150/yr	2 yrs	40 yrs	1 day
New Boiler	£2,000	£150	13 yrs	10-12 yrs	2 days
External Wall	£15,000	£270/yr	55 yrs	40 yrs	4-6 wks
Internal Wall	£9,000	£270/yr	33 yrs	40 yrs	2-4 wks
Double Glazing	£8,000	£120/yr	66 yrs	20 yrs	2-3 days
Traditional Floor	£5,000	£100/yr	50 yrs	40 yrs	10 days
Q-Bot Floor	£2,500	£200/yr	12.5 yrs	40 yrs	1 day

**Note:** Numbers in the table above are from the Energy Saving Trust and Which website for a three bed semi detached house.



### 3. EU Funding – The SME Instrument







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