



Department for
Energy Security
& Net Zero

Evaluation of the BASEE Programme

Evaluation Report Technical Methods Annex

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Introduction

This document provides details on the technical methods used in the evaluation of the Boosting Access for SMEs to Energy Efficiency (BASEE) programme, a £6m programme funded by the Department for Energy Security and Net Zero (the Department). The main evaluation report, which includes details of the BASEE programme aims and objectives, can be found in a separate document.

Programme Theory of Change

A detailed Theory of Change (ToC) was developed at the outset of the evaluation and was refined throughout. This encapsulated how the scheme was intended to work and the assumptions underpinning this. The ToC was generated through review of programme documentation and discussions with the BASEE programme manager. As well as setting out the inputs-activities-outputs-outcomes logic, the ToC covered:

- Assumptions on which the successful operation of the scheme was predicated.
- External factors: the social, cultural, economic and political factors, laws, regulations that influenced change along the major pathways of the ToC.

The final version can be found in Figure 1.

Figure 1 – BASEE theory of change



The BASEE Evaluation

Objectives

Alongside programme delivery, the Department committed to deliver an evaluation of the BASEE programme, incorporating process, impact, and economic evaluation. Through assessing programme delivery and outcomes, the evaluation sought to provide understanding to enhance the design and delivery of current and future programmes. The full set of evaluation questions are in Table 1.

Table 1: List of evaluation questions

Main EQ	Specific sub-questions the evaluation sought to answer
<p>EQ1</p> <p>Have the BASEE pilot projects been effective in encouraging SMEs to take up energy efficiency projects and implement energy efficiency measures?</p>	<ul style="list-style-type: none"> • How successfully have pilots engaged SMEs in their product? Have different messages, trigger points, and targeting of SME profiles been effective? • Where pilots were unable engage SMEs in their product, why not? Where and why did SMEs drop out? • What types of EE measures are being offered, requested, and taken forward through the pilots, and how are they influencing this (especially take up of longer-term measures). • How successful were the pilots in overcoming resource / expertise barriers and encouraging SMEs to progress measures? • To what extent did the tools developed by the pilots enable accurate estimation of EE measure cost savings / return on investment (ROI), and so ensure trust in predicted impacts of action, whilst trading the line between accuracy and simplicity in terms of questions for SME customers? • Has the process for obtaining / approving finance for SMEs been simplified / standardised, are the rates on external finance now more favourable as a result, and is there evidence that SMEs are therefore more likely to borrow?

Main EQ	Specific sub-questions the evaluation sought to answer
	<ul style="list-style-type: none"> • To what extent have the pilots developed approaches to address the landlord/tenant split-incentive barrier? • To what extent have the pilots provided evidence to show their model encourages SMEs to take action that they otherwise would not have? • What are the outstanding barriers to encouraging SMEs to engage with and implement energy efficiency action, what solutions do the pilots envisage, and what are the implications of these for future policy?
<p>EQ 2</p> <p>Have the BASEE project business models demonstrated they will stimulate the supply chain for energy efficiency products and services aimed at SMEs?</p>	<ul style="list-style-type: none"> • To what extent have the pilots demonstrated to the supply chain that there is a sufficient SME market for energy efficiency? • To what extent – and how - have the tools developed by the pilots reduced the money and resource cost to the supply chain of SME energy efficiency action, in particular through use of aggregation? • To what extent have the pilots provided evidence to show they have engaged supply chain in SME energy efficiency that would otherwise not have done so, or to the same extent? • What are the outstanding barriers to encouraging the supply chain to engage with SME energy efficiency action, what solutions do the pilots envisage, and what are the implications of these for future policy?
<p>EQ 3</p> <p>Have the BASEE projects demonstrated that they will encourage lenders to provide finance for SME EE activity?</p>	<ul style="list-style-type: none"> • To what extent have pilot tools improved lender confidence in predicted savings? • Has the process for obtaining / approving finance been simplified / standardised, and have reductions in lender costs and risks created by the BASEE pilots led to less stringent conditions on investing in SME energy efficiency projects?

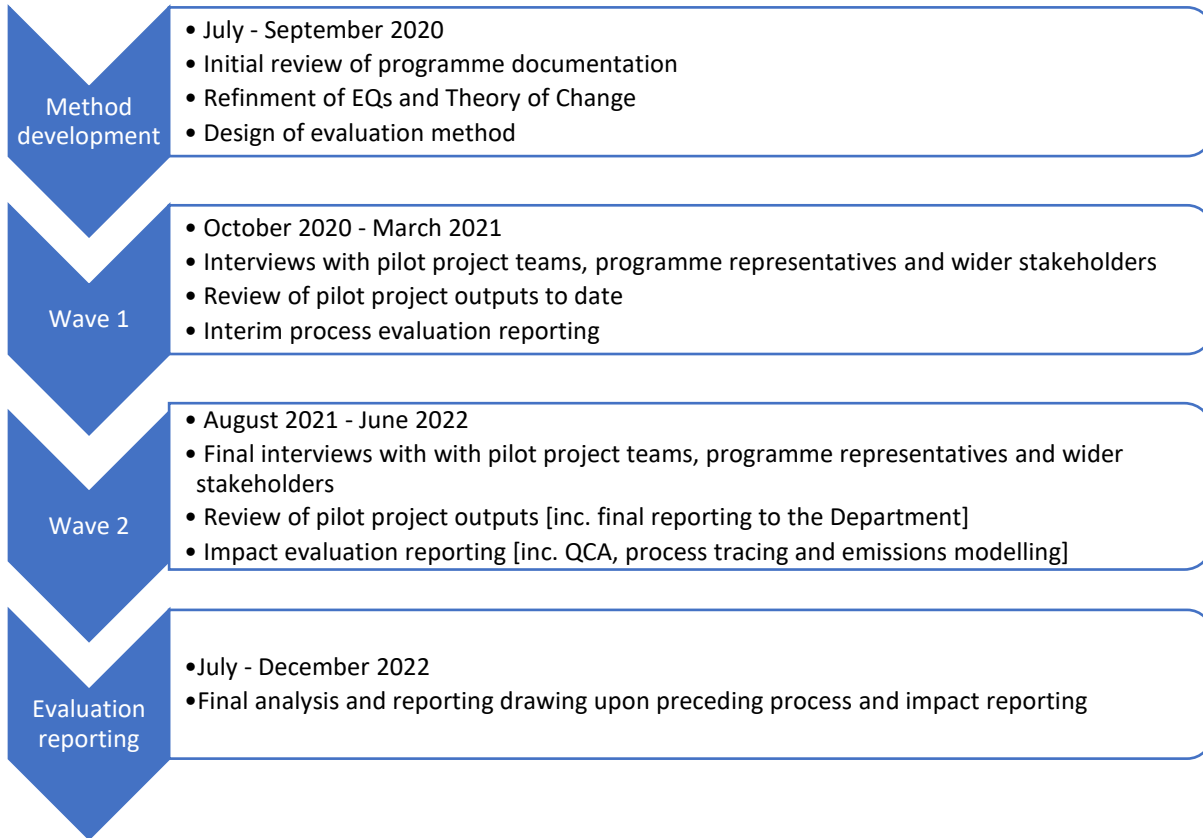
Main EQ	Specific sub-questions the evaluation sought to answer
	<ul style="list-style-type: none"> • To what extent have the pilots utilised aggregation to increase the attractiveness of SME energy efficiency to lenders? • To what extent have the pilots provided evidence to show they have engaged lenders in SME energy efficiency that would otherwise not have done so, or to the same extent? • What are the outstanding barriers to encouraging lenders to engage with SME energy efficiency action, what solutions do the pilots envisage, and what are the implications of these for future policy?
<p>EQ 4</p> <p>What impact have the projects had (or can be expected to have in future) on reducing energy consumption among SMEs?</p>	<ul style="list-style-type: none"> • What is the total amount of (a) lifetime energy savings, (b) lifetime CO2 emission reduction savings that can be attributed to each pilot by the end of the first tranche of the projects (April 2021), over the next five years and up to 2030 and 2032? • Have the BASEE business models demonstrated a cost-effective approach to delivering energy efficiency measures among SMEs than the equivalent action outside the pilots? • Does the BASEE programme represent value for money in terms of government spend i.e. does the present value of expected future benefits outweigh the programme costs?
<p>EQ 5</p> <p>To what extent have the projects delivered on the attributes sought by the BASEE Competition, and why/why not?</p>	<ul style="list-style-type: none"> • To what extent are the funded pilots 'new'? • To what extent are the pilots themselves, and their outputs and outcomes, 'additional'? • To what extent have the funded pilots demonstrated that they will be 'scalable'? • To what extent have the funded pilots demonstrated that they are 'replicable'? • To what extent have the pilots sought to address the stated SME, supply chain and lender barriers that underpinned the rationale for BASEE?

Main EQ	Specific sub-questions the evaluation sought to answer
<p>EQ 6</p> <p>What insights can be gained to improve the design and delivery processes of the BASEE programme, and other similar innovation programmes?</p>	<ul style="list-style-type: none">• What aspects of the promotion and engagement of BASEE (i.e. communications with potential applicants) influenced the characteristics of the funded pilots?• Are there any ways in which the processes from appraising applications to contract award and project initiation may be made more effective or efficient in answering BASEE's objectives?• Are there any ways in which processes for providing ongoing pilot management support, monitoring, invoicing and KPI reporting could be made more effective or efficient in answering BASEE's objectives?• Are there any ways in which programme management and portfolio monitoring processes could be made more effective or efficient?• Considering the intended objectives of BASEE, could / should the scheme have been designed differently to achieve the same, or better, outcomes?

Timescales

Figure 2 summarises the broad stages and timings of the evaluation:

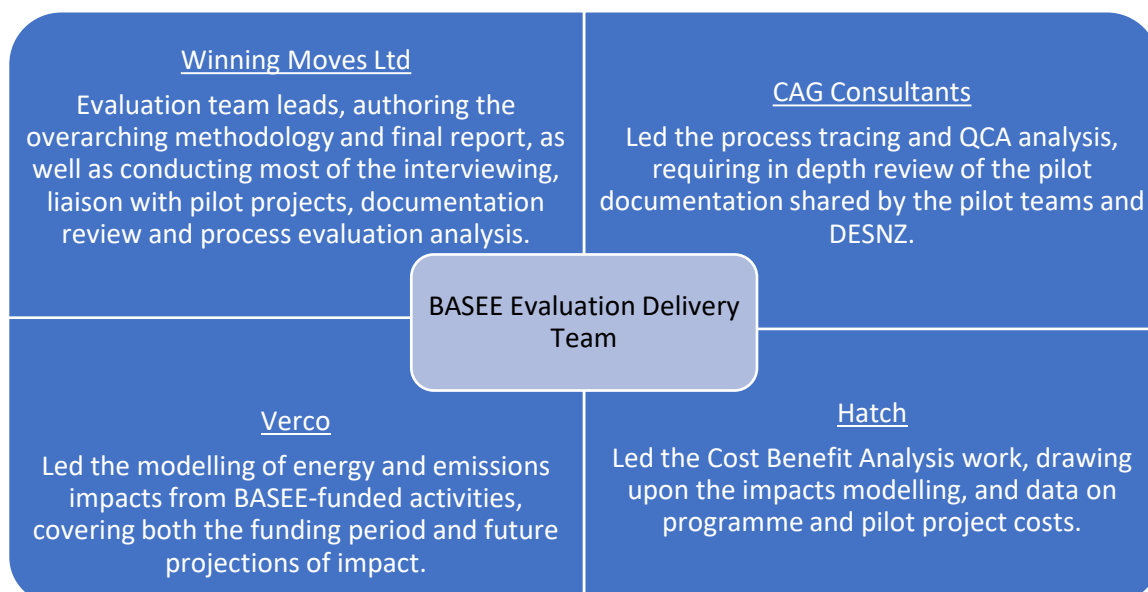
Figure 2 – Stages and timings of evaluation activity.



Evaluation team

The evaluation team comprised four organisations, as detailed in Figure 3:

Figure 3 – Roles within the evaluation consortia



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The evaluation report draws on process, impact, and economic evaluation activity conducted throughout 2019-22. The sources are summarised below, with the chapters in this Annex exploring a number of elements in more detail.

Data collection

Secondary data

A high-level review was undertaken at the evaluation scoping stage of all BASEE-related documentation produced and planned; these were mapped against the key evaluation questions and work elements. The broad categories of documentation – and their use across the different evaluation activities – are summarised in Table 2.

Table 2: Summary table of secondary sources reviewed and for which evaluation elements

Document types	Purpose of review
<p>Wider policy and contextual documents (reviewed during the scoping stage).</p>	<ul style="list-style-type: none"> • Enabled the evaluation team to reflect upon the context and drivers for BASEE, in particular informing the ToC. • Underpinned an internal working paper summarising key findings on BASEE rationale, SME barriers, enabling factors and benefits (in relation to energy efficiency) as well as capturing information on the key external factors that might affect the effectiveness of the programme. • Also useful for the process evaluation, in understanding the context / parameters for programme design decisions.
<p>Programme documentation e.g. documents detailing design decisions / rationale, as well as externally facing documents describing the programme process.</p>	<ul style="list-style-type: none"> • Central to the process evaluation, helping to answer evaluation questions appraising BASEE design and effectiveness.
<p>Project-specific documentation e.g. feasibility reports, evidence base work, and KPI reporting / monitoring (both quarterly reporting against fixed KPIs, and planned project closure reports in 2021).</p>	<ul style="list-style-type: none"> • A key component of analysis for the impact evaluation, CBA and emissions modelling, particularly the KPI outcomes / impact reporting. The documents also contain evidence to inform evidence tests and assessment of conditions coding in process tracing and QCA respectively. • Also useful for the process evaluation, providing evidence on project aspirations / expectations, challenges, and informing assessment of programme decisions on funding awards.

Primary Data - In depth interviews

Table 3a and 3b set out the groups interviewed across the evaluation, the phrasing of these, sample sizes, and an overview of the rationale for the group's inclusion (i.e. what evidence we expected the interviews to provide). All interviews were conducted remotely, mostly over Teams but occasionally by telephone for wider stakeholders.

Across both the main waves of the evaluation, interview responses were analysed both overall (drawing out common themes and contrasts across the programme and pilot projects) and at a per project level / case level.

Table 3a: Summary of primary research respondent groups, key topics and sample during Wave 1 [November – December 2020]

Respondent group	Rationale / questions to explore	Interviews	Length [approx..]
BASEE Programme Manager	<ul style="list-style-type: none"> • BASEE rationale and impact / outcome expectations • Basis of programme design decisions • Assessment of BASEE design strengths / successes 	1	1.5 hours
BASEE delivery support (monitoring officers and technical reviewers)	<ul style="list-style-type: none"> • Assessment of aspects that have worked less well / recommendations for improvement • Assessment of the funded projects – profile and performance to date vs. Expectations • Assessment of project progress to date against expectations, in particular against the key aims / barriers the project was designed to address – economies of scale, reducing SME costs and hassle, improved finance provision and SME appetite for finance • Basis of project design decisions (as well as any adjustments made) 	3	30 mins
Phase 2 funded project teams	<ul style="list-style-type: none"> • Assessment of project strengths / successes • Expectations of the project being commercialised / scalable, including technical feasibility, team capacity (both expertise and lead, lender and supply chain ability to deliver at scale), effective customer channels creating SME appetite, customer perception of the project’s value, clear revenue stream(s) and ability to fund scale-up. • Assessment of aspects that have worked less well / recommendations for improvement 	8 group interviews	1.5 hours

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	<ul style="list-style-type: none"> • Discussion of any unanticipated outcomes to date and their implications 		
<p>BASEE Phase 2 project wider consortium partners, including energy efficiency supply chain and lenders. These were identified and selected in discussion with project leads).</p>	<ul style="list-style-type: none"> • Discussion of any KPIs / data reported to the Department, particularly around predicted outcomes and impacts • Experience to date of the BASEE process and requirements • Attribution (feeding in particular into the process tracing): assessing the importance of BASEE – the funding and wider support - to the delivery of their project to date i.e. projects being quicker / bigger / better due to BASEE than they would otherwise have been. As per the process tracing tests, aspects to explore will include exploration of: BASEE funds enabling action / releasing revenues for other activities, partnership creation, alternative funding options, BASEE support influencing project changes, risk reduction enabling greater innovation, comparison to other / previous R&D innovation projects, the reputational influence of support from the Department leveraging other funding. 		20-45 mins
<p>Unsuccessful applicants (at Phase 1 and 2 stages)</p>	<ul style="list-style-type: none"> • Views on the BASEE programme (both attraction in applying and experience of the process) • [informing the counterfactual] Progression of their project outside of BASEE • Contribution / influence of BASEE to the project 	7	30 mins

Table 3b: Summary of primary research respondent groups, key topics and sample during Wave 2 [Sept 2021 – Feb 2022]

Respondent group	Rationale / questions to explore	Interviews	Length [approx..]
BASEE Programme Manager	<ul style="list-style-type: none"> • Assessment of BASEE design strengths / successes • Assessment of aspects that have worked less well / recommendations for improvement • Assessment of the funded projects – profile and performance vs. expectations • Costs of the programme – administration, delivery etc. – to feed into the CBA. 	1	1.5 hours
BASEE Phase 2 funded pilot project teams	<ul style="list-style-type: none"> • Assessment of overall project delivery against expectations • Discussion of any KPIs / data reported to the Department, in particular around predicted outcomes and impacts • Basis of project design adjustments in 2021 	8 group interviews	1.5 hours
BASEE Phase 2 project wider consortium partners, including energy efficiency supply chain and lenders.	<ul style="list-style-type: none"> • Assessment of project strengths / successes • Assessment of aspects that have worked less well • Discussion of any unanticipated outcomes and their implications • Experience of the BASEE process and requirements • Attribution (feeding in particular into the process tracing): assessing the importance of BASEE – the funding and wider support - to the delivery of their project to date i.e. projects being quicker / bigger / better due to BASEE than they would otherwise have been. 	11	20-45 mins

Primary Data - Indirect SME surveys

Feedback from participant SMEs was crucial in understanding SME experiences and outcomes from interacting with the pilots.

Rather than surveying SME customers directly, the evaluation team shared a small batch of questions (focused on action, impacts and attribution) with the pilot teams. These questions could be integrated into surveys of SME participants that the pilots would administer themselves. Pilots would then share anonymised datasets of responses with the evaluation team. There were several potential advantages to this approach – reduced respondent burden / risks of duplicated effort, reduced administration around sharing contacts, and potentially boosted response rates.

Despite these advantages, it proved difficult to secure insights from this target group. Response rates to the pilots' SME surveys tended to be very low¹ (no pilot SME survey achieved more than 15 responses, with two not achieving any). The small sample limited the insights and conclusions that could be drawn from responses. Furthermore, despite the evaluation team reviewing – and recommending changes to – the project team surveys, in some cases questions were not asked precisely as suggested.

The questions recommended to the pilot projects for inclusion in their SME customer surveys were as follows:

- How did you first hear about the project?
- What motivated you to engage with [product/tool]? What benefits were you hoping it would provide?
- Subsequent to your use of [product/tool], have you:
 - Taken/implemented any energy efficiency measures?
 - Got plans (even if not fixed yet) to implement energy efficiency measures?
 - Neither – why not?
- *[if the respondent had taken action / are planning to do so]* Which of the following statements most closely reflects the influence of [product] on the action you have taken / are planning?
 - We would not have taken / decided to take any action without [product] – why not? How did [product] help you?
 - We would have taken / planned to take some action but not as impactful / extensive / wide-ranging without [product] – in what way? And how did [product] help you?

¹ And likely with overrepresentation of the more enthused SMEs that had engaged more fully with the projects.

- We would have taken / planned to take the same action but slower – how much slower? How did *[product]* help you?
- We would have taken / planned to take the same action in the same timescales anyway – did *[product]* help you in any way?
- *[if the respondent had taken action]* Have you seen any of the following benefits from this yet?
 - Reduction in energy use?
 - Reduction in energy bills?
 - Improved comfort / warmth?
 - Improved air quality?
 - Improved staff health / well-being?
 - Improved staff satisfaction?
 - Improved staff productivity?
 - None of the above / too early to say – do you expect to see any benefits?

[if the respondent had taken action] How much staff time (e.g. working hours) was required of your organisation in planning, managing and / or conducting the installation of measures?

- Thinking about *[product]*, to what extent has it helped you to do the following: *[options were 'to a great extent', 'somewhat', 'slightly', 'not at all', or 'not applicable – have not used [product] for this'.]*
 - Identify what energy efficiency measures would be appropriate for your premises?
 - Reduce the time and effort it would have taken to identify and choose the best measures for your business?
 - Obtain reliable estimates of the costs and benefits / rate of return of implementing those measures?
 - Find installers / quotes for the installation of those measures?
 - Find sources of external finance for the installation of those measures?
- *[if the respondent selected 'to a great extent', 'somewhat', or 'slightly' for option v]* You mentioned that *[product]* helped you to obtain external finance. In what way? For example, did it make finance easier to find / access, had more favourable costs / rates / terms?
- *[if the respondent selected 'to a great extent', 'somewhat', or 'slightly' for option v]* Would the installation of measures have been possible without this external finance?
 - Yes
 - Yes, but fewer / less impactful measures
 - No

Analysis of Primary and Secondary Data

As well as thematic and descriptive analysis of interview responses and data from project and programme documentation, the evaluation included a number of focused analysis elements; these are described in this section.

The elements were proposed at the outset of the evaluation; for most, the actual progress of the funded pilot projects limited the data they could draw upon and the robustness of the insights they could provide. These issues are outlined in the relevant sections.

Process (contribution) tracing

Description of method

The first step in process tracing is to define sets of competing hypotheses, one articulating programme additionality to outcomes, and the other representing alternative explanations for observed outcomes. The second step is then to define what types of evidence one would expect to see, or hope to see, under each hypothesis, thereby making those tests as strong as possible. Where possible, the aim was to identify evidence tests that would have different bearings and consequences for different hypotheses.

Process tracing subjects the hypotheses to a set of tests to establish the strength of different hypotheses:

- Hoop tests – reject the hypothesis if evidence is not found; these relate to pieces of evidence that we would need or expect to see if the given hypothesis is true, but do not confirm the hypothesis (i.e. necessary but not sufficient)
- Smoking gun – confirms the hypothesis if observed but does not reject the hypothesis if not observed; these are pieces of evidence that we would like to see (i.e. sufficient but not necessary)
- Doubly-decisive – confirms the hypothesis if observed and rejects the hypothesis if not observed; these are pieces of evidence that are expected but are also confirmatory of the hypothesis (i.e. both necessary and sufficient)
- Straw-in-the-Wind – not sufficient to confirm the hypothesis if observed nor to reject the hypothesis if not observed (i.e. neither necessary nor sufficient in itself)

The strength of each test is based on the conditional probability of observing a piece of evidence, given that a particular hypothesis was true (or not true). It is important to note that this is different from asking 'what is the probability that the hypothesis is true, given that we've observed this piece of evidence'.

Process tracing is often undertaken in combination with Bayesian updating. This involves assigning numerical probabilities to the ex-ante probability of each hypothesis being true.

Numerical probabilities are also assigned to the likelihood of observing specific pieces of evidence in the circumstances that each hypothesis was true or false. And then a Bayesian formula is applied to calculate the revised, ex-post probability of each hypothesis being true.

For the BASEE evaluation, the process tracing used the four categories of evidence tests but, based on previous experience of assigning numerical probabilities, and given the large number of evidence tests proposed, Bayesian updating was not deemed practical or necessary.

The tests were applied at project rather than programme level, as this allowed more granular exploration about where and how BASEE has influenced the projects. The tests would have become very generalised if applied at programme level.

Process tracing hypotheses and evidence tests were applied to each of the Phase 2 BASEE projects in turn. This tested the strength of the evidence about the BASEE contribution to each of the Phase 2 projects but did not aim to assess how far different elements of the desired outcome were achieved, nor explain why some of the projects were more successful than others in achieving desired outcomes [this was the focus of the QCA].

Hypotheses for pilot projects in the BASEE programme

Process tracing was used to focus on BASEE’s contribution to desired learning from the BASEE programme, as illustrated by the evaluation questions in Table 4.

Table 4 – Mapping evaluation questions to desired learning from BASEE

Broad evaluation questions	Type of learning sought
Have the pilot’s business models demonstrated they can address some of the known barriers to the uptake of energy efficiency (EE) measures for SMEs and lenders and EE providers?	Learning about how to address the known barriers to uptake of energy efficiency (EE) measures for SMEs and lenders and EE providers
To what extent have the pilots utilised aggregation to increase the attractiveness of SME EE to lenders?	Learning about the role of aggregation in attracting increased investment in EE measures for SMEs
Have the BASEE pilots been effective in encouraging SMEs to take up EE projects and implement EE measures?	Learning about the effectiveness of energy efficiency solutions (including individual tools and platforms) in encouraging SMEs to invest in EE measures
Have the BASEE pilots’ business models demonstrated they will stimulate the supply chain for energy efficiency products and services aimed at SMEs?	Learning about how best to stimulate the supply chain for EE products and services aimed at SMEs

Broad evaluation questions	Type of learning sought
What impact have the pilots had (or can be expected to have in future) on reducing energy consumption among SMEs?	Learning about the potential impact of projects on reducing energy consumption among SMEs
What insights can be gained to improve the design and delivery processes of the BASEE programme, and other similar programmes?	Learning about the design and delivery of future innovation competitions and support programmes

As the process tracing focused primarily on BASEE influence on learning from the projects, evidence tests checked for different ways in which BASEE might have had influence (e.g. financial, reputational, managerial etc). There was no attempt to split ‘success’ into separate outcomes, as for QCA, because it was felt this would make process tracing too complex and unwieldy to apply. Contributions to individual outcomes could still be analysed outside the formal process tracing tests.

Four competing hypotheses were specified, reflecting different levels of attribution to BASEE or other innovation support services. The first hypothesis (H1) was the ‘additionality hypothesis’, while H2 and H3 represented alternative hypotheses about the levels of additionality from BASEE (partial additionality to no additionality). H4 was logically separate and looked at potential adverse influences of BASEE, which might be combined with any of the other three hypotheses.

- Hypothesis 1 (H1 - BASEE clearly additional) - BASEE played a major role in supporting development of their project ideas, and they would not have generated the observed learning without BASEE support.
- Hypothesis 2 (H2 - BASEE partially additional) - without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe
- Hypothesis 3 (H3 - BASEE not additional) - without BASEE, they would probably still have progressed their project ideas (possibly using other innovation support) and would probably have generated similar learning over a similar timescale. BASEE funding was nice to have, but not essential.
- Hypothesis 4 (H4 - adverse influence from BASEE) - irrespective of which additionality hypothesis applies, the timescales and requirements of BASEE funding have distorted the activities of the delivery partners and have adversely affected the learning that the project team and partners would otherwise have generated.

Evidence tests were defined to look for evidence about the different ways in which BASEE would be expected to be influencing the projects. These included:

- Activities funded by BASEE: financial support from BASEE enabled the project to generate learning by developing and testing their ideas (e.g. by supporting employment of staff undertaking specific tasks OR by funding research by specialists OR by funding advice/work by lawyers OR by funding website or tools development)
- More/better activities: the scale of financial support from BASEE enabled the project to test more extensively, or improve the quality of their product, or reach a wider number of potential users, or improve their understanding of the market, or improve/refine their value proposition
- Financial de-risking: financial support from BASEE reduced the financial risks facing the project, and enabled them to make bolder decisions about project development
- Reputational leverage: being selected for BASEE support by the Department raised the reputation and profile of their project and made it easier to get support from other sources
- Meeting KPIs: having to work to the Department's KPIs and report regularly to the Department helped to keep them focused and led to faster/better delivery than would otherwise have been the case, possibly prioritising the project over other activities.
- Information and advice: involvement with BASEE helped them to access advice within and beyond the Department, including learning from other BASEE projects and from the evaluation itself, which helped their project development

It was also possible that BASEE might have had adverse influence too. For example:

- Exclusion from other support: projects might conceivably have missed out on other sources of support because they were already involved in the BASEE programme, although this may simply be the consequence of public funding rules designed to avoid duplication of funding.
- Distortion of project activities: BASEE timescales and requirements might have imposed artificial requirements on project activities that were detrimental to the learning process. For example, an effective project prototype design might have been distorted to fit funding criteria; the pilot may have been required to go out to market too soon, before a product or process was fully developed; a process that would have generated more learning if undertaken over a longer time period may have been rushed; additional paperwork or documentation introduced, that does not add to the learning process or the likely success of the project idea.
- De-prioritising of other activities: BASEE timescales and requirements might have led pilot projects to prioritise BASEE over other activities that were outside BASEE. Where the de-prioritised activities were linked to learning about energy efficiency solutions for SMEs, this might have adverse influence on the objectives of the BASEE programme.

Types of evidence

The analysis considered some broad types of evidence that would provide support for full or partial additionality of the Department for Energy Security and Net Zero's influence, and for

whether these would be positive or negative. In broad order of increasing reliability, these included:

- Interview responses from members of the project team
- Interview responses from independent project partners or contractors
- Documents prepared by the project team (including project website etc)
- Documents prepared by independent project partners or contractors
- Research reports or documented findings fully external to the project
- Other findings published by external stakeholders (e.g. news articles; reviews; feedback).

Limited pilot insight into the views of external stakeholders and project partners constrained the testing of some of the hypotheses.

Evidence tests

The tests described below were designed to test different elements of each of the four related hypotheses, using appropriate types of evidence. These tests were developed by CAG and refined in response to comments by Winning Moves and energy efficiency, evaluation, and innovation specialists within CAG Consultants. Similar types of evidence were used across some of the different hypotheses, albeit the likelihood of seeing or not seeing evidence would differ.

Evidence tests for H1

The tests set out in table 5 below are classified in broad terms using the process tracing typology outlined above and grouped by type of test. ‘Hoop’ tests are presented first, which would have to be passed for H1 to be supported, followed by ‘smoking gun’ tests which would confirm H1. No ‘doubly decisive’ tests were identified, not unexpected as these tend to be rare. A wide range of ‘straw in the wind’ tests were included, but these are less important than ‘hoop’ tests (which potentially rule out a hypothesis) and ‘smoking gun’ tests (which potentially confirm a hypothesis).

For H1 to be well-supported, all of the hoop tests below need to be passed, together with at least one confirmatory test (smoking gun). ‘Straw in the wind’ tests would add weight to the hypothesis but would not be confirmatory in themselves.

Table 5: Evidence tests for H1 “BASEE played a major role in supporting development of their project ideas, and they would not have generated the observed learning without BASEE support.”

Evidence test	H1 “BASEE played a major role in supporting development of their project ideas, and they would not have generated the observed learning without BASEE support.”	Discussion
<p>A: Difference in approach: the project is delivering activities in a different way to how the organisation delivers (or delivered) activities outside the BASEE programme (mixed evidence: interview statements from project staff and partners; website materials)</p>	<p>Hoop – expect to see them doing something different from their other activities if H1 is true (i.e. if BASEE is driving them to learn something new, better or faster than their usual activities). But not confirmatory since differences in approach might or might not be good for generating learning that is useful for BASEE.</p>	<p>‘Doing things differently’ from usual might be good or bad.</p> <p>This test would be omitted, rather than failed, if the organisation was only delivering activities via BASEE.</p> <p>One possible issue was that learning from BASEE might have already influenced the organisation’s other activities by the time the research took place. If so, this test would look for evidence that they used to take a different approach to their non-BASEE activities, before BASEE.</p>
<p>B: Influence on timing/quality</p>	<p>Not included in tests for H1. This was looked for in H2.</p>	

Evidence test	H1 “BASEE played a major role in supporting development of their project ideas, and they would not have generated the observed learning without BASEE support.”	Discussion
<p>C: Learning generated: the project team and/or partners have enhanced their learning by accessing expertise/advice/experience that is funded by or arises from BASEE (Three-part evidence test):</p>	<p>Hoop – expect to see all of C1, C2 and C3 if H1 is true (i.e. BASEE funding is generating significant learning from the project). But this does not rule out the possibility that similar learning could have been generated by support from other innovation funders.</p>	
<p>C1: project outputs and reports documenting learning from the project (e.g. reports on specific elements of work; consultancy reports commissioned by the BASEE project)</p> <p>C2: statements from project staff/partner interviews or project reports about the usefulness of findings from some or all of these reports; and/or the usefulness of BASEE signposting to sources of information/advice (including other BASEE projects and evaluation outputs).</p>	<p>Hoop – expect to see all of C1, C2 and C3 if H1 is true (i.e. BASEE funding is generating significant learning from the project). But this does not rule out the possibility that similar learning could have been generated by support from other innovation funders.</p>	

Evidence test	H1 “BASEE played a major role in supporting development of their project ideas, and they would not have generated the observed learning without BASEE support.”	Discussion
<p>C3: Significance of learning set out in project reports/outputs is confirmed by evidence (from documents or interview) of learning points being applied by other BASEE or non-BASEE projects – or failing that – significance is confirmed by peer review of learning outputs</p>		
<p>D: No other suitable funding sources: the project team and partners would not have progressed the project idea(s) without access to BASEE funding</p> <p>D1: project application data and/or interview statements from project staff/partners that it was not feasible for them to obtain equivalent funding to BASEE from other sources (e.g. because of the timing, scale of funding, application requirements, reporting requirements, cost of applying etc)</p>	<p>Hoop (D1) – if H1 is true, the project is likely to claim that BASEE funding was necessary to progress the project (i.e. we would expect them to have a bias of overstating the additionality of BASEE funding, to make their project look good to the Department)</p>	<p>Consideration of timeframe was not included within H1. So if the project team and partners could have taken forward the project idea with funding from other sources, but a bit later or a bit more slowly, this test would be failed. Although H1 would then be failed, H2 might still be supported (see below).</p>

Evidence test	H1 “BASEE played a major role in supporting development of their project ideas, and they would not have generated the observed learning without BASEE support.”	Discussion
<p>D2: interview statements from external funding experts (or other innovation funding bodies) that this project was unlikely to have been able to source equivalent funding from other sources at the time of the BASEE competition, with equivalent conditions (e.g. equivalent investment of ‘at risk’ application effort)</p>	<p>Smoking gun (D2) – funding experts will have a wide knowledge of potential funding sources and are quite likely to claim that there would have been other sources of funding as alternatives to BASEE. Therefore, statements contradicting this from one or more funding experts (or from funding agencies that could have provided realistic alternative funding) would be powerful evidence of the additionality of BASEE funding</p>	<p>There may be subtleties in the D2 test e.g. if external stakeholders say that equivalent funding would likely have been available from other sources for Phase 1 but not Phase 2 (or vice versa). This might suggest that H2 applies, rather than H1 i.e. partial additionality.</p>
<p>E: Project management changes: KPI reporting and progress reporting led to project adaptations (Objective evidence: documentation of changes in project delivery resulting from the Department's scrutiny of plans/proposals; changes in delivery timing resulting from the Department's oversight)</p>	<p>Straw in the wind – fairly likely to see this, but not necessary for H1 to be true. Not confirmatory of H1 in itself, as changes to project delivery do not necessarily imply that useful learning has been generated by the project.</p>	
<p>F: Project adaptation: Learning arising from the BASEE project led to adaptations or changes to proposed project activities (Objective evidence: project documents set out the reasons</p>	<p>Straw in the wind – fairly likely to see this, but not necessary for H1 to be true (e.g. they might have got the project plan right first time). Not confirmatory of H1 in itself since a project may have simply made poor judgements in its early stages and have learnt</p>	

Evidence test	H1 “BASEE played a major role in supporting development of their project ideas, and they would not have generated the observed learning without BASEE support.”	Discussion
for proposed changes in project delivery;)	from its mistakes (e.g. it may not have followed established good practice for energy efficiency services for SMEs).	
G: Risk reduction: BASEE funding for Phase 2 activities changed the internal assessment of the balance between risk and reward, enabling them to do things that they haven’t done on unsupported projects that involved similar levels of investment and risk (Evidence: interview statements from project staff or partners (and/or documentation) about other projects with similar levels of risk being progressed more slowly – e.g. smaller scale testing or more research before the project is progressed)	Straw in the wind - hope to observe if H1 is true (but may be difficult to observe), not confirmatory because of potential bias	
H: Riskier profile: Other R&D/innovation projects that the organisation is taking forward are either clearly lower risk or are being supported by other innovation funding (or similar funds). (Evidence: interview statements by project staff or	Straw in the wind - hope to observe if H1 is true (but not necessary for H1 to be true); not confirmatory because of potential bias in assessing risks levels, and because the BASEE project might have been able to access innovation funding from other sources	

Evidence test	H1 “BASEE played a major role in supporting development of their project ideas, and they would not have generated the observed learning without BASEE support.”	Discussion
<p>partners; documentation about the funding and risk status of their other activities)</p>		
<p>I: Follow-on advantage from BASEE: financial support from other sources is positively leveraged by the reputational influence of the Department's support via BASEE OR resources from BASEE release funds for other activities outside the project (Evidence: interview statements by project staff/partners; documentation of other funding being received, including ‘matched’ funding from other sources).</p>	<p>Straw in the wind – this would be evidence of reputational and follow-on influence from the Department's support, but not particularly likely to be observed. And not confirmatory – enhanced reputation leading to increased funding would not necessarily mean that the BASEE project was generating useful learning.</p>	

Evidence tests for H2

Testing of H2 involved many of the same tests as H1, but the evidence tests were less demanding, as set out in Table 6. The definition of H2 was that “without BASEE, pilot projects would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”. This implies that some form of project would have been developed and progressed without BASEE funding and support, but that it would have either have been smaller scale, later in time, or slower, or lower quality or less effective in generating learning.

There was a great deal of overlap in the types of evidence looked for in H1 and H2 tests, so the same reference system was used for the pieces of evidence as in Table 5 above. For example, the evidence test ‘A’ referred to in Table 6 is the same as evidence test ‘A’ in Table 5. But some of the evidence tests were specific to H2, some of the H1 tests were omitted and the classification of some evidence tests differed between H1 and H2.

The H2 hypothesis was that the project ideas would have been progressed to some degree, but that learning would have been more limited or later. For the H2 hypothesis to be well-supported, all H2 hoop tests needed to be passed, and at least one ‘smoking gun’ test. Straw in the wind tests added support, but did not in themselves confirm the H2 hypothesis.

Table 6: Evidence tests for H2 “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”

Proposed evidence test	H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”	Discussion
<p>A: Difference in approach: the project is delivering activities in a different way to how the organisation delivers (or delivered) activities outside the BASEE programme (mixed evidence: interview statements from project staff and partners; website materials)</p>	<p>Hoop – expect to see them doing something different from their other activities if H2 is true (i.e. if BASEE is driving them to learn something new, better or faster than their usual activities). But not confirmatory since differences in approach might or might not be good for generating learning that is useful for BASEE.</p>	<p>This is a hoop test for H2, as well as H1.</p>
<p>B: Influence on timing/quality: BASEE Phase 2 funding has enabled project activities to be brought forward in time, undertaken on a larger scale or improved in quality compared to how the project idea would have been taken forward without BASEE support (e.g. earlier, larger scale, better quality, more feedback from users, better focused) (subjective evidence: interview statements from project staff and partners)</p>	<p>Hoop - expect to observe this if H2 is true, but not confirmatory because of potential bias and because activities may not necessarily generate useful learning</p>	<p>This is a hoop test for H2, but not for H1. This test implies that they could have done something similar without BASEE support (either without external funding, or with support from another source of innovation funds), but that BASEE has enabled them to learn faster or learn more.</p> <p>It could be argued that this evidence, which we are likely to see if H2 is true, is also sufficient</p>

Proposed evidence test	H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”	Discussion
		proof that H2 is true (i.e. that this test is doubly decisive). But we feel that this would require more objective evidence about influence on timing/quality.
<p>C: Learning generated: the project team and/or partners have enhanced their learning by accessing expertise/advice/experience that is funded by or arises from BASEE (Two-part evidence test:</p> <p>C1: project outputs and reports documenting learning from the project (e.g. reports on specific elements of work; consultancy reports commissioned by the BASEE project)</p> <p>C2: statements from project staff/partner interviews or project reports about the usefulness of findings from some or all of these reports; and/or the usefulness of BASEE signposting to sources of</p>	<p>Hoop – would expect to see at least one of C1, C2 and C3 if H2 is true (i.e. BASEE funding is generating significant learning from the project). But this does not rule out the possibility that similar learning could have been generated by support from other innovation funders.</p>	<p>This is a hoop test for H2, as well as H1.</p>

Proposed evidence test	H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”	Discussion
<p>information/advice (including other BASEE projects and evaluation outputs).</p> <p>C3: Significance of learning set out in project reports/outputs is confirmed by evidence (from documents or interview) of learning points being applied by other BASEE or non-BASEE projects – or failing that – significance is confirmed by peer review of learning outputs.</p>		
<p>D: No other funding sources</p>	<p>Not included for H2, since H2 envisages that the project idea might have been taken forward at a slightly different time, with support from other funding sources. See G and P (below) for H2-specific tests re. funding.</p>	
<p>E: Project idea</p>	<p>Not included for H2, since H2 envisages that the project idea was not formulated in response to BASEE, but that BASEE was one possible means of taking forward their existing project idea</p>	

Proposed evidence test	H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”	Discussion
F: New partnerships formed	Not included for H2, since H2 envisages that partnerships were not formed in response to BASEE, but that BASEE was one possible means of taking forward their existing project idea, probably with existing partners	
<p>G: Other potential funding sources: if they had not obtained BASEE funding, the project could probably have obtained some funding from other sources but with different conditions (e.g. at a smaller scale, or later, more time required for application process, costlier to apply). Evidence:</p> <p>G1: interview statements from project staff/partners that it would have been possible for them to obtain alternative support for the project idea from other sources, with different conditions (e.g. timing, scale, application conditions, reporting requirements etc)</p> <p>G2: statements from external funding experts (or from other innovation funding bodies) that</p>	<p>Smoking gun (G1) – this is not necessary for H2 to be true, because the project team might have been able to progress their project idea to some degree without external funding. But it is confirmatory of H2: the project team is unlikely to state that they could have funded project activities by other means if this was not true (i.e. we would expect them to be biased towards overstating the additionality of BASEE funding). Straw in the wind (G2) – this is not necessary for H2 to be true, because the project team might have been able to progress their project idea to some degree without external funding. And this is not confirmatory of H2, because external funding experts are fairly likely to claim that there might have been other funding options for some elements of the project</p>	<p>If the project team and partners could have taken forward their project idea with funding from other sources, but a bit later, on a smaller scale or more slowly, this test would be passed and would confirm H2.</p> <p>If alternative funding would have been available with the conditions equivalent to BASEE (e.g. scale, timing etc), then H3 would apply.</p> <p>Test G2 would be passed if other funding bodies would have funded Phase 1 but not Phase 2 of the BASEE project (or vice versa).</p>

Proposed evidence test	H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”	Discussion
<p>the project was likely to have been able to access some alternative funding, but with different conditions (e.g. at a smaller scale, later date or with more ‘at risk’ application work than required by BASEE).</p>		
<p>H: Previous unsuccessful funding bid: the same (or a very similar) project had failed to progress after a previously unsuccessful attempt to secure funding (mixed evidence: documentation from previous funding bid(s); supported by interview statements from project staff and/or partners)</p>	<p>Smoking gun – not necessary to see this, even if H2 is true. But this evidence is strongly suggestive that they needed BASEE funding to progress an existing project idea and had been looking for funding from other sources.</p>	
<p>I: Similar unsuccessful funding bids: other similar projects not securing funding from the Department or other innovation funding were shelved, or progressed at a much slower rate (mixed evidence: interview statements from project staff and partners; documentation from past funding bids)</p>	<p>Straw in the wind – fairly circumstantial evidence, that would neither be necessary nor confirmatory. Unlike test H, this evidence could relate to a similar but different project, not the BASEE project.</p>	

Proposed evidence test	H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”	Discussion
<p>J: Step change in activity: project documentation indicates a positive step-change in progress and activity levels, after the start of BASEE Phase 2 (objective evidence: comparison of project records between Phase 1 and Phase 2)</p>	<p>Straw in the wind – hope to observe a step-change in activities and progress if H2 is true, but not ‘necessary’ (because useful learning from BASEE might prompt a change of direction which actually reduced activity levels). Not confirmatory because a step-change in activities might not have generated useful learning.</p>	<p>Slight variant of the tests above, which is included because it is objectively measurable.</p>
<p>K: Project management changes: KPI reporting, and progress reporting led to project adaptations (Objective evidence: documentation of changes in project delivery resulting from The Department’s scrutiny of plans/proposals; changes in delivery timing resulting from the Department’s oversight)</p>	<p>Straw in the wind – fairly likely to see this, but not necessary for H2 to be true. Not confirmatory of H2 in itself, as changes to project delivery do not necessarily imply that useful learning has been generated by the project.</p>	<p>Not a demanding test but included because it is based on objective evidence.</p>
<p>L: Project adaptation: Learning arising from the BASEE project led to adaptations or changes to proposed project activities (Objective evidence: project documents set out the reasons for proposed changes in project delivery;)</p>	<p>Straw in the wind – fairly likely to see this, but not necessary for H2 to be true (e.g. they might have got the project plan right first time). Not confirmatory of H2 in itself since a project may have simply made poor judgements in its early stages and have learnt from its mistakes (e.g. it may not have followed</p>	<p>Included test L as well as test C because, although less demanding in the evidence it looks for, it is based on more objective evidence.</p>

Proposed evidence test	H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”	Discussion
	established good practice for energy efficiency services for SMEs).	
M: Risk reduction: BASEE funding for Phase 2 activities gave the project the confidence to do things that they haven't done on unsupported projects with similar levels of investment and risk (Evidence: interview statements from project staff or partners (and/or documentation) about other projects with similar levels of risk being progressed more slowly – e.g. smaller scale testing or more research before the project is progressed)	Straw in the wind - hope to observe if H2 is true (but may be difficult to observe), not confirmatory because of potential bias	
N: Riskier profile: Other R&D/innovation projects that the organisation is taking forward are either clearly lower risk or are being supported by other innovation funding (or similar funds). (Evidence: interview statements by project staff or partners;	Straw in the wind - hope to observe if H2 is true (but not necessary for H1 to be true); not confirmatory because of potential bias in assessing risks levels	

Proposed evidence test	H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”	Discussion
documentation about the funding and risk status of their other activities)		
O: Follow-on advantage from BASEE: financial support from other sources is positively leveraged by the reputational influence of the Department's support via BASEE OR resources from BASEE release funds for other activities outside the project (Evidence: interview statements by project staff/partners; documentation of other funding being received, including 'matched' funding from other sources).	Straw in the wind – hope to observe this as it would be evidence of reputational and follow-on influence from the Department's support, but it's not particularly likely to be observed. And it's not confirmatory – enhanced reputation leading to increased funding would not necessarily mean that the BASEE project was generating useful learning.	
P: Other funding in place: the project has already obtained partial funding from other	Straw in the wind – although this is supportive of H2, it's not necessary for H2 to be true. And it could	(It's possible that some other funding sources could be

Proposed evidence test

H2 – “without BASEE, they would have progressed their project ideas but would probably not have generated as much learning over the same timeframe”

Discussion

innovation sources, in addition to BASEE, that was not itself dependent on BASEE support. (Evidence: documentation provided by project staff/partners)

also be observed if H3 is true (i.e. not confirmatory of H2).

combined with BASEE funding, even for H1 (clear additionality), provided that project activities were not dependent on the other funding).

Evidence tests for H3

The H3 hypothesis (non-additionality) was that the project would probably still have progressed their project ideas, possibly using other innovation support, and would probably have generated similar learning over a similar timescale. If neither H1 nor H2 were well-supported, this added weight to H3. Separate tests were specified for H3 in Table 7 below. Non-additional tests are designated as 'N-A', 'N-B', 'N-C' etc.

As for the other hypotheses, for H3 to be confirmed, all hoop tests needed to be passed and at least one smoking gun test passed. 'Straw in the wind' tests provided support for H3 but were not confirmatory.

As for the other hypotheses, for H3 to be confirmed, all hoop tests needed to be passed and at least one smoking gun test passed. 'Straw in the wind' tests provided support for H3 but were not confirmatory.

Table 7: Evidence tests for H3: “without BASEE, pilot projects would probably still have progressed their project ideas (possibly using other innovation support) and would probably have generated similar learning over a similar timescale. BASEE funding was nice to have, but not essential”.

Proposed evidence test	H3 “without BASEE, pilot projects would probably still have progressed their project ideas (possibly using other innovation support) and would probably have generated similar learning over a similar timescale. BASEE funding was nice to have, but not essential”.	Discussion/comments
N-A Additionality unproven: neither H1 nor H2 is confirmed for this BASEE project	Hoop: it is a requirement for H3 that no ‘smoking gun’ or ‘double-decisive’ tests are passed for H1 or H2	
N-B Additionality ruled out: both H1 and H2 ruled out for this BASEE project	Smoking gun: It is a ‘smoking gun’ for H3 if one or more hoop tests for H1 and H2 are failed (i.e. that full or partial additionality is ruled out)	
N-C Other funding in place: the project has already obtained partial funding from other innovation sources, in addition to BASEE, that was not itself dependent on BASEE support. (Evidence: documentation provided by project staff/partners)	Straw in the wind – although this is supportive of H3, it’s not necessary for H3 to be true. And it could also be observed if H2 is true (i.e. not confirmatory of H3).	

<p>N-D Project could have been progressed without BASEE funding: for example, the project team/partners would have progressed the project to the same extent themselves or would probably have obtained some funding from other sources (with similar scale and timing). Evidence:</p>	<p>Smoking gun (N-D1) – BASEE projects are unlikely to state this even if H3 is true, as they are likely to overstate the additionality of BASEE funding. Similarly, other funding bids are unlikely to be seen by the research team. If observed, either of these would be powerful evidence to support H3.</p>	<p>If any previous bids were unsuccessful, this would slightly weaken H3 but not rule it out. Unsuccessful funding bids are already referenced as ‘straw in the wind’ evidence test in favour of competing hypotheses H1 and H2.</p>
<p>N-D1: interview statements from project staff/partners that it was feasible for them to progress the project idea (possibly obtaining support for the project idea from other sources) and that they were not dependent on BASEE to generate the observed learning; OR documentation developed for other funding sources, setting out the same project idea to a similar timescale.</p> <p>N-D2: statements from other innovation funding bodies that they would probably have funded the project idea that was presented to the Department at the start of BASEE, with similar scale and timing</p>	<p>Straw in the wind (N-D2) – this is more likely to be observed than N-D1 (because funders in competition with BASEE are likely to understate rather than overstate the additionality of BASEE funding). It’s not necessary, in cases where the project partners might have been able to progress their project idea without external funding. And it’s not confirmatory because it’s relatively easy for funders to make this claim even if H3 is not actually true (i.e. if they would not actually have funded the project to the same scale and timing as the Department).</p>	
<p>N-E Similar projects progressed anyway: Projects very similar to this BASEE project have been or are being progressed by other organisations,</p>	<p>Smoking gun – not necessary for H3 to be true, but confirmatory of H3 if seen.</p>	

<p>without external funding, or with funding from other sources. (Evidence: interview statements from independent innovation experts and/or funding experts, backed up by relevant documentation/website evidence.)</p>		
<p>N-F Unfunded BASEE projects progressed anyway: projects that are very similar to the BASEE project, but that were unsuccessful in getting BASEE funding, have been or are being progressed anyway (either without innovation funding, or with innovation funding from other sources). (Evidence: interview statements or documentary / website evidence from projects unsuccessful in obtaining Phase 1 or Phase 2 BASEE funding, where these are similar to the pilot project under consideration).</p>	<p>Smoking gun – not necessary for H3 to be true, but confirmatory of H3 if seen.</p>	<p>N-F is a special case of N-E, looking specifically at projects that applied for BASEE funding. This could include projects that were unsuccessful in obtaining Phase 1 funding, as well as Phase 1 projects that did not progress to Phase 2. It may be easier to observe N-F than N-E.</p>

Evidence tests for H4

The final hypothesis H4 (adverse influence) is logically separate from the additionality hypotheses. Hypothesis 4 (adverse influence from BASEE) was defined as “irrespective of which additionality hypothesis applies, the timescales and requirements of BASEE funding have distorted the activities of the delivery partners and have adversely affected the learning that the project team and partners would otherwise have generated”. This linked to the evaluation of the BASEE process, as well as evaluation of BASEE impact.

While H1, H2 and H3 were explicitly competing with each other, it was possible for support for H4 to be combined with H1, H2 or H3. For example, it was possible for a BASEE project to generate significant learning that was attributable to BASEE (H1), but for this learning to have been adversely affected by the way that BASEE was run (H4) e.g. because BASEE deadlines meant that certain stages of the project were rushed, or options could not be fully investigated before decisions had to be taken to meet BASEE requirements.

The evidence tests for H4 are set out in table 8 below. These were simpler than the tests for additionality hypotheses (H1-H3). It would have been possible to collect and analyse evidence on the topics below without undertaking formal process tracing for H4.

Table 8: Evidence tests for H4: “irrespective of which additionality hypothesis applies, the timescales and requirements of BASEE funding have distorted the activities of the delivery partners and have adversely affected the learning that the pilot project team and partners would otherwise have generated”

Proposed evidence test	H4 – adverse hypothesis	Discussion/comments
<p>N-G Distortion of project activities: Significant examples of adverse impacts on the quality or extent of learning from BASEE projects, because of the way in which BASEE was designed or run. (Evidence: explanations set out in project reports; interview statements from project staff or partners about learning being constrained by BASEE timetables, or methods or administrative burden)</p>	<p>Hoop test – expect to see this if H4 applies; not confirmatory because project staff perspectives may be biased</p>	<p>Bias might include project partners trying to blame the project design for areas of poor performance which were really their own responsibility.</p>
<p>N-H Diversion of resources: Slowdown in other activities, relevant to BASEE objectives, because BASEE timescales and requirements led pilot projects to prioritise BASEE over other activities that were outside BASEE. Where the de-prioritised activities would themselves have generated learning about the development of energy efficiency solutions for SMEs, this might have adverse influence on BASEE project</p>	<p>Smoking gun – not likely to see this, but confirmatory of H4 if it applies.</p>	<p>The opposite effect might also be observed: BASEE funding might release resources for other non-BASEE activities that were complementary to BASEE. This would be captured by the additionality evidence test ‘N’ about follow-on advantages from BASEE.</p>

Proposed evidence test	H4 – adverse hypothesis	Discussion/comments
<p>objectives. (Evidence: documentation about the level of activity and resources allocated by project staff/partners to non-BASEE activities that relate to energy efficiency solutions for SMEs; interview statements about diversion of resources towards BASEE activities).</p>		
<p>N-I Exclusion from other support: Participation in the BASEE programme led to the pilot project being excluded from other additional support. (Evidence: interview statements from project staff or partners; documentary evidence to this effect; interview statements from other funders and sources of support)</p>	<p>Straw in the wind – might see this if H4 applies; not confirmatory because interview statements may be biased</p> <p>But if evidence includes interview statements from external funders or other sources of support, then this becomes a 'smoking gun' test)</p>	<p>Would expect a degree of mutual exclusivity between sources of public finance (e.g. having won BASEE funding, projects may not have been eligible for other types of publicly funded innovation funding). However, what is being looked for here is evidence that BASEE support has led to lower levels of support/funding from supplementary sources (not from those that would have been an alternative to BASEE).</p>

For each pilot project, the research looked for evidence for each BASEE project across all the hypotheses, including the three competing additionality hypotheses (H1-H3) and the separate 'adverse influence' hypothesis (H4). Process tracing assessed which of the additionality hypotheses H1-H3 was best supported and gauged the level of support for H4. As noted above, H4 could be combined (to some degree) with any of the additionality hypotheses. If contradictions were found (e.g. if a 'smoking gun' test was passed for a given hypothesis, but a 'hoop' test was failed), the reasons for this were investigated and consideration was given to refining the tests to avoid this. The process tracing test results were reported in the final evaluation report.

The specification of process tracing tests had implications for the design of evidence collection. For example, the tests suggested that evidence from external stakeholders could play a role in confirmatory tests. The draft tests were reviewed and refined in parallel with data collection plans for the project, to ensure that evidence for the proposed tests could realistically be collected.

Qualitative Comparative Analysis (QCA)

Qualitative Comparative Analysis (QCA) is a method that uses set-theory to define the minimum set of causal conditions that appear to lead to desired outcomes, across an observed set of cases. QCA is a quantitative approach for assessing qualitative data but requires sophisticated qualitative understanding of individual cases and causal conditions at work within these cases.

Based on Barbara Befani's QCA guidance², the steps involved in QCA can be paraphrased as follows:

- Step 1: Model specification: Step 1a: Selecting outcomes: What are the main outcomes to explain? And Step 1b: Selecting plausible causal factors
- Step 2: Ensuring data availability – what is the empirical basis for the dataset?
- Step 3: Calibration – how to build the dataset. This involves construction of a Boolean dataset, consisting of indicators for each case to reflect the presence or absence of the desired outcome(s) and causal factors. For 'crisp set' QCA, these indicators are 1's or 0's, while for 'fuzzy set' QCA they can be intermediate between 1 and 0.
- Step 4: The Venn Diagram – representing the data graphically
- Step 5: the SuperSubset Analysis – identifying the conditions that are necessary or sufficient for the outcome. Consisting of Step 5a: the necessity (superset) analysis; and Step 5b: the sufficiency (subset) analysis.

² Befani, B. (2016) Pathways to Change: evaluating development interventions with Qualitative Comparative Analysis (QCA). (Expertgruppen for bistanalys (EBA)). Accessed at: https://eba.se/wp-content/uploads/2016/07/QCA_BarbaraBefani-201605.pdf

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- Step 6: building the ‘truth table’ – how can the dataset be synthesised without loss of case diversity?
 - Step 7: the Boolean minimisation – how can the list of sufficient pathways be simplified?
 - Step 8: the INUS3 analysis: which conditions make the difference between success and failure in specific contexts?

Specialist software (for example, fs/QCA) is generally used in Step 5 to identify the causal ‘recipes’ (i.e. minimum set of causal conditions) that appear to lead to the desired outcome.

A final step is the interpretation of the causal recipes identified through the QCA. In practice, the results of the method will only be meaningful if the method is applied using in-depth understanding of the outcome, the individual cases and the causal factors at play within them. While assessment about the presence or absence of each causal factor can be made on either a ‘crisp set’ basis (i.e. yes/no) or a ‘fuzzy set’ basis (i.e. allocating a membership score between 0.0 and 1.0), the quality of this assessment is critical to the results being meaningful.

Step 1: Model specification

The evaluation plan set out an initial draft of ‘Step 1a’ and ‘Step 1b’ of the QCA process, based on existing knowledge of energy efficiency in the SME sector and of innovation, drawing on the findings of the documentation review. The proposals drew on:

- The draft literature review.
- The mapping of BASEE projects against barriers to energy efficiency action by SMEs.
- Widely used innovation scales such as ‘Technology Readiness Level’ or ‘Model Readiness Level’;⁴
- The ‘Business Model Canvas’ (BMC) commonly used in innovation support services, which defines the various areas that a fully-fledged business model needs to cover.

The evaluation plan sketched out Steps (1a) and (1b) of Step 1:

- Defining what ‘a successful outcome’ means for projects in the BASEE programme, and how this outcome will be assessed.
- Undertaking preliminary identification of major causal conditions, drawing on our current understanding and knowledge of theory around innovative business models and around energy efficiency in the SME sector.

The next two sections set out the evaluation plan proposals and explain how these were reviewed and modified during the QCA analysis process.

³ A condition is ‘INUS’ if it is ‘insufficient’ to produce the outcome on its own, but is a ‘necessary’ part of a conjunction that is not in itself ‘necessary’ but is ‘sufficient’ for producing the outcome.

⁴ The Technology Readiness Level was originally developed by NASA but has been adapted for use in a wide range of innovation contexts. For NASA’s original scale, see:

www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html

⁵ The Business Model Canvas is a strategic management and entrepreneurial tool that was created by Alexander Osterwalder of Strategyzer. For more details see: www.strategyzer.com/canvas

Step 1a: selecting success outcomes

In defining successful outcomes from BASEE projects, the evaluation plan took as a starting point the overall target outcome for the BASEE programme as stated in the Theory of Change, which was itself taken from the ITT for the Competition process:

“This pilot has demonstrated that it has developed an effective and scalable model or solution for facilitating energy efficiency within the SME sector and that it is ready for commercialisation.”

The proposed outcome was therefore defined in terms of ‘market readiness’. This encompasses how far the model or solution is an ‘effective’ solution for facilitating energy efficiency within the SME sector and also how far it is potentially ‘scalable’. ‘Scalable’ was interpreted to mean that there is a significant potential market and that the project has considered how to reach this market: The Department did not expect the pilot projects to show full ‘market readiness at scale’ by the end of Phase 2. This proposed outcome was about ‘market readiness’ and encompassed whether the model actually worked in facilitating energy efficiency for at least some types of SME, whether it was effective, whether there was a significant potential market amongst the relevant type of SMEs, whether the model was ready for commercialisation and the project had begun to develop plans to reach their potential market.

The evaluation plan proposed that the ‘market readiness’ of BASEE models should be assessed using an innovation scale adapted from the widely used 9-point ‘Technology Readiness Level’ (TRL) scale. Similar models have been developed using terms such as ‘Model Readiness Level’, but the TRL shown in Table 9 is most the common and standardised 9-point scale. The ‘systems’ referred to in the TRL scale can be interpreted in terms of the development of business models rather than technology, as shown in the ‘Market Readiness Level’ scale shown in Table 10.

Table 9: Technology Readiness Level

TRL	Label	Description of level
TRL 9	System proven in end-use operation	Complete system proven in its final form in real end-use applications for the technology
TRL 8	Complete system tested & qualified	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development
TRL 7	System prototype in operational environment	Prototype near or at planned operational system. Represents a major step up from TRL6 by requiring demonstration of an actual system prototype in an operational environment
TRL 6	Subsystem field demonstration	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness
TRL 5	Field validation of components	The basic technological components are integrated with reasonably realistic supporting element so they can be tested in a simulated environment. Examples include "high-fidelity" laboratory integration of components
TRL 4	Validation in lab environment	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared with the eventual system. Examples include integration of "ad hoc" hardware in the lab
TRL 3	Characteristic proof of concept	Active R&D is initiated. This includes analytical and laboratory studies to physically validate the analytical predictions of separate elements of the technology
TRL 2	Concept formulated	Concept design or novel features of design validated through model or small-scale testing in laboratory environment. Shows that the technology can meeting specified acceptance criteria with additional testing
TRL 1	Basic principles identified	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development

Table 10: Market Readiness Level of BASEE projects

Level	Summary	Description
MRL 9	Business model proven in end-use operation	An effective and scalable model or solution for facilitating energy efficiency within the SME sector that is ready for commercialisation.
MRL 8	Complete systems for business model tested and proven	Complete systems and elements of the business model have been proven to work in their final form with significant numbers of SME users, but commercial readiness is not fully established.
MRL 7	Systems trialled with SME users in operational environment	Trial of business model systems which are close to a fully operational system. Requires demonstration of an actual system prototype with SME users.
MRL 6	Demonstration and testing of trial system	Representative systems for the business model are tested with a few potential 'users' and refinements incorporated into the design.
MRL 5	In-house testing of trial system	Basic system components for the business model are integrated and tested in an in-house environment.
MRL 4	Development of individual components of trial system	Basic components of the business model system are developed and tested in-house.
MRL 3	Proof of business model concept	New research (for example, with potential customers and/or partners/suppliers) is initiated to validate the basic hypotheses in the business model concept.
MRL 2	Business model concept formulated	Business model concept, or novel features of concept, is set out in more detail, building on existing research.
MRL 1	Basic business idea identified	Customer/technology research begins to be translated into applied research and development.

Source: CAG Consultants' adaptation of TRL levels

The evaluation team's review of the BASEE competition Invitation to Tender (ITT) strongly suggested that projects applying for BASEE funding were expected to be at market readiness level (MRL) 6 or 7 at the start of Phase 1, and that projects completing Phase 2 were expected to reach level 8 or 9 on the MRL scale. 'TRL' levels were reported within each pilot's KPI submissions (but appear to have been interpreted more narrowly in terms of 'technological' innovation rather than wider 'business model' innovation) so the evaluation team proposed to

make an independent assessment of each business model's 'market readiness', based on evaluation evidence. Each pilot project's model or solution was expected to be both technically feasible and commercially viable at the end of the programme. In innovation terms, the model was expected to be 'market ready' at the end of Phase 2. For example, the BASEE ITT stated that:

“technical solutions should be market-ready at completion of Phase 2 and not require any additional post-competition development” and that “to meet these objectives we expect competition participants to....deliver outputs that are ready for commercialisation at the end of Phase 2.”

In practice, the evaluation team's assessment was that projects reached MRL 7 or 8 rather than 9 on the innovation scale. This assessment was made using the rubrics set out in the next section, as agreed with the Department and the evaluation team. The process for making the assessment is described under Step 2 below.

Using the Business Model Canvas to assess 'market readiness' outcome

The evaluation plan proposed that the assessment of projects against a 9-point innovation scale should involve assessment of the elements of their business model against a tool such as the 'Business Model Canvas' (BMC). This is a widely used strategic management tool that had been used by some of the pilots. The Business Model Canvas sets out the main elements of a successful business model. These are summarised here:

- The Value proposition (for example, what value does the project deliver to its customers? what customer needs does the project satisfy?)
 - Supply-side elements:
 - Key partners (for example, are key partners and suppliers on board?)
 - Key Activities (for example, what activities need to be done to deliver the value proposition)
 - Key resources (for example, what resources need to be in place to deliver the value proposition?)
 - Demand-side elements:
 - Customer segments (for example, for whom is the project creating value? Who are the most important customers?)
 - Channels (for example, through which channels to our customer segments want to be reached? which ones work best?)
 - Customer relationships (for example, what type of relationship does each customer segment expect the project to establish/maintain?)
 - Financials:
 - Revenue streams (for example, for what value are our customers really willing to pay? what revenues are predicted?)

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- Cost structure (for example, what are the most important costs inherent in our business model? are these commensurate with predicted revenues?)

Central to the BMC is development of the 'value proposition': i.e. the 'offer' to customers and whether this provides a service that generates value for customers at the price level offered. The evaluation plan set out preliminary thinking about how elements of the BMC could be used to assess the 'market readiness' of a pilot project's model. The rubrics shown in Table 11 were developed in consultation with the Department and the contractor team, including advice from an innovation specialist within CAG Consultants' team.

Table 11: Elements of the BMC and types of evidence expected at ‘levels 7-9’ of the ‘market readiness’ scale

Element of BMC	Type of evidence expected at MRL 7	Type of evidence expected at MRL 8	Type of evidence expected at MRL 9
Value proposition	<p>Some articulation of value proposition, but not yet clear.</p> <p>Little evidence yet of customers being willing to pay.</p>	<p>The project either doesn't have a clearly articulated value proposition</p> <p>OR</p> <p>They don't yet have much evidence customers being willing to pay... (i.e. do they 'get' it and are they willing to pay for it)</p> <p>OR</p> <p>Not enough evidence of either of these</p>	<p>Feedback from users (and outputs from emissions/value for money analysis) show that the model is successful in enabling and stimulating energy efficiency action by at least some types of SMEs and creates value for customers that justifies the price being charged by the project.</p>
Key partners	<p>There are significant gaps in their line-up of potential partners. There is a risk that some of the potential partners may not be fully on board.</p>	<p>They have identified almost all the partners that they need and have agreement in principle, although they haven't yet started negotiating agreements with some of them.</p>	<p>The project has established partnerships with the supply chain, lenders and other partners needed to deliver their solution/model, with necessary agreements under negotiation or in place</p>
Key resources	<p>They have not yet thought about the skills/capacity that they will need to commercialise (for</p>	<p>They have identified the skills/capacity that they will need to commercialise their offer and are planning to take</p>	<p>The project has access to the skills and capacity to commercialise their offer and have realistic plans to put external funding in place, if required. A key point will be whether they</p>

Element of BMC	Type of evidence expected at MRL 7	Type of evidence expected at MRL 8	Type of evidence expected at MRL 9
	example, develop support systems; user guides etc).	action or recruit to put this capacity in place.	have the right people in post within their organisation, or whether their commercialisation plans are dependent on recruiting people to fill certain posts or outsourcing these roles to appropriate third parties.
Key activities	They have not yet developed a plan as to how they will commercialise or 'exploit' the product. Their procedures are not fully defined.	They have developed procedures for their key activities and have started to develop a commercialisation plan but there are significant gaps. For instance, they may not have identified resources/partners to enable them to do certain elements (for example, who is going to provide field support? Who is going to update the product and/or the manuals?)	The project is technically feasible, having tried and tested procedures for their key activities, which have been tested during Phase 2. This is likely to include activities by the supply chain and by lenders to SMEs. (NB. They need a delivery, 'commercialisation' or 'exploitation' plan going forward).
Cost structure	There is little information on the costs of commercialising the model and on whether costs will be covered by projected revenues.	Some attempt has been made to define the costs of commercialising the model but there are some gaps.	The costs of commercialising the model are well-defined, for the organisation itself and for key partners (for example, supply chain, lenders). Projected costs and return on capital can realistically be covered by projected revenues or the project has identified sources

Element of BMC	Type of evidence expected at MRL 7	Type of evidence expected at MRL 8	Type of evidence expected at MRL 9
		There are some uncertainties as to whether these costs will be fully covered by projected revenues.	of potential debt/equity funding to address the funding gaps.
Customer relationships	Less engagement with prospective customers and little evidence of traction	Significant engagement with prospective customers but limited evidence of traction (for example, traction with a few prospective customers...)	The project has good feedback from users during the pilot phase and has contracts in place (or at least good levels of interest) from prospective customers. Relevant accreditations or certifications are in place, to ensure customer trust in the product.
Customer segments	Project does not yet have a good understanding of the customer segments that it is targeting	Project has a good understanding of the customer segments that it's targeting (or if it's a 'vanilla' product, has a plan about which bits of the market to target first) – but no evidence that the value proposition has been validated for these customers.	The project has a good understanding of the customer segments that it is targeting, and for which the value proposition works.
Customer channels	Channels identified but not yet tried and tested – or not yet signed up as partners	Channels identified and beginning to be established, but not enough or not yet sufficiently developed to give confidence	The project has tried and tested means of reaching these target customer segments, which are included within the cost structure. The project has plans on how it will reach its

Element of BMC	Type of evidence expected at MRL 7	Type of evidence expected at MRL 8	Type of evidence expected at MRL 9
			potential market at sufficient scale to support the model.
Revenue streams	There is little information on potential revenues OR there is significant uncertainty about whether projected revenues are consistent with the 'value proposition' for customers.	Some attempt has been made to define potential revenues that are consistent with the 'value proposition' for customers, but there are still some uncertainties.	Projected revenue streams are clearly defined and well understood. Revenues are consistent with the cost structure and the 'value proposition' for customers, while providing the required level of return to current or prospective project investors.

Source: adapted from TRL scale by CAG Consultant

In practice, the evaluation team's assessment was that all the projects' market readiness levels were lower than MRL 9 at the end of the BASEE programme. A preliminary assessment of market readiness levels was made at two analysis workshops in December 2021 involving researchers from CAG Consultants and Winning Moves, together with a representative from the Department for Energy Security and Net Zero. This workshop assessed most of the projects as being between MRL 7 and 8 against these rubrics, based on a high-level review of evidence from project outputs and the final wave of research. This was confirmed by more detailed review and analysis of evidence from each project during the final QCA analysis process. with BASEE projects.

The success outcome for 'market readiness' was therefore recalibrated to reflect actual levels of success for the projects, as discussed under Steps 2 and 3 below.

Consideration of other success outcomes

As noted above, the evaluation plan separated out assessment of scalability because it would be possible for a pilot model to be 'market ready' (reaching MRL 9 on the innovation scale) but only be targeted at a small niche within the SME market. For example, the model might only be relevant to SMEs over a certain size or within a certain sub-sector or might only be relevant to SMEs that fulfilled certain criteria (for example, those that were not affected by particular barriers to energy efficiency action). Similarly, models might differ in their durability (or 'scalability') over time: some models might only involve a one-off sale of a product while others might involve the provision of ongoing services. This might have significant implications for the scalability of carbon savings associated with different models.

Consideration was therefore given to treating 'scalability' as a second success outcome. However, given the lower level of market readiness observed at the end of the programme, it was agreed with the Department that 'scalability' would be difficult to assess and would be less relevant than expected as a success outcome. Therefore no QCA analysis was undertaken on 'scalability'.

The QCA analysis was, however, extended to consider two other important aspects of project success for the BASEE programme, which were closely related to the evaluation questions:

- The extent to which each Phase 2 project attempted to tackle multiple barriers for SME energy efficiency.
- The effectiveness of each Phase 2 project in establishing relationships with SMEs and engaging them with energy efficiency.

The three success outcomes analysed using QCA were therefore:

- Success outcome 1 ('SUCCESS'): Overall market readiness, defined on the 9-point MRL scale, supported by analysis of the Business Model Canvas elements for each project.
- Success outcome 2 ('SMEBARR'): The extent to which each Phase 2 project attempted to tackle multiple barriers for SME energy efficiency, as assessed by the evaluation team.

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- Success outcome 3 ('RELATIONSHIPS'): The effectiveness of each Phase 2 project in establishing relationships with SMEs and engaging them with energy efficiency, as assessed by the evaluation team.

It is worth noting that QCA analysis for success outcome 3 focused in one particular element of the BMC assessment (i.e. the strength of customer relationships).

Step 1(b) sets out the causal conditions that were identified as potentially influencing these success outcomes. Step 2 then explains how the dataset was created for both success outcomes and causal conditions, based on the analysis of evaluation evidence, while Step 3 explains how the success outcome variables were calibrated for use in QCA analysis.

Step 1b) What causal conditions might influence the success outcomes?

Suggested causal conditions for 'market readiness' success outcome

Table 12 below sets out the evaluation team's initial suggestions for the causal conditions that might be linked to the 'market readiness' success outcome. These causal conditions were based on the findings of the literature review on how energy efficiency initiatives for SMEs could be made more effective, both by reducing barriers and by increasing the drivers, benefits and salience of energy efficiency to SMEs in their target group. The causal conditions set out here explore in more detail the high-level assumptions about pilot project success that were set out in the theory of change for the BASEE programme. The evaluation plan pointed out that these causal conditions may not all be necessary to achieve the success outcome, and there might be other conditions and configurations that were not included in this initial table.

Table 12: Suggested causal conditions relating to ‘market readiness’

Overarching causal conditions or configurations	Underlying elements of these causal conditions
Development of the model has been well funded and resourced	<ul style="list-style-type: none"> • Funding from BASEE fully covered the project’s requirements • Funding from BASEE or other sources were sufficient to respond to covid impacts on the project • The BASEE timescale allowed good testing of key elements of the model • Funding from other sources addressed any gaps in BASEE resourcing • [Note: it is possible that funding could be combined with other elements of resourcing (such as the ‘strong project team’ condition)].
The model has been developed by a strong project team	<p>Possible sub-conditions within this grouping could include:</p> <ul style="list-style-type: none"> • Strong champion leading the project • Effective project management • Continuity in key roles in the run up to and during BASEE delivery • Well-established relationships between the lead organisation and partner organisations
The project has had access to the necessary range of skills	<ul style="list-style-type: none"> • No significant skills gaps or capacity issues within the project delivery team (across the lead organisation and partner organisations) • Necessary skills might include marketing, project management, finance, technical skills, software development, project design, communications etc.
The project team had a clear vision of their offer and their target group	<ul style="list-style-type: none"> • Common vision across different members of the project team and partner organisations • Vision remains clear even though learning about delivery may change

Overarching causal conditions or configurations	Underlying elements of these causal conditions
	<ul style="list-style-type: none"> [Note: there may be tensions between ‘consistency’ of vision and the next condition, which relates to flexibility. It might be possible to develop a combined configuration which allowed for a clear vision combined with flexibility in implementation.]
Project team has adapted to learning arising from the project	<ul style="list-style-type: none"> Project team and partners have a flexible approach to project design and project management Project team is willing to accept advice and incorporate learning from the project findings, from customer feedback, from the Department, from other BASEE projects and/or other expert sources Project plan allowed adaptations to be made at reasonable cost (for example, adaptations could be made without having to redo major elements of the project)
The project is effective at overcoming the main barriers experienced by its target customers.	<p>This condition would be based on addressing the particular barriers relevant to target SMEs. These are likely to include some or all of the barriers below, based on the literature review. Other barriers may also be identified for particular projects:</p> <ul style="list-style-type: none"> ‘Behavioural’ barriers: pilot is made easy to access and implement and/or co-benefits (beyond financial savings) are identified and promoted ‘Capital’ barriers: Pilot either involves no upfront costs for target SMEs, or, where there are upfront costs, SMEs can self-finance or access bespoke financing measures. ‘Hidden cost’ barrier: pilot helps companies to minimise disruption associated with energy efficiency measures by identifying and taking advantage of trigger points ‘Lack of time’ barrier: pilot reduces the time demands on SMEs. ‘Lack of expertise’ barrier: pilot provides external advisers to undertake work or facilitate work on behalf of SME

Overarching causal conditions or configurations	Underlying elements of these causal conditions
	<ul style="list-style-type: none"> • ‘Lack of trust’ barrier: pilot builds trust in the service provider (for example, by use of trusted intermediaries, accreditation or endorsement) • ‘Split incentive’ barrier: pilots support landlords to improve the energy efficiency of their building stock; OR target groups SMEs are selected to avoid split incentives between tenants and landowners
<p>The project is effective at attracting target customers to its offer.</p>	<p>This condition would be based on a configuration of ‘attraction factors’. The factors below are based on the literature review, but other ‘attraction factors’ may be identified during the research:</p> <ul style="list-style-type: none"> • Saliency: the value proposition is framed in a way that aligns with SME priorities and helps them to address their existing problems (for example, costs being too high; customer quality needing to be improved) even if they do not perceive energy efficiency as relevant to them. The value proposition is adjusted as appropriate to ensure that it optimises the value for different target customers. • Peer pressure: pilot encourages competition on energy efficiency performance between SMEs in the same sector • Integration: pilot activities are linked to and synergise well with other local, regional and national initiatives for target SMEs • Targeting: pilot activities are carefully targeted at a particular sub-sector of SMEs and/or on the basis of size, ownership model, energy intensity and/or geographic locations • Communications: the pilot has a sound strategy for communicating its value proposition to target customers, emphasising these attraction factors.

Overarching causal conditions or configurations	Underlying elements of these causal conditions
Other enabling factors make this model's offer attractive to target SMEs	<ul style="list-style-type: none"> • Possible enabling factors suggested by the evaluation team's initial review of projects and literature include the following. Other factors may emerge during the research. • Minimisation of risk for SMEs – SMEs are offered guaranteed savings (for example, through an Energy Service Company (ESCO)) • Transaction costs for SMEs, suppliers and/or lenders is reduced • Digital platform works because SMEs are technically confident • Limited list of measures focuses offer to SMEs and streamlines supply chain • Marketing based on climate change appeals to SMEs • Advisory 'handholding' support is offered to SMEs • [Note: it may be possible to develop a configuration which combines these enabling factors with 'attraction factors' above.]
The project is targeted at a sizeable sub-group of SMEs	<ul style="list-style-type: none"> • Target group of SMEs is relatively homogenous (for example, in terms of the barriers and characteristics they share, and their perspective on the 'value proposition') • Size of target group of SMEs, within area targeted by project
Product can readily be replicated	<ul style="list-style-type: none"> • Product can be applied to different customers without requiring significant product development work
Project team has designed for scalability from the outset	<ul style="list-style-type: none"> • Systems developed for delivery can cope with larger scale delivery • Systems and procedures used during the pilot can readily be scaled up

Overarching causal conditions or configurations	Underlying elements of these causal conditions
Delivery at scale is cost-effective	<ul style="list-style-type: none"> • Transaction costs for suppliers have been reduced by streamlining and aggregating contracts to build economies of scale.
The project has engaged with wider stakeholders in relation to its plans for reaching its potential market	<ul style="list-style-type: none"> • Engagement with local authorities and Local Enterprise Partnerships (LEPs) • Engagement with wider suppliers, to support potential scale-up • Engagement with potential channels to reach a wider market
The model reaches groups not well-served by existing offers and business models	<ul style="list-style-type: none"> • Relatively little competition from other providers in the target market, within the geographic area served by the pilot project • EITHER Paybacks on measures are expected to be under 2 years (i.e. still some 'low hanging fruit' in terms of energy efficiency improvements) OR • Models are innovative in reaching parts of the energy efficiency market that are usually 'hard to reach'
The model's offer is reliable and trusted by SME customers	<ul style="list-style-type: none"> • Measures are well tried and tested • Suppliers, lenders and any intermediary bodies are trusted by customers • Existing networks used and trusted by SMEs support and encourage participation in the project • [Note: it is possible that these causal conditions could be integrated into a wider configuration relating to 'overcoming barriers' or 'attracting customers']
The model's operations have not been significantly constrained by external factors	<ul style="list-style-type: none"> • External factors and risks (for example, Covid) have not significantly constrained activities

The causal conditions were reviewed and extended during Step 1(b) of the QCA process.

Final set of ‘candidate’ causal conditions used in QCA analysis

As well as covering the causal conditions set out in Table 12, additional causal conditions were identified as being important for the three success outcomes outlined in Step 1(a) of the QCA process above:

- Success outcome 1 (‘SUCCESS’): Market readiness, as defined using the 9-point MRL scale, supported by analysis of the Business Model Canvas elements for each project.
- Success outcome 2 (‘SMEBARR’): The extent to which each Phase 2 project was able to tackle multiple barriers for SME energy efficiency, as assessed by the evaluation team.
- Success outcome 3 (‘RELATIONSHIPS’): The effectiveness of each Phase 2 project in establishing relationships with SMEs and engaging them with energy efficiency, as assessed by the evaluation team.

Additional causal conditions were identified through the final impact analysis that underpinned the evaluation impact report as a whole. As explained in the main report, the impact analysis involved systematic review of qualitative and quantitative research collected by the evaluation team, as well as review of the final project reports and other key documents from each project. This evidence was analysed against the detailed evaluation questions, both within each project and across projects. The final set of causal conditions used in the QCA analysis was informed by this wider analysis process and is set out in table 13. The table also includes the outcomes for individual elements of the BMC as these were considered as potential causal conditions for success outcomes 2 and 3.

Table 13: Full set of causal conditions

**indicate conditions that were excluded from the eventual QCA analysis because they were observed for all projects, with no variation.*

*** indicate conditions that were excluded from the QCA analysis because they were found to overlap with other conditions.*

Casual conditions	Source	QCA Code
Development of the model has been well-funded and resourced	Evaluation plan	FUND*
The model has been developed by a strong project team	Evaluation plan	TEAM*
The project has a clear vision of their offer and their target group	Evaluation plan	CLEAR
The project team has adapted flexibly to learning arising from the project	Evaluation plan	ADAPT*
The project attempted to tackle the main barriers experienced by its target customers (for example, behavioural barriers, capital barriers, hidden cost barrier, lack of time barrier; lack of expertise barrier; lack of trust barrier; split incentive barrier.	Evaluation plan (modified)	SMEBARR
The project attempted to tackle the main barriers experienced by suppliers (= 'installers'; white label intermediaries covered elsewhere for QCA purposes)	Evaluation plan (modified)	SUPPLYBARR
The project attempted to tackle the main barriers experienced by lenders	Evaluation plan (modified)	LENDERBARR
The project is effective at attracting target customers to its offer (for example, using salience, peer pressure, integration, targeting, communications, trust)	Evaluation plan	ATTRACT
Other enabling factors make this model's offer attractive to target SMEs (overlap with 'ATTRACT')	Evaluation plan	ENABLE**
The model reaches groups not well-serviced by existing offers and business models	Impact analysis	GAP*

Casual conditions	Source	QCA Code
The model's offer is reliable and trusted by SME customers (overlap with 'ATTRACT')	Impact analysis	TRUST**
External factors: the model's operations have been significantly constrained by COVID	Impact analysis	COVID*
The lead organisation is interested in commercialisation	Impact analysis	COMMER
The project requires access to smart meter data	Impact analysis	SMART
The project provides signposting to grant funding to SMEs in their local areas	Impact analysis	GRANTS
The project targets SMEs with energy bills above a certain level (for example, £10k or £20k) and/or energy-intensive sectors	Impact analysis	SPEND
The project uses messaging around net zero and carbon reductions (for example, linked to COP26 and increased awareness of net zero)	Impact analysis	CARBON
The project offers solar PV as well as energy efficiency	Impact analysis	SOLAR
The project offers 'easy wins' and small measures	Impact analysis	SMALL
The project offers costlier investment packages	Impact analysis	BIG
The project is tailored to specific sectors	Impact analysis	SECTOR
The project provides comparisons with similar businesses	Impact analysis	COMPARE
The project is readily scalable (for example, costs of acquiring and servicing additional customers are reasonable)	Impact analysis	SCALE
The project offers smart tariffs, making use of demand flexibility and demand side response	Impact analysis	FLEX

Casual conditions	Source	QCA Code
Value proposition	BMC analysis	VALUE
Key partners	BMC analysis	PARTNERS
Key resources	BMC analysis	RESOURCES
Key activities	BMC analysis	ACTIVITIES
Cost structure	BMC analysis	COSTS
Customer relationships	BMC analysis	RELATIONSHIPS
Customer segments	BMC analysis	SEGMENT
Customer channels	BMC analysis	CHANNEL
Revenue streams	BMC analysis	REVENUES

Step 2: Ensuring data availability

A preliminary assessment of the building blocks for the QCA analysis was made during the interim impact assessment in 2021. Specifically, CAG Consultants made an initial assessment of each projects’ progress against the elements in the Business Model Canvas, as a steppingstone to assessing the project’s market readiness. These assessments were shared and discussed with the Department. The interim impact assessment enabled the evaluation team to identify areas where assessment against BMC elements was uncertain and where further evidence of progress was needed. The final wave of qualitative research with the Phase 2 projects and their partners aimed to fill these gaps. Researchers from CAG Consultants were involved in reviewing the topic guides for final interviews, to ensure that evidence gaps were filled where possible.

Preliminary assessment of success outcome 1 (i.e. market readiness) was made at a series of cross-team analysis workshops. Two three-hour analysis workshops were held in late 2021, when the final wave of qualitative research was complete, and the suite of project reports and outputs was nearly complete. Workshop participants included representatives from Winning

Moves, CAG Consultants and the Department. Some participants were chosen for their familiarity with emerging findings, some for their knowledge of ‘clean tech’ innovation and others for their role in the QCA analysis. Each workshop considered four of the eight Phase 2 projects in turn. The analysis workshops were undertaken online, using shared whiteboards to generate a preliminary assessment of each project in terms of:

- MRL levels for each element of the Business Model Canvas
- Preliminary assessment of success outcome 1 (i.e. the overall ‘market readiness’ of the project)
- Key factors contributing to success
- Key factors contributing to any lack of success
- The extent to which each of the initial causal conditions identified in the evaluation plan had been observed for this project

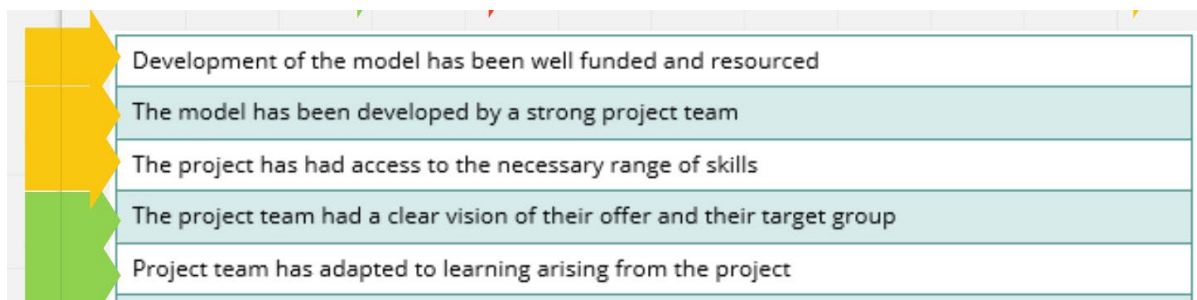
Sample images from one of the assessment boards are shown in Figure 4. Red stars were used to indicate the MRL level that workshop participants suggested as applying to a given BMC element for a given BASEE project, based on the evidence of which they were aware. Comments were also collected on virtual post-it notes, allowing participants to add qualitative comments and record their rationale for this preliminary assessment.

Figure 4 – Sample images from workshop whiteboard – MRL level

Element of BMC	Priority 1= top	Type of evidence expected at ‘MRL level 7’	Type of evidence expected at ‘MRL level 8’	Type of evidence expected at ‘MRL level 9’
Customer segments	2	Project does not yet have a good understanding of the customer segments that it is targeting	Project has a good understanding of the customer segments that it's targeting (or if it's a 'vanilla' product, has a plan about which bits of the market to target) but no evidence that the value proposition has been validated for these customers.	The project has a good understanding of the customer segments that it is targeting , and for which the value proposition works. <i>(Have they got the right value proposition for the right target customers? Need to cross reference with what the project is trying to do – e.g. via channels.)</i>
Value proposition	1	Some articulation of value proposition, but not yet clear. Little evidence yet of customers being willing to pay	They either don't have a clearly articulated value proposition OR They don't yet have much evidence customers are willing to pay... (i.e. do they want and are they willing to pay for it?) OR Not enough evidence of either of these	Feedback from users (and outputs from emissions/value for money analysis) show that the model is successful in enabling and stimulating energy efficiency action by at least some types of SMEs, and creates value for customers that justifies the price being charged by the project <i>(i.e. clearly articulated value proposition; tangible commitment – e.g. evidence that the market will pay what you're charging.)</i>

Key: red star indicates preliminary assessment

Similarly, figure 5 below shows that coloured arrows were used to highlight causal conditions that workshop participants reported as applying to each BASEE project. Green arrows were used to point to causal conditions that participants reported as being supported by the evidence for that project, while orange arrows were used to indicate evidence of these causal conditions being present to some degree. Red arrows were used where available evidence did not support this causal condition being present.

Figure 5 – Sample images from workshop whiteboard - causal conditions


Development of the model has been well funded and resourced
The model has been developed by a strong project team
The project has had access to the necessary range of skills
The project team had a clear vision of their offer and their target group
Project team has adapted to learning arising from the project

Key: green arrow = evidence clearly supports this condition being present; amber arrow = evidence of this condition being present to some degree; red arrow = evidence does not support this condition being present.

A more detailed assessment of all three success outcomes and a wider range of causal conditions was undertaken after the main impact analysis was complete. For the 'market readiness' success outcome, and the causal conditions identified in the evaluation plan, assessment was informed both by detailed impact analysis and by the preliminary assessment made during the analysis workshops. Two additional success outcomes were added at this stage, based on analysis of key evaluation questions considered during the impact analysis. Additional causal conditions were identified from the success factors and barriers identified during the analysis workshops as well as the detailed impact analysis. Assessment of the newly identified success outcomes and causal conditions was undertaken as part of the main impact analysis, involving detailed assessment of qualitative and quantitative research for each project, together with assessment of the final project report and other key project documents. Findings from this assessment were collated in a spreadsheet which presented an assessment for each variable against each project, together with notes indicating the evidence on which this assessment was based.

Step 3: Calibration of the QCA dataset

The evidence assembled during Step 2 was calibrated during Step 3. This section describes the calibration of the three success outcomes first, before moving on to describe the calibration of causal conditions.

Success outcome 1 – 'market readiness'

Various options were considered for calibration of success outcome 1 'market readiness'. The QCA analysis was run with four variants of this variable as shown in Table 14. SUCCESS1 and SUCCESS2 were defined in terms of 1's and 0's and hence suitable for clear set QCA, but using different thresholds for success (for example, more than 6 or more than 7 of the BMC elements were assessed as being at level 8). Two further variants were defined as real numbers, SUCCESS3 and SUCCESSFUZ, which were calculated using the mean MRL across BMC elements. As these were real numbers, rather than 0's and 1's, these were suitable for fuzzy set QCA analysis. The most meaningful results were obtained with 'SUCCESS1', as explained in Steps 4-6.

Table 14: Assessment summary for success outcome 1 'market readiness'

Variable	arb-nco	BRE	Consid erate	Element Energy	Energy Pro	Hoare Lea	Joule Assets	Qbots
SEGMENT: customer segments	7	8	8	8	8	8	8	7
VALUE: value proposition	7	7	7	8	8	7	8	8
CHANNEL: customer channels	8	7	8	8	8	7	8	8
RELATION SHIPS: customer relationships	8	8	7	8	8	7	8	8
REVENUES: revenue stream	8	7	8	8	7	7	8	8
COSTS: cost structure	8	7	8	8	7	7	8	8
PARTNERS: key partners	8	8 ⁶	8	8	8	7	7	8
ACTIVITIES: key activities	7	7	7	8	7	7	8	8
RESOUR-CES: key resources	8	8	8	8	8	7	8	8
Number of BMC elements	6	4	6	9	6	1	8	8

⁶ No external partners involved, but BRE's model did not require external partners.

Variable	arb-nco	BRE	Considerate	Element Energy	Energy Pro	Hoare Lea	Joule Assets	Qbots
assessed at level 8								
SUCCESS1 (at least 6 BMC elements rated 8)	1	0	1	1	1	0	1	1
SUCCESS2 (at least 7 BMC elements rated 8)	0	0	0	1	0	1	1	1
SUCCESS3 (mean MRL – 7.0)	0.67	0.44	0.67	1.00	0.67	0.11	0.89	0.89
SUCCESSFUZ (Mean MRL across BMC elements)	7.67	7.44	7.67	8.00	7.67	7.11	7.89	7.89

Success outcome 2 ('SMEBARR')

The extent to which each Phase 2 project attempted to tackle multiple barriers for SME energy efficiency, as identified by BASEE, was assessed on a scale from 0 to 1. This did not mean that they had overcome each of the barriers, as this could not be ascertained from the evidence given the low take-up of all projects. Instead, this success outcome looked at whether projects had taken action that clearly aimed to overcome the relevant barrier.

All of the projects had done something to assess the BASEE barriers to SME energy efficiency, but only two had attempted to tackle all the barriers identified by BASEE. A binary scale was therefore found to be inappropriate. Instead, a four-point scale was used as follows:

- 0.00 – action to tackle no or only one barrier
- 0.33 – action to tackle a few of the barriers
- 0.66 – action to tackle most but not all of the barriers
- 1.00 - action to tackle all of the barriers

This scale provided a meaningful fit with the findings of each project so no variants were tested. This outcome variable had to be analysed using fuzzy-set QCA as it was not framed solely in terms of '0's and '1's.

Success outcome 3 ('RELATIONSHIPS')

The effectiveness of each Phase 2 project in establishing customer relationships with SMEs and engaging them with energy efficiency was based on the assessment of this element of the Business Model Canvas, as presented in Table 11. As the Business Model Canvas assessments were binary, ranging from level 7 to level 8, a simple binary variable was created for this success outcome:

- 0 – customer relationships assessed as MRL 7
- 1 – customer relationships assessed as MRL 8

This scale was consistent with the BMC assessment so no variants were tested.

Summary of success outcome variables after calibration

A summary of all three success outcome variables used in the QCA analysis is shown in Table 15.

Table 15: Dataset for success outcome variables used in the QCA analysis

Projects	'arbnco'	'BRE'	'Cons-iterate'	'Element Energy'	'EnergyPro'	'Hoare Lea'	'Joule Assets'	'Qbots'
SUCCESS1	1	0	1	1	1	0	1	1
SMEBARR	0.33	0.33	0.33	0.33	1	0.66	1	0.66
RELATIONSHIPS	1	1	0	1	1	0	1	1

Calibration of causal conditions

There were two categories of 'candidate' causal conditions:

- Potential causal conditions which were based on elements of the BMC
- Causal conditions that were identified in the evaluation plan or wider impact assessment, which were assessed separately independent of the BMC assessment.

The causal conditions relating to BMC elements were calibrated in the same way as success outcome 3 ('RELATIONSHIPS'). As the Business Model Canvas assessments were binary, ranging from level 7 to level 8, a simple binary variable was created for these causal conditions:

- 0 – this BMC element was assessed as MRL 7
- 1 – this BMC element was assessed as MRL 8

This scale was consistent with the BMC assessment so no variants were tested.

The causal conditions outside the BMC assessment were assessed on a four-point scale, similar to that used in the calibration of success outcome 2 ('SMEBARR'). This assessment used four levels between 0 and 1:

- 0.00 – no evidence of this causal condition
- 0.33 – evidence that this causal condition applied to a small degree
- 0.66 – evidence that this causal condition applied to a significant degree but not fully
- 1.00 – evidence that this causal condition applied fully

In practice, the intermediate levels (0.33 and 0.66) were not observed for some of the causal conditions, with the effect that some of the causal conditions look as if they have been assessed on a binary scale. This scale provided a meaningful fit with the findings of each project so no variants were tested.

The full set of candidate causal conditions is set out in table 16.

Table 16: Dataset for candidate causal conditions used in the QCA analysis

Projects	'arbnc o'	'BRE'	'Cons- iderat e'	'Elem- ent Ener- gy'	'Ene- rgyPr o'	'Hoar e Lea'	'Joule Asset s'	'Qbots ,
SEGMENT	0	1	1	1	1	1	1	0
VALUE	0	0	0	1	1	0	1	1
CHANNEL	1	0	1	1	1	0	1	1
REVENUES	1	0	1	1	0	0	1	1
COSTS	1	0	1	1	0	0	1	1
PARTNERS	1	1	1	1	1	0	0	1
ACTIVITIES	0	0	0	1	0	0	1	1
RESOURCES	1	1	1	1	1	0	1	1
CLEAR	0.66	0.66	1	1	1	0.66	1	0.33
SUPPLYBARR	0.33	0	0.66	0	0.66	0.66	1	0.66
LENDERBARR	0.33	0	0.33	0	0.66	0.66	0.66	0.66
ATTRACT	0.33	0.33	0	0.66	1	0.33	0.66	0.66
COMMER	1	0	1	1	0.66	0.66	1	1

Projects	'arbnc o'	'BRE'	'Cons- iderat e'	'Elem- ent Ener- gy'	'Ene- rgyPr o'	'Hoar e Lea'	'Joule Asset s'	'Qbots ,
SMART	1	0	1	1	0	0	0	1
GRANTS	0	1	0	1	1	0.33	0	1
SPEND	0	0	0	0	1	1	1	0
CARBON	0.33	0	0	0	1	1	0	0.33
SUPPLY	1	0	0.33	1	0	0	0.33	1
SOLAR	0	0	0	1	1	1	1	1
SMALL	1	1	1	1	0	0	1	1
BIG	1	1	0	0	1	1	1	1
SECTOR	0	1	1	0.66	0	1	1	0
COMPARE	1	0	0.33	1	0	0	0	0
SCALE	0.66	1	0.66	1	0	1	0.33	0.33
FLEX	0	0	0	0	0	0	0	1

Step 4: The Venn Diagram – mapping out the data

Linkages between each success outcomes and selected causal conditions were identified based on the Theory of Change and the overall impact analysis. The hypothesised relationships are shown in the figures below.

Analysis of success outcome 1 (market readiness)

The impact analysis identified that those business models closest to market readiness fell into two groups:

- Those using smart-meter data that were relatively light-touch and therefore easily scalable to new SME users
- Those not using smart-meter data that tackled a wider range of energy efficiency barriers for SME users, which did not generally require smart meter data and were less easily scalable

The exceptions seemed to be projects (such as 'BRE') where the project lead did not have a strong drive to commercialise the product. Partnerships with energy suppliers seemed to be an

important causal condition in projects using smart meter data, facilitating access to customers and possibly improving access to data.

Causal conditions affecting SUCCESS1 were therefore hypothesised to be:

- SCALE – the project is readily scalable (for example, costs of acquiring and servicing additional customers are reasonable)
- COMMER – the lead organisation is interested in commercialisation
- SMART – the project requires access to smart meter data
- SUPPLY – the project partners include an energy supplier (scored as 1) or energy broker (scored as 0.33)

The dataset for this analysis is in Table 17. Because of the use of intermediate values between 0 and 1, this is termed a ‘fuzzy dataset’.

Table 17: ‘Fuzzy’ dataset for QCA analysis of SUCCESS1

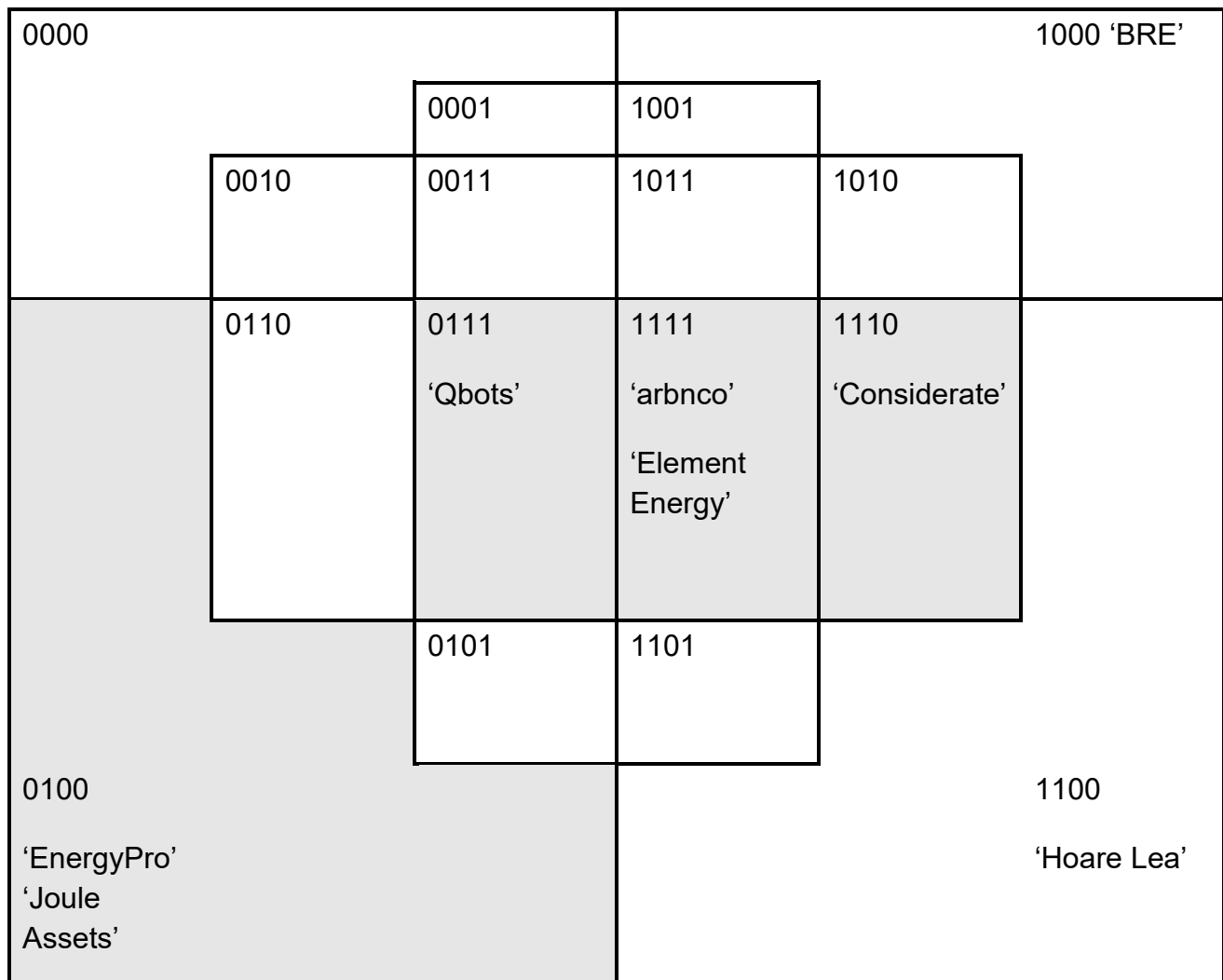
Projects	‘arbnco’	‘BRE’	‘Consi- derate’	‘Eleme nt Energy’	‘Energy- Pro’	‘Hoare Lea’	‘Joule Assets’	‘Qbots’
SUCCESS 1	1	0	1	1	1	0	1	1
SCALE	0.66	1	0.66	1	0	1	0.33	0.33
COMMER	1	0	1	1	0.66	0.66	1	1
SMART	1	0	1	1	0	0	0	1
SUPPLY	1	0	0.33	1	0	0	0.33	1

To plot Venn diagrams, the data had to be stated in ‘crisp’ terms. To do this, scores of 0.33 were converted to zero, while score of 0.66 were converted to 1. The resulting ‘crisp’ dataset is in Table 18, and is presented visually in a Venn diagram in Figure 6.

Table 18: ‘Crisp’ dataset for QCA analysis of SUCCESS1

Projects	‘arbnco’	‘BRE’	‘Consi- d- erate’	‘Eleme- nt Energy’	‘Energy Pro’	‘Hoare Lea’	‘Joule Assets’	‘Qbots’
SUCCESS 1	1	0	1	1	1	0	1	1
SCALE	1	1	1	1	0	1	0	0
COMMER	1	0	1	1	1	1	1	1
SMART	1	0	1	1	0	0	0	1
SUPPLY	1	0	0	1	0	0	0	1

Figure 6 - Venn diagram for ‘crisp’ dataset SUCCESS1



Grey shading indicates that SUCCESS1 = 1

The successful ‘causal recipes’ based on the ‘crisp’ dataset were:

- SUCCESS1 = SCALE*COMMER*SMART*SUPPLY (2 cases)
- SUCCESS1 = SCALE*COMMER*SMART*~SUPPLY (1 case)
- SUCCESS1 = ~SCALE*COMMER*SMART*SUPPLY (1 case)
- SUCCESS1 = ~SCALE*COMMER*~SMART*~SUPPLY (2 cases)

(Note: ~SUPPLY~ means ‘not SUPPLY’)

The causal condition COMMER was common to all the successful cases. Further analysis of the dataset for SUCCESS1 is presented under Step 5.

Analysis of success outcome 2 – SMEBARR

The impact analysis identified a number of causal factors as influencing the extent to which each project was able to overcome the barriers to SME energy efficiency that had been identified by BASEE. The impact analysis highlighted the following causal conditions:

- Offering larger energy efficiency investments (BIG)
- Having a clear vision of their offer and target group (CLEAR)
- Targeting SMEs with higher energy spend (SPEND)

Causal conditions affecting SMEBARR were therefore hypothesised to be:

- BIG
- CLEAR
- SPEND

The dataset for this analysis is in Table 19. Because of the use of intermediate values between 0 and 1, this is termed a ‘fuzzy dataset’.

Table 19: ‘Fuzzy’ dataset for QCA analysis of SMEBARR

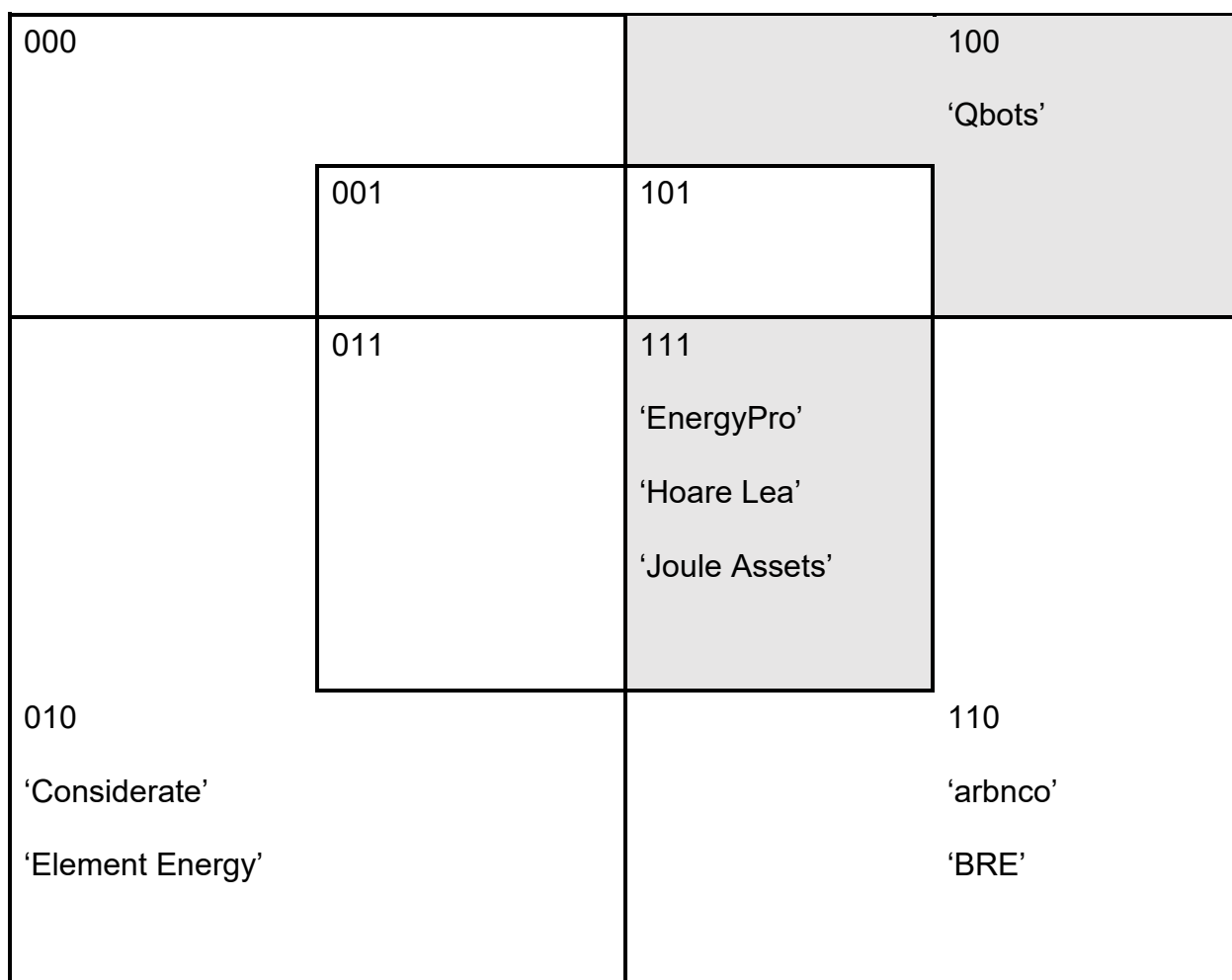
Projects	‘arbncoc	‘BRE	‘Consid	‘Elemen	‘Energy	‘Hoar	‘Joule	‘Qbots
	‘	‘	-erate’	t	-Pro’	e Lea’	Assets	‘
				Energy’			‘	
SMEBAR	0.33	0.33	0.33	0.33	1	0.66	1	0.66
R								
BIG	1	1	0	0	1	1	1	1
CLEAR	0.66	0.66	1	1	1	0.66	1	0.33
SPEND	0	0	0	0	1	1	1	0

To plot Venn diagrams, the data had to be stated in ‘crisp’ terms. To do this, scores of 0.33 were converted to zero, while score of 0.66 were converted to 1. The resulting ‘crisp’ dataset is in Table 20 and is presented visually in a Venn diagram in Figure 7.

Table 20: ‘Crisp’ dataset for QCA analysis of SMEBARR

Projects	‘arbnc o’	‘BRE’	‘Consi d- erate’	‘Eleme nt Energy ,	‘Energ y-Pro’	‘Hoare Lea’	‘Joule Assets ,	‘Qbots’
SMEBAR R	0	0	0	0	1	1	1	1
BIG	1	1	0	0	1	1	1	1
CLEAR	1	1	1	1	1	1	1	0
SPEND	0	0	0	0	1	1	1	0

Figure 7 - Venn diagram for ‘crisp’ dataset SMEBARR



Grey shading indicates that SMEBARR = 1

The Venn diagram indicates that the successful ‘causal recipes’ based on the ‘crisp’ dataset are:

- SMEBARR = BIG*CLEAR*SPEND (3 cases)
- SMEBARR = BIG*~CLEAR*~SPEND (1 case)

(Note: ~BIG means ‘not BIG’)

Further analysis of the dataset for SMEBARR is presented under Step 5.

Analysis of success outcome 3 – RELATIONSHIPS

The impact analysis identified a number of causal factors as influencing the success of each project in both attracting SMEs and establishing customer relationships. The impact analysis highlighted the following causal conditions:

- Offering solar PV measures as well as energy efficiency (SOLAR)
- Using carbon and net zero messaging as well as energy cost reduction messaging (CARBON)
- Having a good understanding of customer segments, and tailoring the project’s offer to particular segments of the market (SEGMENT)
- Using trusted intermediaries to reach customers (CHANNEL)

Causal conditions affecting RELATIONSHIPS were therefore hypothesised to be:

- SOLAR
- CARBON
- SEGMENT
- CHANNEL

The dataset for this analysis is in Table 21. Because of the use of intermediate values between 0 and 1, this is termed a ‘fuzzy dataset’.

Table 21: ‘Fuzzy’ dataset for QCA analysis of RELATIONSHIPS

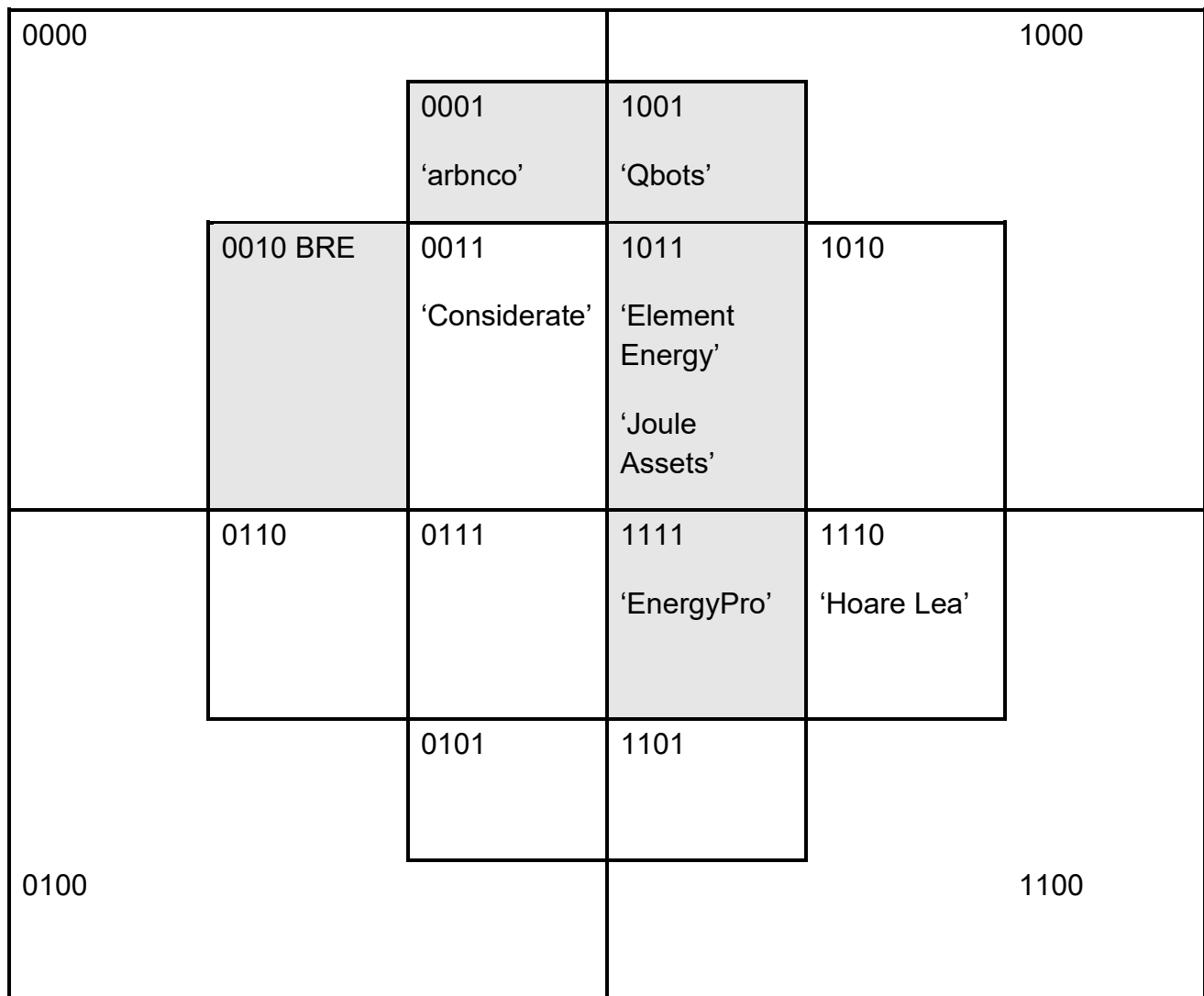
Projects	‘arbnc o’	‘BRE’	‘Consi - derate’	‘Eleme nt Energy’	‘Energy-Pro’	‘Hoare Lea’	‘Joule Assets’	‘Qbots’
RELATIONS HIPS	1	1	0	1	1	0	1	1
SOLAR	0	0	0	1	1	1	1	1
CARBON	0.33	0	0	0	1	1	0	0.33
SEGMENT	0	1	1	1	1	1	1	0
CHANNEL	1	0	1	1	1	0	1	1

To plot Venn diagrams, the data had to be stated in ‘crisp’ terms. To do this, scores of 0.33 were converted to zero, while score of 0.66 were converted to 1. The resulting ‘crisp’ dataset is in Table 22, and is presented visually in the Venn diagram in Figure 8.

Table 22: ‘Crisp’ dataset for QCA analysis of RELATIONSHIPS

Projects	‘arbnc o’	‘BRE’	‘Consi derate’	‘Elem ent Energy’	‘EnergyPro’	‘Hoar e Lea’	‘Joule Asset s’	‘Qbot s’
RELATIONSHIP S	1	1	0	1	1	0	1	1
SOLAR	0	0	0	1	1	1	1	1
CARBON	0	0	0	0	1	1	0	0
SEGMENT	0	1	1	1	1	1	1	0
CHANNEL	1	0	1	1	1	0	1	1

Figure 8 - Venn diagram for 'crisp' dataset RELATIONSHIPS



Grey shading indicates that RELATIONSHIPS = 1

The successful 'causal recipes' based on the 'crisp' dataset are:

- RELATIONSHIPS = SOLAR*CARBON*SEGMENT*CHANNEL (2 cases)
- RELATIONSHIPS = SOLAR*~CARBON*SEGMENT*CHANNEL (1 case)
- RELATIONSHIPS = ~SOLAR*~CARBON*~SEGMENT*CHANNEL (1 case)
- RELATIONSHIPS = SOLAR*~CARBON*~SEGMENT*CHANNEL (1 case)
- RELATIONSHIPS = ~SOLAR*~CARBON*SEGMENT*~CHANNEL (1 case)

All the successful cases exhibited one or both of 'SEGMENT' and 'CHANNEL'. Further analysis of the dataset for RELATIONSHIPS is presented under Step 5.

Step 5: The Super Subset analysis

Specialist QCA software (fs/QCA software) was used to analyse the 'fuzzy set' truth tables set out in Step 4. This software used the Quine-McCluskey algorithm for QCA analysis. The fuzzy

set versions of the truth tables were used for this analysis because they more meaningfully reflected the observed evidence for the 8 projects.

Findings from super subset analysis for SUCCESS1

Model: SUCCESS1 = f(COMMER, SMART, SUPPLY, SCALE)

Analysis of the truth table for SUCCESS1 using fs/QCA software generated three solutions: a complex solution, parsimonious solution and intermediate solution. The complex solution identified three ‘recipes’ for SUCCESS1 as shown in Table 23. In this case, the complex solution and intermediate solution were the same.

Table 23: Super subset analysis findings for SUCCESS1

Solution	Raw coverage	Unique coverage	Consistency
Complex and intermediate solutions (solution coverage 0.831667; solution consistency 1)			
COMMER*SMART*SUPPLY	0.555	0.168333	1
COMMER*SMART*SCALE	0.441667	0.0550001	1
COMMER*~SMART*~SUPPLY*~SCALE	0.221667	0.221667	1
Parsimonious solution (solution coverage 0.945; solution consistency 1)			
~SCALE	0.503333	0.278333	1
SMART	0.66667	0.441667	1

Note: frequency cutoff: 1; consistency cutoff: 1

The findings from QCA analysis for SUCCESS1 (i.e. market readiness) were taken from the complex/intermediate solution:

- SUCCESS1 = COMMER*SMART*SUPPLY
- SUCCESS1 = COMMER*SMART*SCALE
- SUCCESS1 = COMMER*~SMART*~SUPPLY*~SCALE

The findings are consistent with the clear set ‘causal recipes’ identified in Step 4. Our interpretation of these findings are as follows.

Necessary conditions

Success, in terms of market readiness, was only observed for projects which exhibited ‘COMMER’ (i.e. the lead organisation was interested in commercialisation). This means that COMMER was a necessary condition for market readiness.

Sufficient conditions

There were three configurations of sufficient conditions:

- SMART*SUPPLY and SMART*SCALE. Those projects that used smart meter data achieved market readiness if they had a partnership with an energy supplier or if they had a light-touch product that was readily scalable (or both of these).
- ~SMART*~SUPPLY*~SCALE Projects that did not use smart meter data still achieved market readiness, even though they didn't partner with suppliers, by offering in-depth services but these were not readily scalable.

As mentioned under Step 3, calibration of the 'market readiness' success variable was tested by repeating the analysis for slight variants of SUCCESS1. The solution coverage and/or consistency was lower for the other variants, as shown in Table 24. This confirmed use of SUCCESS1 as the most appropriate calibration of the 'market readiness' variable.

Table 24: Consistency and coverage of solutions for SUCCESS variants

	Variable	SUCCESS1	SUCCESS2	SUCCESS3	SUCCESSFUZ
Complex solution	Coverage	0.832	0.2475	0.826	0.114
Complex solution	Consistency	1	1	0.906	1
Parsimonious solution	Coverage	0.945	0.2475	0.83	n/a
Parsimonious solution	Consistency	1	1	0.846	n/a
Intermediate solution	Coverage	0.832	0.2485	0.826	0.114
Intermediate solution	Consistency	1	1	0.906	1

Findings from super subset analysis for SMEBARR

Model: SMEBARR = f (BIG, CLEAR, SPEND)

Analysis of the truth table for SMEBARR using fs/QCA software generated three solutions: a complex solution, parsimonious solution and intermediate solution. The complex solution identified two 'recipes' for SMEBARR as shown in Table 25. In this case, the complex solution and intermediate solution were the same.

Table 25: Super Subset analysis findings for SMEBARR

Solution	Raw coverage	Unique coverage	Consistency
Complex and intermediate solutions (solution coverage 0.857759; solution consistency 0.992519)			
BIG*CLEAR*SPEND	0.573276	0.573276	1
BIG*~CLEAR*~SPEND	0.284483	0.284483	0.977778
Parsimonious solution (solution coverage 0.857759; solution consistency 0.914943)			
SPEND	0.573276	0.5	0.886667
~CLEAR	0.0357759	0.284483	0.982249

Note: frequency cutoff: 1; consistency cutoff: 0.977778

The findings from QCA analysis for SMEBARR (i.e. tackling multiple barriers to SME energy efficiency) were taken from the complex/intermediate solution:

- SMEBARR= BIG*CLEAR*SPEND
- SMEBARR= BIG*~CLEAR*~SPEND

Necessary conditions

SMEBARR was only observed for projects which exhibited ‘BIG’ (i.e. that offered larger energy efficiency investments instead of (or in addition to) behavioural and lower cost measures). This means that BIG was a necessary condition for tackling multiple barriers to SME efficiency.

Sufficient conditions

There were two configurations of sufficient conditions:

- CLEAR*SPEND: Those projects that targeted SMEs that spent more on energy and that had a clear offer for their target group.
- ~CLEAR*~SPEND: This was typified by the Qbots project which had a more complex offer linked to tariff switching and flexibility (hence not particularly ‘CLEAR’) but which did not necessarily target SMEs that spent more on energy (hence ‘not SPEND’). Our interpretation is that the revenues from ‘Qbots’ wider offer enabled them to tackle a relatively wide range of SME barriers despite not having a clear offer and not targeting SMEs with a higher energy spend.

Findings from super subset analysis for RELATIONSHIPS

Model: RELATIONSHIPS = f (SOLAR, CARBON, SEGMENT, CHANNEL)

Analysis of the truth table for RELATIONSHIPS using fs/QCA software generated three solutions: a complex solution, parsimonious solution and intermediate solution. The complex solution identified three ‘causal recipes’ for RELATIONSHIPS as shown in Table 26. In this case, the complex solution and intermediate solution were the same.

Table 26: Super Subset analysis findings for RELATIONSHIPS

Solution	Raw coverage	Unique coverage	Consistency
Complex and intermediate solutions (solution coverage 0.89; solution consistency 1)			
~CARBON*~SEGMENT*CHANNEL	0.223333	0.223333	1
SOLAR*SEGMENT*CHANNEL	0.5	0.5	1
~SOLAR*~CARBON*SEGMENT*~CHANNEL	0.166667	0.166667	1
Parsimonious solution (solution coverage 0.945; solution consistency 1)			
~SEGMENT	0.333333	0.166667	1
SOLAR*CHANNEL	0.666667	0.5	1
~CARBON*~CHANNEL	0.166667	0.166667	1
Intermediate solution (solution coverage 0.831667; solution consistency 1)			
~CARBON*~SEGMENT*CHANNEL	0.223333	0.223333	1
SOLAR*SEGMENT*CHANNEL	0.5	0.5	1
~SOLAR*~CARBON*SEGMENT*~CHANNEL	0.166667	0.166667	1

Note: frequency cutoff: 1; consistency cutoff: 1

The findings from QCA analysis for RELATIONSHIPHS (i.e. customer relationships) were taken from the intermediate solution:

- RELATIONSHIPS = ~CARBON*~SEGMENT*CHANNEL
- RELATIONSHIPS = SOLAR*SEGMENT*CHANNEL
- RELATIONSHIPS = ~SOLAR*~CARBON*SEGMENT*~CHANNEL

Necessary conditions

There were no necessary conditions for RELATIONSHIPS.

Sufficient conditions

There were three configurations of sufficient conditions for those projects that were more successful in establishing customer relationships:

- SOLAR*SEGMENT*CHANNEL: Those projects that offered solar PV to customers, that had a clear understanding of their customer segments and that used trusted intermediaries as marketing channels to reach them. As shown in the Step 4 analysis, most but not all of these projects used messaging around carbon saving so CARBON does not form part of the 'sufficient' configuration.
- ~CARBON*~SEGMENT*CHANNEL: Those projects that did not have clear customer segmentation and that focused on energy cost savings rather than carbon reductions, but that made effective use of trusted intermediaries to reach customers. This was typified by 'arbnco' and 'Qbots'.
- ~SOLAR*~CARBON*SEGMENT*~CHANNEL: Those projects that focused on a clear customer segment and had a good understanding of this segment but that did not offer solar PV, did not use carbon reduction messaging and did not use a trusted intermediary as a marketing channel. This was typified by 'BRE', which focused its initial offer on care homes but which used direct marketing to care homes.

Step 6: Identifying INUS conditions

A condition is 'INUS' if it is 'insufficient' to produce the outcome on its own but is a 'necessary' part of a conjunction that is not in itself 'necessary' but is 'sufficient' for producing the outcome.

Barbara Befani⁷ states that:

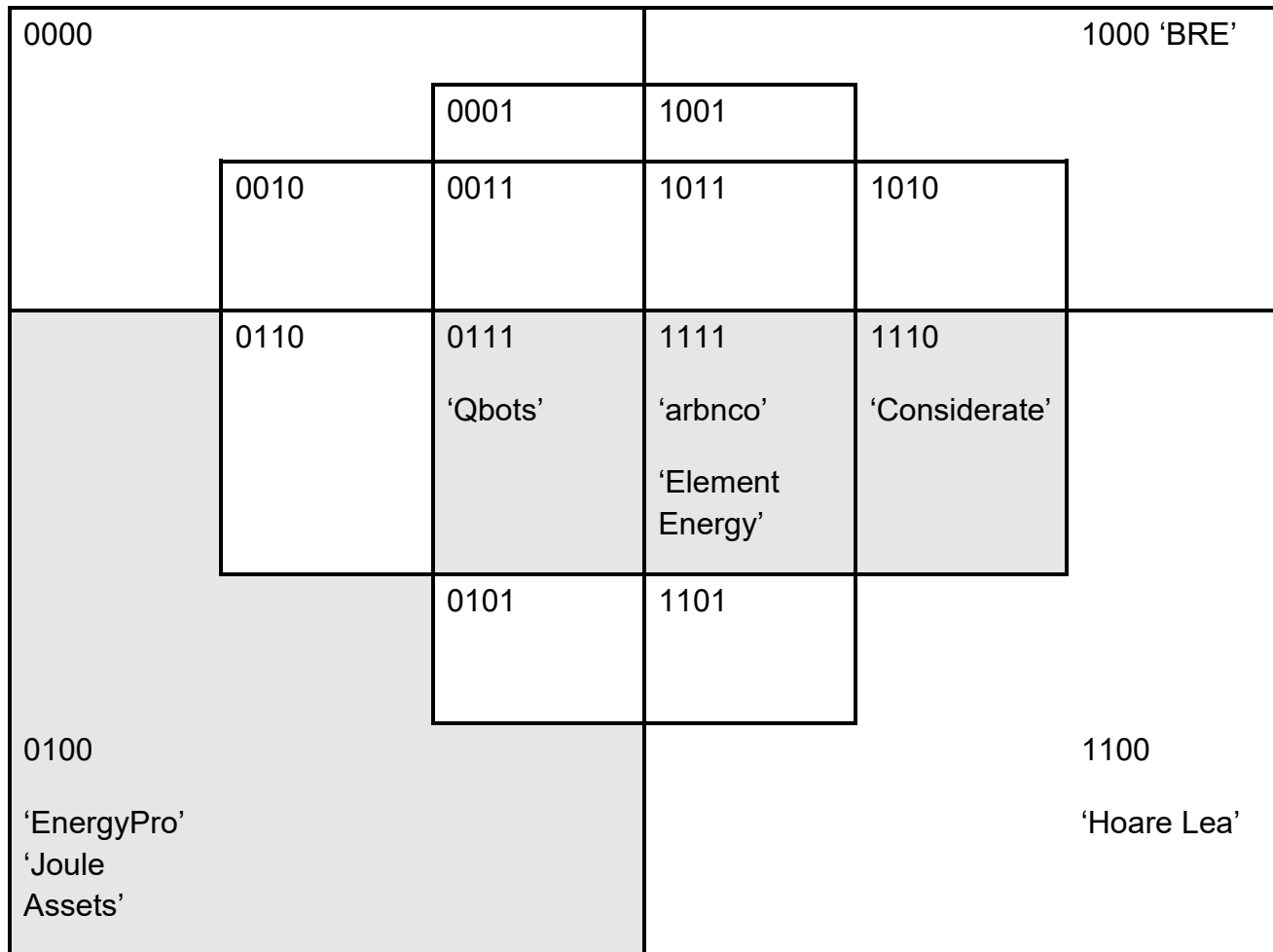
“INUS conditions are extremely relevant to impact evaluation because they answer the question “did it make a difference, for whom and under what circumstances” in a way that directly and automatically emerges from the data.”

The Venn Diagram plots in Figure 9, Figure 10, and Figure 11, which were based on 'crisp' versions of the data but generated consistent results to the 'fuzzy' datasets, were used to identify INUS conditions. Where there are two contiguous areas which differ only in one condition, but which have a different outcome, then that condition can be described as 'INUS'.

⁷ Befani, B. (2016) Pathways to Change: evaluating development interventions with Qualitative Comparative Analysis (QCA). (Expertgruppen for bistanalys (EBA)). Accessed at: https://eba.se/wp-content/uploads/2016/07/QCA_BarbaraBefani-201605.pdf

INUS analysis for SUCCESS1

Figure 9 – Venn diagram for ‘crisp’ dataset SUCCESS1 (replicated from Step 4 above)



Grey shading indicates that SUCCESS1 = 1

Causal conditions were: SCALE, COMMER, SMART, SUPPLY

Inspection of the Venn diagram shows that the INUS conditions for ‘SUCCESS1’ were:

- SMART, as part of the ‘SCALE*COMMER*SMART configuration (distinguishing between the cases of ‘Hoare Lea’ and ‘Considerate’)
- ~SCALE, as part of the ‘~SCALE*COMMER*~SMART*~SUPPLY configuration (distinguishing between the cases of ‘EnergyPro’/‘Joule Assets’ and ‘Hoare Lea’).

This shows the importance of smart meter data in contributing to one set of more successful projects (i.e. those that offered relatively light touch services and therefore easily scalable), and also the importance of in-depth, non-scalable services for those projects that did not use smart meters and were not linked to energy suppliers.

INUS analysis for SMEBARR

Figure 10: Venn diagram for 'crisp' dataset SMEBARR (replicated from Step 4 above)

000			100 'Qbots'
	001	101	
	011	111 'EnergyPro' 'Hoare Lea' 'Joule Assets'	
010 'Considerate' 'Element Energy'			110 'arbnco' 'BRE'

Grey shading indicates that SMEBARR = 1

Causal conditions were: BIG, CLEAR, SPEND.

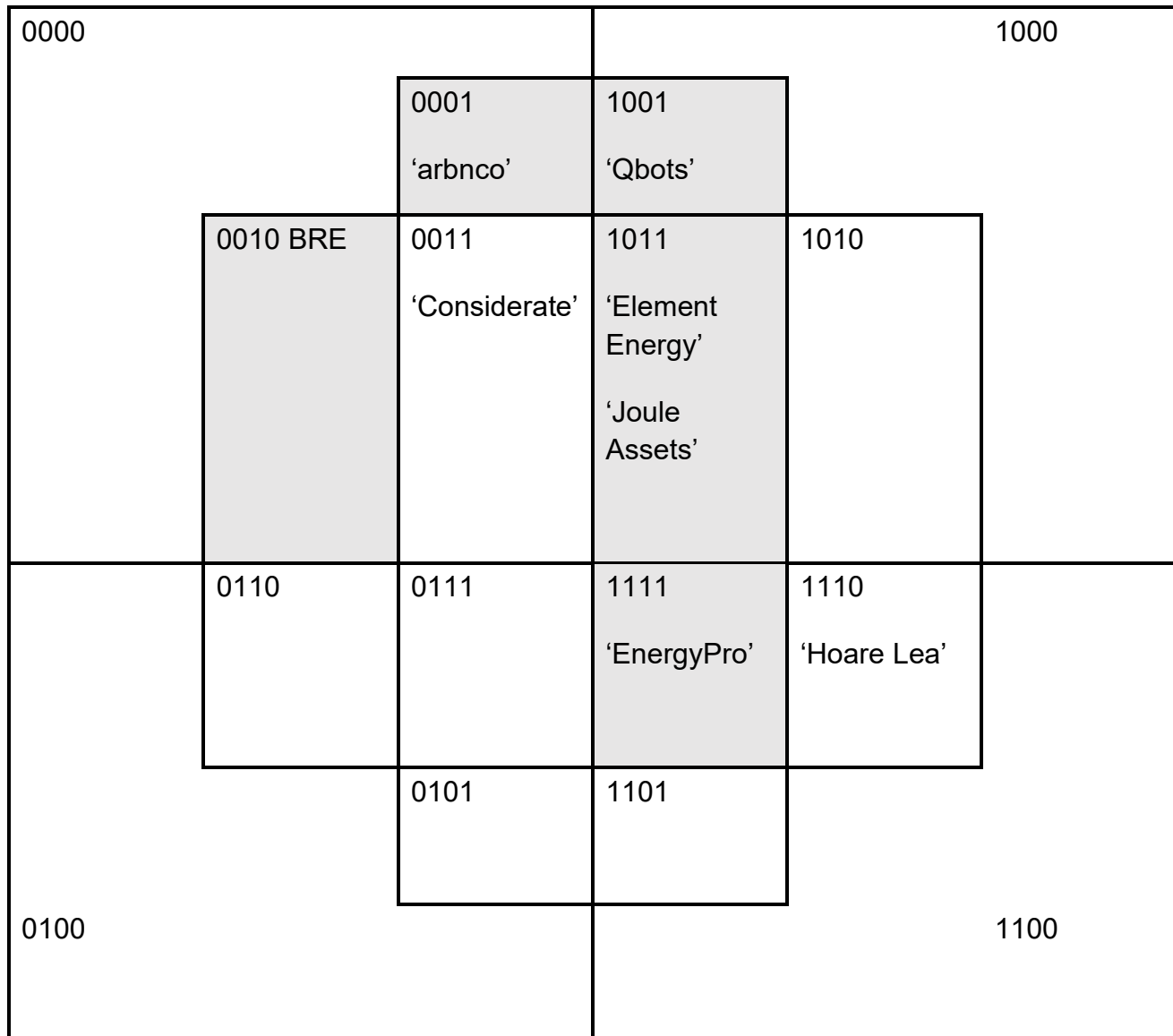
Analysis of contiguous areas on the Venn diagram with different outcomes shows that the INUS conditions for 'SMEBARR' were:

- SPEND, as part of the 'BIG*CLEAR*SPEND' configuration (distinguishing between the cases of 'EnergyPro'/'Hoare Lea'/'Joule Assets' and 'arbnco'/'BRE')
- ~CLEAR, as part of the BIG*~CLEAR*~SPEND' configuration, distinguishing between the cases of 'Qbots' and 'arbnco'/'BRE'.

This analysis shows the importance of focusing on SMEs with high energy spend in order to tackle a wide range of SME barriers to energy efficiency, for those projects offering larger energy efficiency measures with a clear, well-specified offer. It also shows the importance of the breadth of 'Qbots' offer (which included flexibility and tariff switching elements) in enabling them to overcome multiple SME barriers to energy efficiency despite not targeting high energy spend SMEs.

INUS analysis for RELATIONSHIPS

Figure 11: Venn diagram for 'crisp' dataset RELATIONSHIPS (replicated from Step 4 above)



Grey shading indicates that RELATIONSHIPS = 1

Causal conditions were SOLAR, CARBON, SEGMENT, CHANNEL

Analysis of contiguous areas on the Venn diagram with different outcomes shows that the INUS conditions for 'RELATIONSHIPS' were:

- CHANNEL, as part of the 'SOLAR*CARBON*SEGMENT*CHANNEL' configuration, distinguishing between 'EnergyPro' and 'Hoare Lea'.
- ~CHANNEL, as part of 'BRE's '~SOLAR*~CARBON*SEGMENT*~CHANNEL' configuration, distinguishing between 'BRE' and 'Considerate'.
- ~SOLAR, as part of 'arbnco's '~SOLAR*~CARBON*~SEGMENT*CHANNEL' configuration, distinguishing between 'arbnco' and 'Considerate'.

- SOLAR, as part of ‘Element Energy’ and ‘Joule Assets’s ‘SOLAR*~CARBON*SEGMENT*CHANNEL configuration, distinguishing between ‘Element Energy’/‘Joule Assets’ and ‘Considerate’.

This analysis is difficult to interpret and not particularly helpful. It shows that ‘CHANNEL’ and ‘SOLAR’ were key to establishing customer relationships in some configurations, but that the absence of these factors appears to have contributed to the outcome in other configurations.

Interpretation of QCA analysis

Overview

The QCA analysis provided insights into the causal conditions that influenced various aspects of project success. There were two main limitations to this analysis: firstly, the small number of pilots taking part in the BASEE programme and used for this analysis; and secondly, the use in the QCA analysis of variables that were developed through the evaluation team’s subjective assessment of evaluation evidence. The evaluation team’s response to the first limitation was to ensure that QCA findings were carefully triangulated against evidence from other sources during the synthesis process. The response to the second limitation was to ensure that the assessment of QCA variables was informed by a joint analysis workshop attended by multiple members of the research team and by a representative from the Department, ensuring that differing perspectives had been considered. Overall, the QCA analysis generated findings that ‘made sense’ to the evaluation team in the context of wider evaluation evidence.

The evaluation team’s interpretation of the QCA findings on the three variables analysed above (SUCCESS1, SMEBARR and RELATIONSHIPS) is set out below. This has informed relevant elements of the evaluation report.

Interpretation of QCA findings on causal conditions influencing the viability of business models (‘SUCCESS1’ analysis)

The QCA analysis of the causal conditions observed for ‘less successful’ (‘BRE’ and ‘Hoare Lea’) compared to ‘more successful’ (‘arbnc’, ‘Considerate’, Element, ‘EnergyPro’, ‘Qbots’ and ‘Joule Assets’) projects – in terms of viability - showed that:

- In all cases, the more successful projects had a project team that were actively seeking to develop a commercially viable model that would become self-funding.
- Where projects depended on access to smart meter data, the more successful projects either had an easily scalable model which was low-cost to roll out OR they had developed a partnership with one or more electricity suppliers (which would facilitate access both to customers and/or smart meter data).
- Where projects did not require access to smart meter data and were not in partnership with electricity suppliers, they still developed more successful projects provided the team was actively seeking to develop a commercially viable model. However, these involved more intensive delivery of services to SMEs and were higher cost to roll out (hence less easily scalable).

The evaluation team's interpretation of the SUCCESS1 results is that the more successful or viable projects either focused on intensive delivery of services to SMEs that did not depend on smart meter data (and was not readily scalable), or they used smart meter data in combination with an easily scalable model or a partnership with an energy supplier. All the more successful projects were led by a project team that was actively seeking to develop a commercially viable model that would become self-funding.

The 'INUS' analysis for SUCCESS1 showed the importance of smart meter data in contributing to one set of more successful projects (i.e. those that offered relatively light touch services and therefore easily scalable), and also the importance of in-depth, non-scalable services for those projects that did not use smart meters and were not linked to energy suppliers.

Interpretation of QCA findings on whether pilots sought to address the SME barriers that underpinned the rationale for BASEE ('SMEBARR' analysis)

QCA was used to analyse the causal conditions observed for projects that did and did not attempt to tackle the main barriers experienced by their SME customers (such as behavioural barriers; capital barriers; hidden cost barrier; lack of time barrier; lack of expertise barrier; lack of trust barrier; split incentive barrier). No assessment was attempted of how successfully the projects overcame the SME barriers, since the projects were not sufficiently advanced to assess this.

The 'causal condition' that was observed for all the projects that attempted to tackle the main barriers for SME customers was:

- These projects offered costlier investment packages (with or without smaller measures and easy wins).

In most cases, the projects also had:

- A clear vision of their offer and their target group; and
- Targeted SMEs with energy bills above a certain cost threshold and/or in energy-intensive sectors.

The 'SMEBARR' findings suggest that these projects could only attempt to address the deep and multiple nature of SME barriers if they could sell costly investment packages that justified the level of support required to address the barriers. Having a clear vision of their offer and target group and targeting SMEs with higher energy bills or in energy-intensive sectors, helped to achieve the goal of selling more costly investment packages.

The 'Qbots' project attempted to address multiple SME barriers despite having an offer that was complex rather than clear (linked to tariff switching and flexibility) and despite not explicitly targeting high energy spend SMEs. This suggests that the revenues from 'Qbots' wider offer enabled the project to tackle a relatively wide range of SME barriers despite not having a clear offer and not targeting SMEs with a higher energy spend.

The INUS analysis for 'SMEBARR' showed the importance of focusing on SMEs with high energy spend in order to tackle a wide range of SME barriers to energy efficiency, for those

projects offering larger energy efficiency measures with a clear, well-specified offer. It also showed the importance of the breadth of 'Qbots' offer (which included flexibility and tariff switching elements) in enabling them to overcome multiple SME barriers to energy efficiency despite not targeting high energy spend SMEs.

Interpretation of QCA findings on establishing relationships with SME customers ('RELATIONSHIPS' analysis)

Successful establishment of relationships with SME customers was assessed not just in terms of the number of potential SME customers attracted to the project, but also whether these customers progressed through the pipeline towards delivery of measures.

All projects used messaging around the reduction of energy costs when engaging with SME customers, and the QCA analysis identified three additional causal conditions for successful engagement, where pilot projects:

- Had a good understanding of the customer segments they were targeting.
- Used intermediaries as channels to reach their targeted customer segments (such as working via Local Enterprise Partnerships (LEPs), local authorities, energy suppliers, tourist boards and landlords rather than relying solely on direct marketing to SMEs.
- Offered solar photovoltaics (PV) to SMEs, in addition to energy efficiency measures, as a way of attracting interest from SMEs.

Most of the 'successful engagement' projects exhibited all three of these success factors but there were exceptions. Specifically, arbnco and Qbots did not have clear customer segmentation and focused on energy cost savings rather than carbon reductions but did make effective use of trusted intermediary channels to reach customers. Arbnco were not offering solar PV to SMEs but Qbots were doing so. Also, BRE focused on a clear customer segment (care homes) but did not show the other causal conditions.

Some of the successful projects used messaging around Net Zero and carbon reductions in addition to messaging around 'reducing energy costs', but the QCA analysis found that this was not critical to successful SME engagement.

It is interesting to note that solar PV, while not within the Department's intended scope of energy efficiency measures, may have played a role in encouraging SMEs to engage with the pilot projects. Effectively, some of the pilot projects have delivered 'bundles' of measures comprising solar PV plus energy efficiency measures.

The 'INUS' analysis for successful SME engagement did not provide useful results. It showed that using intermediary channels and offering solar photovoltaics were key to establishing customer relationships in some configurations, but that the absence of these factors appears to have contributed to the outcome in other configurations.

Emissions / energy modelling

The BASEE energy and carbon modelling had two principal aims:

- Verify the claimed energy saving and Greenhouse gas (GHG) emission reductions of each of the projects.
- Verify the estimate of the cumulative energy savings and GHG emission reductions of each project up to the end of June 2021, over the next five years and up to 2030 provided by the participants for each project.

The first of these goals was considered to be the priority for the evaluation and it was envisaged that this could be approached in one of two ways:

1. Direct method review: If a project could share comprehensive information relating to how their calculations and projections had been made and all the input data and assumptions used, a satisfactory verification could be achieved by review and approval of the method used, meeting the first aim with minimal modelling complexity. However, if the review raised concerns about the project's approach, no alternative prediction of the impact would be generated. It was also possible that projects may have viewed their calculations as sensitive intellectual property, or complex models may have been employed which could be time consuming to review individually and result in inconsistent methods being applied.
2. Parallel evaluation: an independent, parallel calculation of the expected savings based on contextual and energy data provided by the project and comparing this with the project's projected saving. The benefit of this approach was that the project team would retain control of the method and any assumptions used in the parallel calculation, and in the event that the project's estimates were considered unreliable, an alternative quantitative estimate of the impact would be generated. The disadvantage is an increased modelling complexity and need for quality assurance.

After discussion with the project teams, the direct review method was the preferred approach. This is because the Covid-19 pandemic had already disrupted the project implementation timeline and parallel evaluation would result in further delay to the energy savings and GHG reduction modelling.

Approaching the evaluation using the direct method review required a degree of flexibility to accommodate the possible wide range of approaches that may be used. The core principles of this review were as follows:

- Identify and evaluate the calculation method used – is the calculation sound?
- Identify and evaluate the quality of, and any processing of, quantitative input data sources (e.g. energy data, floor area, equipment ratings) where these are based on actual reference information or measurement – is good quality data being collected and is it being handled robustly?

- Identify and evaluate any assumptions used – how much uncertainty is introduced to the result? This will incorporate considerations of persistence of measures, which itself has two facets: the technical persistence of measures and business churn/building change of use.
- Identify the source of emissions factors adopted for estimating GHG emissions reduction.
- Identify and evaluate uptake projections and quantify sensitivity to different assumptions.

Table 27 below shows the key parameters that were reviewed for each project’s energy savings and GHG emissions reduction calculation.

Table 27: Energy savings and GHG emission reduction review – key parameters

KPI data from participants	Level	Units
Participant estimated energy savings (2021, 5 year and to 2030)	Project	kWh
Participant estimated GHG savings (2021, 5 year and to 2030)	Project	tCO2e
Contextual data for Energy Conservation Measure (ECM) saving calculations		
Building type	Site (whole building or part of building)	Space type
Floor area	Site	m2 Gross Internal Area (GIA)
Main heating fuel	Site	Text
Typical building occupancy	Site	Hours of use and number of occupants
Occupancy impact of Covid 19 / Reduction in operating hours	Site	Hours of use and number of occupants Anticipated return to normal date
Energy Conservation Measures (ECMs) recommended	Site	List
Energy savings of ECMs by fuel/source	Site	kWh/yr.
Energy saving calculation / Measurement and Verification (M&V) approach - Input	By site or ECM	Text

KPI data from participants	Level	Units
parameters, Assumptions, Conversion factors, Reference sources, Calculation method		
ECMs planned/ in progress/implemented	Site	Text
Estimated 2021 energy savings by fuel/source	Site	kWh
Estimated 2021 GHG savings by fuel/source	Site	tCO ₂ e
Commercialisation / scale up		
Explanation of scale up assumptions to 2030	Project	Qualitative
Global modelling assumptions		
Emissions factors	National	tCO ₂ e/kWh
ECM Persistence factors	National	Years
SME business churn/change of use	National	% of stock

Each project was reviewed individually against this framework. The results were compiled into tables to summarise the impact of the programme as a whole. Some ‘parallel evaluation’ was required for the forecasting aspect (2025 and 2030) where project information was absent or weak in this area, requiring further data collection / dialogue with the projects to mutually agree appropriate assumptions. The key output tables are shown in Table 28a and 28b.

Table 28a: Energy savings model – anticipated summary outputs

Energy savings (MWh/yr.)	Cumulative - reported			
	Projects	2021	2025	2030
Qbots				
Energy Pro Ltd				
BRE				
Hoare Lea				
Arbnco				
Considerate				
Element Energy				
VRMTech				
Total				

Table 28b: GHG emission reduction model – anticipated summary outputs

Projects	GHG emissions reduction (tCO2e)		Cumulative - reported	
	2021	2025	2025	2030
Qbots				
Energy Pro Ltd				
BRE				
Hoare Lea				
Arbnco				
Considerate				
Element Energy				
VRMTech				
Total				

Based upon the calculations provided in final pilot reports, SME uptake projections could be calculated for six of the eight pilot projects. Each pilot team submitted a calculations spreadsheet containing the emissions factors used by each consortium to estimate the equivalent carbon savings that could be achieved by implementing the energy conservation measures. Wherever it was observed that inaccurate emission factors were used by the consortia, these were amended, and the carbon savings were remodelled independently. It should be noted that this stage of the process often required multiple iterations / correspondence between the evaluation and pilot project teams to provide further clarification on the savings and assumptions. The review of energy and carbon projections by Phase 2 projects enabled a RAG rating of the uncertainties in the analysis, across: the calculation method, quality and quantity of data, assumptions, and uptake projections. The assessment concluded that across the pilots, the savings projections could not be robustly verified or modelled. This was for several reasons:

- The projections were based upon the pilots’ own estimations of how many SMEs will engage and implement measures as a result. There has not yet been sufficient evidence of SME appetite to provide confidence in these estimates.
- Forecasted carbon savings were not disaggregated by energy efficiency measures.
- Linked to this, and as highlighted in the evaluation report, there remain uncertainties as to the long-term commercial viability of the pilot business models.
- Whilst EPC and user data was collected by some pilots, for other’s data was captured by third party surveyors or limited data was collected.
- Some pilots made assumptions about operating hours, appliance ratings and measure savings that mean projections for energy and carbon savings are very unlikely to be 100% accurate.
- It is possible, even likely, that marketing will be targeting similar groups, meaning a strong likelihood of duplication in projections between pilots. For this reason, it was not possible to aggregate the energy saving and carbon saving projections across the eight pilots into an overall total for BASEE.

Had the data been viable, to generate a correct model for the reduction in carbon emissions, the conversion factors to be used for electricity were “long-run marginal commercial”, as published by the Department in Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal (June 2021). The conversion factors for natural gas to be used in this model would have taken from table 2-a of the same publication.⁸ These factors would have been used to model the GWh and KtCO₂e savings for each year up to and including 2031.

Because of the aforementioned limitations with the data, robust modelling was not possible and therefore quantified emissions reduction impacts are not presented in the evaluation report.

Cost Benefit Analysis (CBA)

The aim of the analysis was to be able to produce outputs including estimation and evaluation of:

- Net Present Value (NPV)
- Benefit-Cost Ratio (BCR)
- Payback periods.

Table 29 reproduces a summary of the data required to complete the Cost-Benefit Analysis. Unfortunately, due to a lack of information being available across a number of strands, it was

⁸ These tables can be found at:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1024043/data-tables-1-19.xlsx

not possible to follow the original method for data collection/inputs. The key reasons driving the data limitations were:

- Data was not provided by the projects to show the impact of SME energy efficiency activity within the trial period
- Forecasted carbon saving disaggregated by energy efficiency measures were not possible for Verco to calculate.
- Some of the benefits associated with the future forecast may not be from SMEs, as half of the projects all suggested that they would not confine themselves to dealing with SMEs.
- Subsequently, it is not possible to provide monetised cost forecasts due to a lack of information about which types of energy efficiencies are being taken forward and by how many SMEs.

The low response rates to the pilot SME surveys made extrapolation less reliable; in particular, the small number of SMEs responding to the surveys were likely to be, in terms of the overall profile of the group, atypically engaged.

Each data source was given a RAG⁹ (Red, Amber, or Green) rating based on the quality and the amount of the information which was actually available. In light of this, Table 29 provides an update on the original method proposed and explains what assessment was possible, and how this was carried out. Due to the reasons set out, it was not possible to capture the hard quantitative outputs stated above. Instead, the assessment focused on the carbon estimates provided by the projects and adjusted by Verco. The cost assumptions were assessed on a qualitative basis.

⁹ Red = no or little information available and no influence on the CBA method/results. Also, even where data/information was provided, it could not be used due to quality or the number of responses.
Amber = Information was provided, or wider research was collated, but issues with quality.
Green = Justifiable evidence was provided which could be used as part of the CBA analysis.

Table 29: Summary of data available to inform the CBA analysis

Data Source	Information Need	Use in CBA	Comment	RAG rating
Department for Energy Security and Net Zero	Costs of development and administration of BASEE, values by year	Costs Modelling	The Department provided a breakdown of costs of development and administration and explained that they were likely to all be incurred in 2020.	
	Investment in feasibility studies and pilots, values by year	Costs Modelling	Feasibility studies and pilot costs provided within the above cost breakdown from the Department	
	Research insights on % of all SMEs which invest in energy efficiency each year	Wider Narrative	Hatch researched the impact of SMEs investing in energy efficiency to help determine the level of deadweight. This drew on published evaluation evidence.	
	Research insights on % of all SMEs unable to access external finance for EE investments and the extent to which that has been an obstacle	Wider Narrative	As part of the wider context, Hatch looked at reasons why SMEs are unable to invest in energy efficiency measures, building upon the reasons stated in the project reports. This also influenced the deadweight values used given the current escalation in energy costs.	
	Research insights on typical hassle costs for SMEs wishing to invest in energy efficiency, and the extent to which that has been an obstacle.	Wider Narrative	Hatch looked at the evidence that hassle costs stop SMEs investing in energy efficiency and the associated hassle costs. This also influenced the deadweight values.	

	Research insights on payback periods from EE interventions delivered under other policy approaches	Wider Narrative	Hatch undertook research to look at the payback periods associated with EE interventions, in particular those relating to some of the interventions which could be implemented by the SMEs within each project. This evidence was drawn upon when assessing the associated costs of energy efficiency via wider research.	
Project Delivery Leads (via template forms)	Value of investment into feasibility studies, pilot	Costs Modelling	See above	
	Typical/mean average investment per SME for interventions supported through the project's product, and typical profile of investment (e.g. single year payment / payback over longer period to external finance provider)	Costs Modelling	The templates were not completed by the projects, which means this information was not included from this source within the analysis undertaken.	
Process Tracing Workstream (CAG)	Extent to which delivery of the BASEE projects can be attributed to the BASEE funding – used to formulate a central, high and low quantification of attribution.	Attribution of Impacts	Hatch were provided with a summary of the headline assessment of “to what extent are the projects themselves, and their outputs and outcomes, additional?” This evidence was used to support the deadweight assumptions.	
Energy Savings Modelling Workstream (Verco)	Energy and carbon savings modelling by year (2020-30) and by project, based on market forecasts by projects which have been quality assured by the Department	Benefits Modelling	Verco provided the energy and carbon savings to Hatch to use for the monetisation of carbon savings delivered by the scheme. As agreed by the Department, the model period changed to 2022 – 2031. On the basis of not fully understanding what	

	(and based on a central, high and low scenario)		underpins the values provided to Verco, the quality of the output was in the red-amber category for the RAG rating.	
	Assumptions behind the figures above including typical/mean average energy savings per business and number of businesses by year (which can be matched to associated data on typical/mean costs per business)	Matching Costs and Benefits	Verco were provided the number of SMEs per consortium on an annual basis to allow for comparison of energy efficiencies per SME per annum. SME numbers were not provided by two of the projects. However, for those provided, it could also not be verified by Verco and it is unclear how two consortium members were able to calculate electricity savings without knowing the number of SMEs which will implement energy efficiency measures. For this reason, mean average energy savings per business may not be accurate if calculated.	
Project and Wider Stakeholder Consultations Workstream (WM)	Insights from project / EE supply chain consultations on supply chain effects of projects	Co-benefits Analysis	The evidence presented by CAG showed that the wider categories were asked. The nature of the responses did not necessarily inform the quantitative evidence or evidence which could be used to support any underlying assessment of the CBA, but did provide some reassurances about the assumptions made.	
	Insights from project / innovation consultations on research/innovation effects of projects	Co-benefits Analysis	See above	
	Insights from projects on extent to which they have generated enhanced economies of scale, reducing EE	Co-benefits Analysis	See above	

	investment costs for SMEs as a result of the BASEE backed project (including quantification of savings this has generated where possible)			
	Insights from projects / financiers on impacts of BASEE projects in increasing willingness to lend for EE investments	Co-benefits Analysis	See above	
	Insights from projects on typical payback periods offered by their project packages for SMEs	Wider Narrative	See above	
SME Surveys and Analysis (led by WM)	Extent of SME rebound effect from new energy efficiency installations (e.g. heating the office more as it is cheaper to do so)	Benefits Modelling	This was not asked in the surveys to the SMEs. However, respondents often struggle to provide meaningful answers to this question anyway, and there is likely to be limited incidence of this as there was minimal installation of EE measures. It was therefore felt to be most sensible to use existing standard factors / assumptions for rebound.	
	SME Management and hassle costs associated with installing new technology	Costs Modelling	This was a question that project teams were asked to include in their surveys when these were reviewed by the evaluation team. However, several did not, and even where they did, there was little response due to the low level of action taken.	
	Wider benefits secured by SMEs from EE improvements, e.g. productivity,	Co-benefits Analysis	Again, reflecting the minimal levels of action taken, there were few responses to this question. Even where SMEs had taken some form of action, they had not	

	wellbeing, increased appetite for further energy efficiency investment		really expected, or sought to measure, wider benefits beyond energy bill savings; and for some it may have been too soon after taking action to properly assess benefits. One SME installing LED lighting said this had improved staff satisfaction, another implementing energy monitoring said this (or presumably the adjusted behaviours arising from it) had improved comfort, staff well-being / satisfaction, and productivity.	
	Attribution - Extent to which SMEs believe they would have gone ahead with EE investments without the BASEE-backed project (and whether it accelerated / affected scale of the investment)	Attribution of Impacts	The sample size for most of the projects was less than 10 responses and with two not providing any information to this question and one of the projects getting only one response. Due to the small sample size it was not clear how reflective the responses were of the wider SMEs market.	
	Extent to which SMEs have been able to access external finance to fund the investment, through the BASEE-backed project, and whether this made the investment feasible where it would not have been otherwise.	Wider Narrative	Some projects did not provide an external finance offer, or just signposted customers to grant schemes or similar. This may not have been reflective of all SMEs predicted to take up the different energy efficiency measures put forward by the projects.	
Green Book Guidance	Carbon intensity of energy saved, by year	Benefits Modelling	Hatch used the latest values produced by the Department to monetise the carbon saving per year.	

Evidence reviewed

Hatch reviewed the information provided by the Department, the projects and also adjustments to carbon and electricity values by Verco. Where possible, information from wider research was included to supplement any gaps in information.

Focus of analysis undertaken

The quantitative analysis undertaken focused on the carbon savings, based on information provided by the projects, which was assessed by Verco. Verco reviewed the electricity and subsequent carbon values, which were adjusted based on their knowledge of the likely benefits of the scheme. The Verco values formed the basis of the monetised carbon values used within the CBA assessment.

Disaggregation of results

It was not possible to provide a breakdown of the energy efficiency measure due to limited disaggregation of data provided to Verco, and, where it was provided, the small sample sizes covered. Since there was little information about the energy efficiency measures implemented, it was not possible to know the capital costs attributed to the energy efficiency measures and therefore to work out any payback periods or net present values. To complete this type of assessment, SMEs would need to provide the number of energy efficiency measures per annum, and the associated costs of these to install and maintain per annum. It would also need to be confirmed that the current carbon savings align with these types of energy efficiency measures implemented.

The attribution of benefit to the projects and to the SME was based on qualitative research to determine the level of deadweight of the scheme. The survey carried out by the projects with SMEs yielded limited quantitative evidence to understand what level of the interventions would have happened without the Department's scheme.

Outputs

Given the limited information provided by the projects, it was not feasible to derive the NPV, payback periods or BCRs for either the pilot programme or the future uptake to 2026 or 2031 (final year of the appraisal period). Each of the three outputs were dependent on a full appraisal of the cost or benefits estimates associated with the pilot programme or future forecast.

For the pilot, whilst costs incurred by the project were provided (i.e. the funding provided by the Department), there was missing information about costs incurred by the SMEs during the pilot period. For almost all of the pilot projects, no carbon saving values were stated in their finalised reports.

For the future forecast (up to 2031), projects did not provide information on a yearly basis the costs being incurred by them (the projects) or by SMEs (either on a total or yearly basis). Due to not knowing the exact nature of energy efficiency measures, it was not possible to replace

the information gap with wider research. The lack of costs means that it was not possible to calculate a NPV, BCR or payback periods.

Because of the aforementioned limitations (including with the emissions modelling), robust CBA was not possible and this was therefore not quantified in the main evaluation report.

This publication is available from: www.gov.uk/government/publications/boosting-access-for-smes-to-energy-efficiency-basee-evaluation-of-the-programme

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