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Non-Domestic Smart Energy Management Innovation Competition

Evaluation case study: E-CAT

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Executive summary

This report describes findings and lessons from the evaluation of E-CAT, an online web and mobile/tablet-friendly energy management application (app) piloted by Element Energy as part of the UK Government's Non-Domestic Smart Energy Management Innovation Competition (NDSEMIC). E-CAT aims to increase the user's understanding of their energy consumption and the ways they can reduce it. It was piloted across 58 small-medium retail and hospitality businesses and in 11 schools.

There is clear evidence from the evaluation that E-CAT has helped small retail and hospitality businesses to effectively track their energy use and wastage and, in some cases, save on their energy bills. Overall, the evaluation has a high level of confidence that E-CAT has contributed to energy savings in at least some sites.[1] However, evidence of behaviour change and savings in schools was more limited.

The majority of users surveyed or interviewed as part of the evaluation had actively used E-CAT and around half of those surveyed and a third of those interviewed reported behaviour change which they attributed to using the tool. In-depth energy consumption analysis conducted for two businesses who had self-reported changes to the way they used energy (after using the tool) indicated potential annual energy savings of between 5-10% for one business and 11% for the other. The qualitative data also indicates that use of E-CAT encouraged users to make upgrades, and to put more emphasis on energy efficiency when selecting replacement equipment.

Small retail and hospitality businesses made more frequent and meaningful use of E-CAT than schools. This may have been because E-CAT did not pursue any educational objectives, which might have given it an additional 'hook' with which to engage schools (such an approach has proven successful for other project developers piloting tools in the Competition). Amongst active users of E-CAT, the tracking of live[2] energy data was found to be the most useful and the most used of E-CAT's functions. However, overall, users liked E-CAT because it provided energy use information in a simple and user-friendly format.

The findings from this report suggest Element Energy could take forward the following points as it progresses its commercial offer, which may also be relevant for other innovators:

- Retain the simple-to-use and visually accessible format of E-CAT.
- Consider enhancing E-CAT's functionality by enabling equipment-level monitoring.
- Further tailor energy saving tips and recommendations to the premises and operations of each user. This is likely to make them more successful in driving behaviour change, as the usefulness of tips and recommendations is dependent on how relevant / actionable they are seen to be to the user's school or business.

[1] This is the conclusion reached from applying the evaluation's strength of evidence framework (see Chapter three). This framework triangulated various quantitative and qualitative data sources to give a level of confidence that savings had been achieved in some pilot sites.

[2] Live data in the context of this Competition describes energy consumption data at half hourly (or more detailed) granularity fed to the tool or platform on an on-going basis. Non-live data may provide the same level of granularity but is not updated on an ongoing basis, for example being uploaded to the tool or platform once a day (and in arrears).

- Highlight how benchmarks are calculated and what organisations they are based on, and what users can do to make sure they are as specific as possible to their business (by adding details to the ‘My Premises’ page). This may help convince users that the comparisons are accurate and reliable, making the benchmarking feature and ‘gamification’ element more likely to encourage behaviour change.
- Consider additional features that encourage engagement with students, teachers, and other staff in schools (such as educational elements), which may be required to encourage uptake of E-CAT and achieve the desired outcomes in schools.

1 Introduction

This report describes the findings and lessons from the evaluation of 'E-CAT', an energy management tool developed by Element Energy as part of the UK Government's Non-Domestic Smart Energy Management Innovation Competition (NDSEMIC). NDSEMIC (from here on referred to as 'the Competition') is an £8.8 million programme, funded by the Department for Business, Energy and Industrial Strategy (BEIS). It aims to maximise the potential for energy saving in three priority sectors (hospitality, retail and schools). To do this, it has developed energy management products and services that use smart meter data to help smaller organisations to manage their energy consumption better.

Nine projects were selected as part of the Competition to receive initial development funding. Seven of these passed through to the next 'feasibility and initial testing' stage. All seven project developers, including Element Energy, also went through to the final stage of the Competition (from February 2019 to January 2020) during which the innovations were piloted with small businesses and schools in a real-world setting.

This report is part of a package of reports published as products of the Competition, which also includes six other pilot evaluations, an overall final evaluation report, insights for innovators, user impact case studies and an evaluation technical report. These are available on www.gov.uk.

Overview of E-CAT

E-CAT is a web-based tool (which can be viewed on mobile phones and tablets, as well as desktops/laptops). It aims to increase users' understanding of their energy consumption and the ways they can reduce it, and to encourage users within an organisation (school, business) to talk to each other about energy use and energy supply (e.g. tariffs).

It targets retail and hospitality businesses, as well as schools, focusing in particular on small organisations with a low level of engagement with their energy consumption and a lack of skills and capacity to conduct energy management activities. Functionality for other sectors, such as offices, has also been added to E-CAT since the NDSEMIC Competition concluded.

Element Energy partnered with an energy supplier, Octopus Energy, to pilot E-CAT, and the majority of retail and hospitality businesses who piloted E-CAT were recruited by Octopus Energy from their customer base.

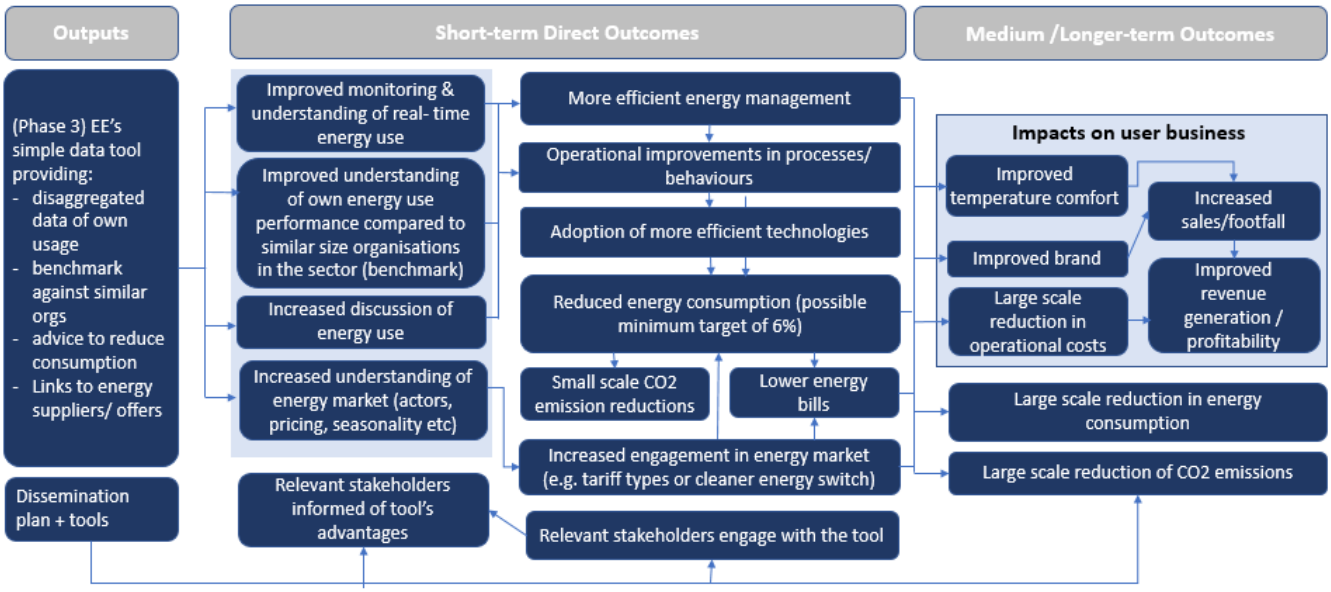
E-CAT provides users with information on:

- Their organisation's live energy consumption (in half hourly intervals) as both energy used (kWh) and cost (£).
- How this compares to organisations of a similar size and other characteristics (for example, an independent café compared to another independent café) – both a 'typical' business (in terms of energy use) and an 'efficient' business.
- How the user can save energy in their organisation. E-CAT gives users tips and recommendations on how to improve energy efficiency, which are tailored to their organisation.

The anticipated effects of E-CAT (its theory of change)

Figure 1 presents the theory of change underpinning E-CAT's design.[3] It sets out the functions of E-CAT (its 'outputs') and how these are expected to lead to the short-term and long-term impacts ('outcomes'). By the end of the pilot in January 2020, E-CAT was expected to be generating all of its short-term outcomes, as well as demonstrating potential for the medium and long-term outcomes to be achieved, as it was not possible to assess these given the pilot period. Chapter three assesses the extent to which each of these outcomes was achieved.

Figure 1: Logic model showing E-CAT's theory of change



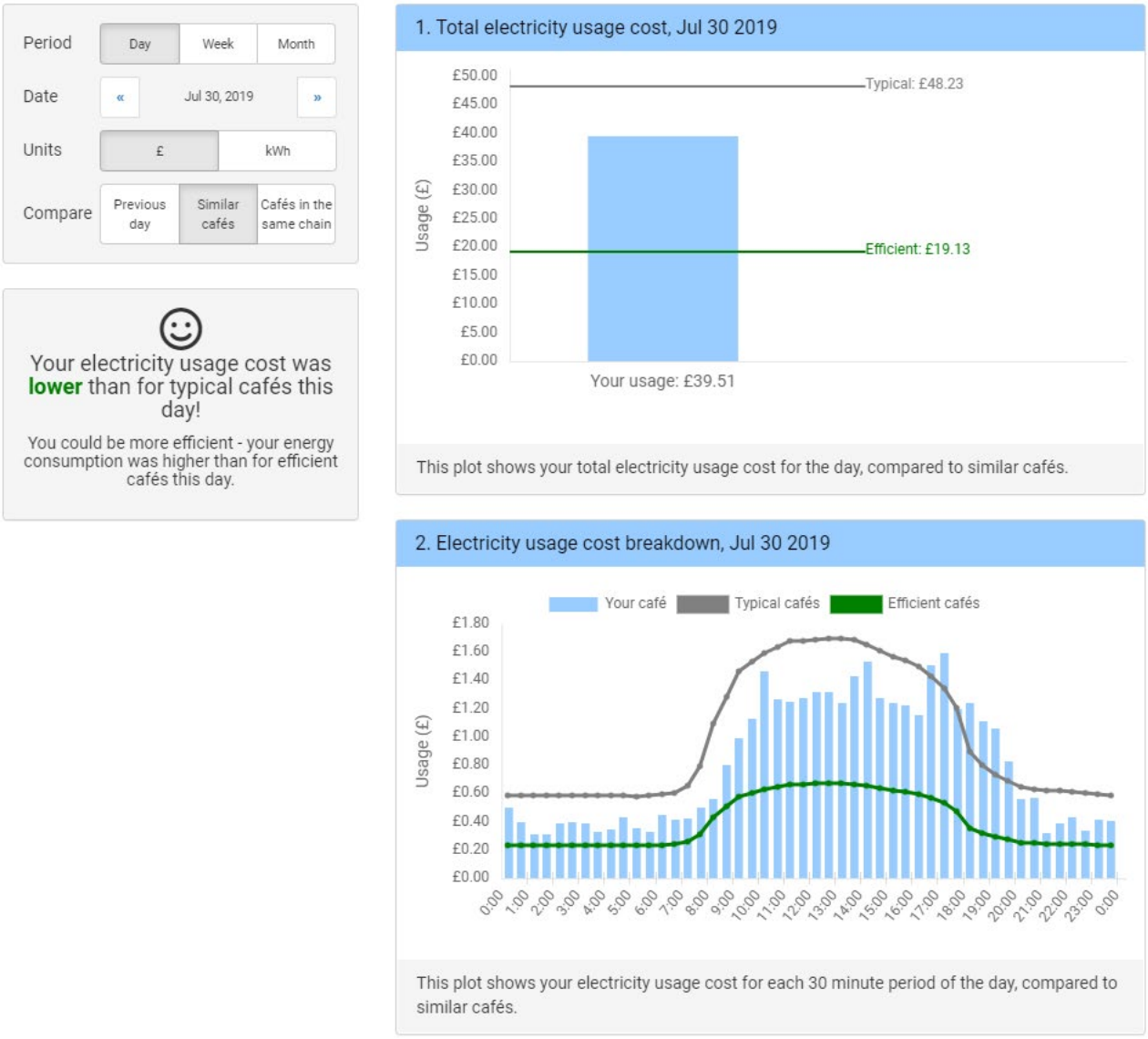
Key features of E-CAT

E-CAT comprises several webpages accessible to the user through a personal log-in:

- The live energy use and benchmarking functions of E-CAT are both provided on the '**My Usage**' page. The screenshots below show how users can see their live energy use and compare this to both 'typical' establishments and 'efficient' establishments. The benchmarks shown to each user are calculated from similar organisations in the same sub-sector (a café would be shown the average energy use of other cafés, for example). The benchmark calculations are further tailored to each organisation according to data entered by the user on a 'My Premises' page, which prompts them to provide information on the characteristics of their business (such as occupancy times and floorspace). Users can choose to have their energy usage and the benchmarks presented in either kilowatt-hours or pounds (£). They can also select the time interval that they want to view the energy usage in (half hourly / daily / weekly / monthly), so that, for example, users can see how their usage compares to similar organisations at different times of the day. For managers of multiple organisations registered on E-CAT (e.g. chain store managers), there is also a function to view the energy data for each organisation in the chain.

[3] A theory of change describes how change is assumed to come about through an intervention. It describes the connections between interventions and outcomes – often called 'causal pathways' or results chains.

Figure 2: E-CAT Screenshot



- The '**Efficiency Measures**' page provides users with tailored tips and recommendations, split into four categories: '**Maintenance & Servicing**' (such as cleaning ventilation systems regularly), '**Energy Management**' (such as switching IT equipment off overnight), '**Simpler Investments**' (such as switching general lighting to Light-Emitting Diodes (LEDs)), and '**More Demanding Investments**' (such as installing double glazing). Users are able to mark which tips they have implemented and set reminders for themselves to implement tips in the future, such as monthly notifications to clean air ducts, filters and fans.

In addition to website access, users were provided with:

- **Monthly summary emails** of the organisation's energy usage for that month and how it compared to other organisations; and
- **Coaching and technical support**: for the first month of E-CAT's operation, Element Energy sent users a series of short introductory emails, each one covering one key aspect of E-CAT's functionality. An introductory video was also embedded within E-CAT and ad-hoc support was also provided by the Element Energy team for participants who requested it, usually delivered via email or over the phone.

How E-CAT was piloted

E-CAT was piloted from late 2018 to January 2020. Element Energy identified and recruited users to pilot E-CAT through several different routes. A total of 69 schools and businesses were recruited for the pilot. All participants were offered a £50 incentive to take part in the pilot.

Qualitative research for this evaluation indicated that the cash incentive was a key reason for signing up for some users, rather than an environmental or energy saving agenda. This is an important consideration for the findings of this evaluation, as it gives greater confidence that any observed changes in behaviour were due to E-CAT, as opposed to an energy saving environmental agenda already put in place in the organisation.

In total, 58 retail & hospitality businesses and 11 schools were recruited into the pilot. 36 retail and hospitality organisations were recruited through Element Energy's partner, Octopus Energy, and 22 were recruited directly at networking events and webinars organised as part of the Competition. Nine schools were recruited following networking events, webinars or workshops organised as part of the Competition and via outreach to multi academy trusts, and the remaining two schools were recruited through an existing contact at a community energy company.

An additional 15 organisations signed up to take part in the pilot but then withdrew. Reasons for withdrawal included: technical issues with installing the required kit, connectivity issues that inhibited data transfer and requests from users to be withdrawn for other reasons (such as staff illness, and businesses closing or limiting operations).

For the majority of organisations, E-CAT was set up to collect energy data via 'clamps' – i.e. monitoring equipment that was attached to organisations' energy meters to access their data. In this case the energy data was fed automatically from the energy meter to E-CAT. For some organisations, the meter type was incompatible with the clamp so the user requested the energy data from their supplier and then sent it by email to Element Energy, who then uploaded it manually to E-CAT.[4]

The majority of pilot participants started the pilot during Phase 3 of the Competition, which started in February 2019, although some had access to E-CAT prior to this (in 2018). All participants of the evaluation fieldwork had E-CAT installed for a minimum of three months. On average, pilot participants had access to E-CAT eight months before the post-pilot data collection took place.

This evaluation

The research for this evaluation was conducted by Ipsos MORI in conjunction with their consortium partners the Carbon Trust and Technopolis Group. Ipsos MORI designed the evaluation approach and designed and delivered all aspects of the methodology, except for the energy consumption analysis which was designed and conducted by the Carbon Trust and quality assured by Technopolis Group.

The evaluation takes a theory and case-based approach which is described in Annex 1. The findings draw on insights from online surveys, completed by 16 pilot participants in total after

[4] Users typically received the data from their energy supplier via email in CSV format and then sent it to Element Energy as an email attachment.

the pilot had been completed; seven visits to SMEs and schools piloting the tool, at which the main tool user was interviewed and observations of the site were made by the interviewer; and two further interviews with the tool users in pilot SMEs were conducted by telephone. An energy consumption analysis (ECA) was conducted across organisations where energy data was available before, during and after the pilot period. Additionally, three organisations were selected for in-depth site-specific ECAs. Sites for visit and telephone interview were sampled purposively by the evaluation team, with sites selected to represent the range of organisations piloting E-CAT.

The evaluation, like E-CAT itself, was more successful in engaging businesses than schools, with three schools participating in the evaluation (one via a survey, two via interviews). The findings are therefore largely reflective of the ways in which E-CAT engaged and impacted on businesses. Where possible, the report highlights findings that apply to schools.

This report

The following chapters summarise the findings of the E-CAT evaluation in terms of the extent to which businesses and schools in the pilot engaged with E-CAT (Chapter two – How users engaged with E-CAT), and; the extent to which users experienced the intended effects of E-CAT (Chapter three – E-CAT pilot outcomes). The final chapter summarises the findings of the evaluation (Chapter four – Conclusions).

2 How businesses and schools used E-CAT

This chapter discusses how E-CAT users engaged with the tool during the pilot in terms of the profile of users, frequency of use, user experience and accessibility.

Anticipated and actual user profile

Element Energy designed E-CAT to target owners or managerial staff within organisations. This is because they hypothesised that these actors were the ones most likely to have a key role in energy management and decision-making on equipment purchases.

Most E-CAT users were either an owner / manager (in businesses) or an office or business manager (in schools). Within businesses, these users were typically heavily involved in day-to-day management, with oversight of every aspect of the business's operations and spending. While the office managers and business managers in schools did not necessarily have day-to-day energy management roles, they did have decision-making roles and the potential to influence others. The reasons engagement may not have led to actual behaviour change amongst these particular users (see Chapter three for discussion) was therefore related to usage and perceived value rather than lack of agency or authority to enact change.

Frequency of user engagement and interaction

Most business users surveyed (14 out of 15) had engaged with E-CAT at least once, with **over half (9 out of 15) using it monthly or more frequently.** The one school user surveyed had not used E-CAT.

To use E-CAT, users needed to log into the app. This tended to be more ad-hoc rather than prompted by the tool or driven by set activities or times (except for one case in which the user said it tended to be prompted by monthly account reviews). Usage tended to be more frequent initially when users were exploring the new data and investigating links to their activities, after which usage patterns shift to less frequent monitoring checks.

> *"Originally daily because it was novel. It was a new thing that we'd not seen before. And then, after a couple of months, it went to just monthly. That's all I needed to do. Are we doing okay?" – Business owner, Post Office*

> *"…when we were focussed on reducing our energy usage, I guess going through a mini-project, I was probably using it several times a month. Subsequently it's tended to be once a month to just have a quick look and see how we're going". – Business manager, large deli and restaurant*

User experience of E-CAT

User experience of live energy data

The evaluation findings suggest that users found the tracking of live energy data to be the **most useful and the most used** of E-CAT's core functions among pilot participants. Monitoring energy use in their organisation is something which users had typically not been able to do in detail pre-pilot, instead relying on monthly bills or statements from energy suppliers. Users were positive about how the energy data was accessed in the app and presented to them, and generally found it easy to understand and interpret.

> *"…as a monitoring tool, yes, you can't fault it. It was really good." – Business owner, Post Office*

Prompting behaviour change was highly dependent on E-CAT providing new information to users or known information but in a more engaging or applied way. There is clear evidence of E-CAT, and particularly the live energy data, achieving this, as users reported that it had told them things that they did not previously know about their organisation's energy consumption. Users found it particularly useful to find out the times of day at which they used the most energy, as they were then able to attribute to specific processes or equipment in the business or school.

> *"I'd never realised how much electric our kitchen was using, above the rest of the school. It was very good at showing us the times when we were using the most energy." – Office manager, Primary School*

Users were positive about the level of granularity of the energy data (users could see their energy use at half hourly intervals). A particular benefit of this was allowing users to see the impact of any changes they had made.

> *"…we've actually used it to, for example, switch something off for a period of time, and compare the usage on the day we did that to the equivalent day the week before, so we could see the impact." – Business manager, large deli and restaurant*

Most interviewees reported that they would continue to use E-CAT to monitor their energy use after the pilot had ended.

> *"…having used it, I prefer to have it always available." – Business owner, antique and furniture shop)*

User experience of comparisons to similar businesses (benchmarks)

The qualitative evidence suggests that benchmarks enhanced the utility of energy data for some users. Although some users had not paid much attention to the benchmarks or had not found them useful, some had engaged with them and seen clear benefits as a result. Reported benefits include:

- Allowing users to identify anomalies in their own usage, such as overnight spikes that stand out from trend data from typical establishment.
- Providing reassurance that they are not overspending.

A key limiting factor for engaging with the benchmarks for some users was a perceived lack of relevance to their own organisation:

> *"I didn't find it helpful anyway, really…people are in different circumstances to me and the sizes of buildings and all this sort of thing, it all makes a lot of difference, doesn't it…" – Business owner, small retailer*

Benchmarks are tailored to the organisation based on information they enter themselves about the sector they operate in and other characteristics of their business. However, some participants felt that their organisation could not be reliably compared to other organisations.

> *"I don't think that's relevant…[…] we're a hybrid retail and restaurant operation […] So, the amount of refrigeration we have in the business is probably like nothing else…" – Business manager, large deli and restaurant*

Benchmarks were not motivating to all users. Some participants who had usage that was significantly higher or lower than the benchmark saw it as being of limited value.

> *"I've looked at the similar premises occasionally, but, to be honest, I know it's going to be lower, so that's not really as much interest." – Business owner, coffee shop*

The findings above focus on the reasons for engagement/non-engagement with the benchmarks feature of E-CAT. The outcomes for those who did engage with benchmarks are discussed in Chapter three.

User experience of tips and recommendations

User experience of the E-CAT 'tips' function was mixed. Some users found the tips useful and had actioned these during the pilot. These include tips around how refrigeration was used within the organisation and tips on cleaning windows to reduce lighting requirements. In these cases, the tips had been actioned because they either told the user something new about how they could save energy, or because they provided a useful reminder of things they thought they should be doing anyway to save energy.

Other users had not engaged with the tips and recommendations after an initial review of them. A key limiting factor in this was their perceived lack of relevance to their organisation, either because they related to equipment or appliances that they did not have in their business, or because they would be too expensive to implement.

> *"The tips for us were too general…they weren't specific enough for us, so I don't think that we'd check the tips." – Business owner, Post Office*

> *"…there were some efficiency suggestions in there that might be useful, but, you know, the capital cost of them would be too hard to recover." – Business owner, antique and furniture shop*

Accessibility

E-CAT was broadly seen as being user-friendly, with simplicity and ease of use highlighted by users as particular positives during qualitative interviews. Participants generally viewed E-CAT as being easy to navigate and were able to interpret the data with limited support.

> *"It's so intuitive…It was just load it up, log in. Yes, it does what it does. It was idiot-proof, for want of a better word." – Business owner, Post Office*

The only source of confusion identified in qualitative research related to the background energy usage, with one user finding it difficult to understand how this differed from overall usage.

While adult users were broadly positive about E-CAT's usability, a potential issue within schools was the ease with which children could be engaged with E-CAT and its data. This could be a potential limiting factor in getting students to use and act on the information from E-CAT.

> *"I think they'd probably have to make it a bit more child friendly for the children to get something from it, for the children to be able to use it and know what was-, especially our age. The senior school children would probably be alright, but for our age group children, I think that to use that as a learning tool, I think you would need it to be a bit more child friendly." – Office manager, Primary School*

3 The results of the pilot of E-CAT

This chapter assesses the results of the pilot of E-CAT and the key factors that contributed to their achievement, as well as the factors that may have limited the success of E-CAT in some cases.

E-CAT was successful in generating at least some of its expected short-term results in most sites using the tool. At most sites, users gained a higher level of confidence in and understanding of how, when and where energy was used within their business. At several retail and hospitality organisations, the survey and site-visit evidence suggests that this led to more efficient energy management practices. However, within schools, while use of E-CAT led to some changes in energy monitoring, the effects of E-CAT on actual behaviour change were minimal during the pilot.

Immediate outcomes

Improved Monitoring of Energy Use

E-CAT was designed first to improve users' ability to monitor their energy use. It was expected that access to E-CAT would therefore lead to users increasing the frequency with which they monitored their energy use. Most of the organisations interviewed had started using E-CAT to monitor energy usage at different time intervals, including half hourly, whereas previously they had not monitored this in any way other than reviewing their monthly / quarterly bills and statements.

> *"Originally, we didn't but when I put the E-CAT thing on that is when I started watching it like a hawk." – Business owner, Post Office*

Users reported that, by monitoring their energy use through E-CAT, they were able to:

- Check for irregularities in energy use.
- Measure the impact of any changes they had made to their energy use.
- Check that they were generally not spending too much money on energy.
- Prioritise energy more than they had previously.

Most organisations consulted for the evaluation reported that they would continue to use E-CAT to monitor energy data following completion of the pilot where available (for some pilot sites, the E-CAT data was no longer available after the completion of the pilot period).

Improved understanding of energy use

E-CAT clearly improved users' understanding of energy use within their organisation by showing specifically how much energy was being used at different times of the day/week, out-of-hours energy use, and activities and equipment driving energy use. Improvements in users' confidence in their understanding of their energy use were evident amongst both the survey

and qualitative interviews.[5] While interviewees were generally aware of *which* pieces of equipment had high energy usage, they rarely knew (before using E-CAT) how much energy individual appliances or activities required, nor when the peaks and troughs were in energy usage throughout the day.

> *"Certainly, by doing the E-CAT trial it gave us a very good picture of the profile of our daily use. We could see clear patterns and correlate those to specific activities, like turning on the coffee machines in the morning, which are quite heavy energy usage. You're able to understand the pattern of usage and overlay it onto the pattern of your business basically". – Business manager, Large deli and restaurant*

As well as increasing their understanding of energy consumption, businesses also increased their understanding of how they could take action to reduce this through changes to equipment, processes and the building (10 of 15 survey respondents) or through changes to their own behaviour (9 of 15 respondents).

An additional benefit of being able to monitor energy usage more accurately is that it can help in the process of switching or negotiating with new suppliers or tariffs.

> "It is an accurate usage. When I'm negotiating new deals for different suppliers they'll say, 'How much do you use?' I'm going to tell them accurately because the data is on my phone. I haven't got to go back through all the records of all the meter readings, add it all up. I can just see because there's the total figure, that's how much I use." – Business owner, Post Office

Improved understanding of energy use performance compared to similar organisations (benchmarking)

There is strong evidence that pilot businesses improved their understanding of how their organisation's energy use compared to others after using E-CAT (although as discussed in previous sections, some users had not found this information to be useful). Over half (9 / 15) of the businesses responding to the survey reported that they were **more confident about how the energy use of their organisation compared to that of other similar organisations**. A particular added value for some pilot participants that had used the benchmarks was that it allowed them to identify anomalies in their own usage, which they could then further investigate.

> *"It graphs your usage over 24 hours, and I noticed on ours that the overnight usage wasn't tailing off in line with businesses that are similar to ours." – Business owner, Post Office*

This same business had used the energy consumption benchmarking function of E-CAT as a metric of operational performance – to provide reassurance that the business was operating as it should.

[5] Specifically, survey respondents from businesses reported an improved understanding of how much energy is used by their organisation out-of-hours (10 of 15 respondents); which activities and specific pieces of equipment use the most energy in their organisation (7 of 15 respondents); the times of day or night that their organisation uses most energy (5 of 15 respondents); and the days of the week on which their organisation uses the most energy (5 of 15 respondents).

> *"What was more interesting for me was how we compared within the same sector. If we can sit in the middle then I know we were doing alright, if we were going too high there was a problem somewhere." – Business owner, Post Office*

In another organisation, the benchmarking function created competition for the user to achieve lower energy use. This 'gamification' of energy data had – in the case of this user site – led to behaviour change.

> *"My goal is just to play that game and go, 'Right, okay, I've got to stay lower than that.' Because that feels good." – Business owner, workshop*

However, there is also evidence to suggest that having lower than average usage reported might discourage action in some cases (known as the 'boomerang' effect).

> *"Our energy usage was far lower than either of the other two categories…It makes me feel that we can't do much more than we're already doing, actually, and that there's not much point in trying to follow any further efficiency savings." – Business owner, antique and furniture shop*

Increased discussion of energy use and involvement of relevant stakeholders

Within the businesses piloting E-CAT, use of the tool sometimes involved multiple users who discussed the results of the tool and/or energy use as monitored through E-CAT. Business owners used the information provided by E-CAT to manage their employees' use of energy and (thus) improve operations within their organisation:

> *"…we ran through the whole thing and just went through with the management team that we used it to review energy usage, and briefed staff on certain things that they should and shouldn't do has made them more aware of it..." – Business manager, large deli and restaurant*

> *"I'll say to* her*, 'Did you not turn the boiler off last night? There's still a peak on it. Sometimes, you forget, don't you?' She'll remember and come back in and turn it off." – Business owner, coffee shop*

The results of the survey conducted amongst users supports this: around half of businesses reported that – after using E-CAT - they discussed **how their organisation could save energy** more often; just under half (7/15) said that they **discussed what activities or pieces of equipment in their organisation use the most energy** more often and just under half (7/15) also said that they **discussed when their organisation uses the most energy** more often.

There have also been examples of users telling other businesses or a central office for a chain about ways they can save energy as a result of engaging with E-CAT.

- One coffee shop business owner had realised a boiler was using lots of energy, and that they could switch it off at night: "*I've told a few people about the boiler, to, like, look because it saves a lot of money. Like, 'Look at what you can turn off overnight,' especially other business owners that I know."*
- A Post Office was given a new counter, which was also given to other Post Offices nationwide. E-CAT showed them that they were using a lot of energy overnight compared to similar businesses, and the user thought this was linked to the new counter, which has a touch screen counter with bright lights. They then got in touch with

> the central post office team, who told them how to turn it off, and also told other Post Office branches: "*Nationally people were leaving the screens on and because of what we were seeing and our overnight energy usage, it was like, 'Well, how can you turn the screens off?' The Post Office did a quick check and thought, 'Oh, yes. They can.' So, that was circulated nationally from what we saw."*

Just under half (7 / 15) of the businesses responding to this evaluation's survey reported that there was a **higher level of priority placed on energy management** within their organisation **since engaging with E-CAT**.

However, there were still cases where **the information from E-CAT did not get shared with anyone beyond the main user, despite there being other staff in the business who could also enact changes**. This is a particularly limiting factor in schools; neither of the participants interviewed had communicated with facilities managers or others in the school with oversight for managing equipment, nor to students or teachers about E-CAT. This lack of dissemination about the information, findings or implications of E-CAT and absence of other means of engaging staff and pupils with E-CAT, such as through gamification and lesson plans, is likely to be a factor in the lack of behaviour change reported in schools.[6]

Another limiting factor in schools may be communication between the user at the school and external stakeholders. One school had an office manager as the main user in their organisation, but responsibility for energy bills was with a finance director at a local authority. The user within the school did not see the school's energy bills and had not received any communication from the local authority about energy bills or costs, meaning they were disconnected from the potential impact of energy efficiency measures.

Operational changes and the adoption of more efficient technologies

There is strong evidence from this evaluation's survey of E-CAT prompting businesses to adopt more efficient technologies. Over half (8 / 15) said that their organisation has **implemented (or plans to implement) energy efficiency or clean energy measures** since engaging with E-CAT, with changes reported in a number of areas. Across these eight businesses, there were 22 examples of energy efficiency measures implemented or planned, and in 18 cases the businesses reported that this was implemented to some / a great extent **as a result of engaging with E-CAT**.

The qualitative data also indicates that engaging with E-CAT encouraged businesses to make upgrades, and to put more emphasis on energy efficiency when selecting replacement products.

> *"Taking more notice before we bought the heater… Where I'd normally have looked at the price and the suitability, I was looking at how much it cost to run, probably, as a priority, which I wouldn't have done before." – Business Owner, Coffee Shop*

> *"The fridges were all changed into better efficiency ones. That was always on the plan before we got the E-CAT, that just kind of spurred us on to do it." – Business owner, Post Office*

[6] Within one of these schools, issues with the smart meter clamping equipment meant that live energy data from E-CAT could not be accessed by the user; data was instead obtained from the energy supplier and uploaded to E-CAT on a monthly basis.

Most businesses surveyed (10 / 15) agreed that their organisation **has tried to reduce the amount of energy used at their organisation(s) since they started to engage with E-CAT**.

Where E-CAT had not necessarily told users something new, it had sometimes still served as a prompt for more efficient energy use.

> *"Probably things that we knew we should be doing but it reminded you, like consolidating fridges and turning them off when they're not required." – Business Owner, large deli and restaurant*

While there were some clear examples of improved energy management in some organisations, several users who were interviewed did not report making any changes in their business. A key reason for this was **a perception that there is not much they can change in their organisation in terms of energy management**. Two owners of small retail organisations consulted both considered their business simple in terms of type of appliances and equipment used and saw little scope for changes to the pieces of key equipment, such as lighting and heating.

> *"…I would have thought it would be more suitable for a bigger business where they could save, you know, energy in other ways than I can. […] You know, there's not a lot that I can do, really, to improve the way I use my energy." – Business owner, small retailer*

> *"…I looked at the efficiency suggestions, and there was nothing really that applied to me. I can understand how they could be useful of bigger businesses or other businesses where they have more energy consumption but, I need my lights and what else can I do…". – Business owner, antique and furniture shop*

Conversely, another two users running businesses, one with heavy machinery and one with multiple coolers / heaters, similarly felt unable to make changes because of the *complexity* of energy use within their business. Both of these users stated that they would have felt more confident in making changes had they had **access to equipment-level data on energy use**. Whereas users within businesses with just a couple of items using energy were able to 'test' their usage by switching equipment on and off (and monitoring the effects of this by tracking the live data); businesses with lots of energy using equipment felt unable to do this. One of these clearly stated that they would only be motivated to switch the equipment off if the tool could accurately predict / demonstrate the savings of doing so (so that the benefits of that could be weighed against operational costs or risks – e.g. the risk of forgetting to switch the fridge back on or the costs of training up staff to switch off equipment).

Practical barriers and the **cost** involved prevented businesses using the tool from making more substantial upgrades to equipment or buildings suggested in the tips section.

> *[On insulation / double glazing] "Not realistic for my business, you know, as I said, the capital cost/payback equation just doesn't work for this business." – Business owner, antique and furniture shop*

> *"We'd like to put insulation in, change the windows, but it's very expensive and also some of that stuff, this building's a conservation area […] so some of the stuff we want to do […] we can't." – Business owner, Workshop*

While improved energy management was reported by both retail and hospitality organisations, there is no evidence of improved energy management being adopted in any of the three

schools who participated in the evaluation. Evidence from the qualitative interviews indicates that cost was a key reason behind this.

> *"When we are looking for new things, electrical things and that sort of thing, we could maybe look for something that is more energy-efficient, but you tend to find the more energy-efficient, the more they cost, and when you're on a budget, which we are, it's not as though we've got money to spare because we don't, we have to go more for value for money rather than energy-efficient." – Office Manager, Primary School*

Two users consulted for the evaluation reported a low impact on their energy use: the businesses had been run by the users for a number of years with few changes to the businesses' operations. Both users said they already had a good idea of what used energy and how much it costs, which meant that E-CAT's ability to deliver new information was highly limited. This, again, underlines that **E-CAT benefitted users most when it provided them with new information**.

Medium-term outcomes: the effects of E-CAT on energy consumption and energy bills

Based on an assessment of the available evidence, there is a **high level of confidence that E-CAT contributed to energy savings in at least some businesses**. This is based upon the following sources of evidence:

- **Self-reported behaviour change**: Half (eight out of 15) of the pilot businesses responding to the evaluation survey stated that they had implemented (or plan to implement) energy efficiency or clean energy measures as a result of engaging with E-CAT. This was supported by evidence from three out of nine interviews with businesses at which users described making changes to improve energy efficiency due to information provided by E-CAT.
- **The perspectives of multiple users at a single site**: At two sites, more than one user was interviewed and they converged in reporting energy efficient behaviours that might be expected to lead to a reduction in energy use (which they assigned to using the tool).
- **Self-reported energy savings**: At one business, two users interviewed together converged in noting energy savings (observed in their bills).
- **Analysis of energy consumption trends across all participating sites**: This showed average reductions in energy consumption for schools (3%), hospitality (7%) and retail (1%) sites though it is not possible to firmly attribute savings to the tool without additional evidence.
- **In-depth analysis of site-specific consumption trends**: For two business sites, an analysis of energy data over the intervention period showed a reduction in energy consumption over the period of using the tool (approximately eight months), which could have been attributable to use of the tool. These observed reductions in energy use amounted to a 11% saving if sustained over the year for one business, and a 5-10% saving is sustained over the year for the other. At both of these sites, users reported that they had made energy management improvements in their business as a result of using E-CAT, including switching off appliances and lighting improvements.

- The **assumptions underpinning the overall E-CAT theory of change** were tested at all sites, and for most sites these occurred as anticipated (for example, the assumption that E-CAT was able to provide new information to users).
- For the businesses that had reported making changes to become more energy efficient, possible **alternative theories of change** (such as a change in building/business operating hours or reduced building use) were also investigated and at these sites, E-CAT appeared to have been the key driver of change.
- For each Competition tool, the evaluation assessed the extent to which the tool had contributed to energy savings at pilot sites, and the strength of the evidence supporting this. Eight 'types' of evidence were defined and scored for strength (see Table 2 in Annex 2). A higher score was given to evidence which was observed (e.g. energy consumption data) and triangulated (displaying a convergence in qualitative evidence and energy consumption data) or identified at a larger number of sites.
- An overall score was derived to give an **average confidence rating in the evidence available: E-CAT scored 2.75, i.e. there is a 'high level of confidence that the tool has contributed to energy savings in at least some sites'**. The scores and associated confidence ratings are outlined in Table 2 below. Annex 2 provides more detail on how the score was derived.

Table 2: Energy savings confidence ratings (E-CAT rated 2.75 'high level')

0- 1	Low level of confidence that the tool has contributed to energy savings at any site*
1 – 1.99	Medium level of confidence that the tool has contributed to energy savings in at least some sites
2 – 2.99	**High level of confidence that the tool has contributed to energy savings in at least some sites**
3 to 4.5	Very high level of confidence that the tool has contributed to energy savings in at least some sites

** A low level of confidence does not preclude the tool from working in the future, if some adjustments / lessons learned are taken on board.*

Taking a case-based approach below, the remainder of this section explores in further detail the factors which drove energy savings at two sites. These organisations were selected as case studies as they had (i) robust energy data relative to other organisations, and (ii) had reported making changes to their energy management as a result of engaging with E-CAT in either the survey or the qualitative interviews. The ECA indicates that reductions were achieved in both of these sites, and these reductions correlate with changes in energy management, which users directly attributed to engagement with E-CAT.

Business #1: Retail business

User Role: Business Owner | **Pilot start:** May 2019

Changes made: The participant completed the evaluation survey and indicated that they used E-CAT on a weekly basis, and *strongly agreed* that their business had tried to reduce the amount of energy used since they started to engage with E-CAT. They said that they had made lighting upgrades in their business, which were 'to a great extent' as a result of using E-CAT. They also reported that there was a higher priority on energy management within their business, and a much higher level of confidence in understanding their energy use and ways they could change it to reduce consumption compared to before the pilot.

Energy data analysis: This evaluation's review of the businesses' energy data showed a reduction in energy consumption observed over the pilot period which would amount to an 11% saving if sustained over the year. As there was no pre-pilot energy data for comparison, energy data for the first four months of the pilot was compared to energy data in the last two months of the pilot,[7] controlling for the impact of weather. As there was no historic data to allow for comparisons between similar times of the year nor a known date for when the upgrades were made, the evaluation could not be certain that reductions observed were due to the pilot of E-CAT. However, the energy reductions do appear to be of a magnitude that is consistent with the changes reported by the user.

Business #2: Mixed retail and hospitality business

User Role: Business Manager | **Pilot start:** May 2019

Changes made: The participant took part in a qualitative interview and said that they used E-CAT about once a month (although they had used it more frequently when they first had access to it). They said that they had made a number of energy management improvements in their business as a result of using E-CAT, including:

- Turning off lights when not in use.
- Moving food from two storage fridges to a single fridge and switching the other fridge off.
- Moving storage fridges to a cooler location in the organisation.
- Switching cold storage room off overnight.
- Turning off kitchen grills when not in use.
- Replace halogen lights with Light Emitting Diodes (LEDs).

Energy data analysis: This evaluation's review of the businesses' energy data over the pilot period potentially showed a positive impact of E-CAT. As there was no pre-pilot data for comparison, energy data for the first two months of the pilot was compared with energy data for the final six months of the pilot.[8] A general trend of reducing consumption was observed over the pilot period which would amount to a 5-10% saving if sustained over the year. The business had

[7] These timeframes for comparison were used as there was a clear point of noticeable change in the data after four months, which is assumed to be the point at which the reported changes were implemented.
[8] These timeframes for comparison were used as there was no confirmed intervention start date while a two-month baseline period was assessed to provide adequate data to allow for robust comparisons.

reduced overnight consumption, which was consistent with the changes to energy management described by the user. However, due to a lack of historic data to allow for comparisons between similar times of the year and confirmed dates for when the reported changes and upgrades were made, it is not possible to firmly attribute the observed reductions in energy use to E-CAT.

Other users consulted in qualitative interviews also report that they had experienced energy savings since using E-CAT which they attribute to the tool:

> *"The one thing that we have noticed is the evening usage has dropped…When we knocked everything off, it was literally the overnight power bill because everything was left on. The till was left on, the lottery machine was left on, the Post Office counter was left on, the storeroom lights were left on. So, knock them all off, instant saving." - Business owner, Post Office*

> *"…it has gone down since we've switched the boiler off, definitely." – Business Owner, Coffee Shop*

> *"Yes, the bill has gone down, yes. Even having the heater on, the monthly bill is still less than having the boiler in and out…" – Business Owner, Coffee Shop.*

Longer-term outcomes

This section considers E-CAT's progress towards the longer-term impacts outlined in its theory of change. It was not expected that such outcomes would be realised in full by the end of the Competition, as most pilot participants who participated in the evaluation research had been using E-CAT for less than a year.

In the long-term, it was expected that E-CAT would:

- Generate energy savings (and CO2 reductions) through ongoing energy consumption reductions for the piloting businesses and wider take-up of the tool; and
- Contribute to increased customer / staff comfort, reduced operational costs and green branding for the businesses using it.

There is strong evidence from both the survey and qualitative interviews that some businesses have improved energy management as a result of engaging with E-CAT, with an associated reduction in energy consumption in some cases. Energy consumption analysis of two organisations indicated that they achieved energy savings that, if sustained, would equate to between 5-11%[9] annually, and it is possible that savings would increase over a longer engagement period with E-CAT.

The qualitative interviews and surveys both indicated that some businesses would make further changes to energy management after the pilot had ended, and the qualitative research strongly suggests that users will continue to engage with E-CAT, albeit less frequently than they had initially in some cases. This intention to continue engaging with E-CAT among users gives further confidence that larger scale energy reductions will be achieved.

[9] As discussed in Chapter three, data limitations mean it is not certain this was as a result of using E-CAT.

A potential limiting factor in organisations continuing to make reductions in usage is the extent to which E-CAT can provide new information to users that they can act upon. The most substantial changes made tended to be in the early stage of engagement with E-CAT, when users discovered things they had not previously known, such as appliances left on overnight which they subsequently turned off. A key dependency in ensuring that E-CAT continues to drive energy saving action is therefore the ability to provide actionable tips and recommendations on an ongoing basis.

The achievement of large-scale reductions will be dependent on the extent to which E-CAT is taken up by other organisations in the wider market. Interviewees were asked whether they would pay for E-CAT if not offered as part of a free pilot, and while responses were mixed, a key factor in making a potential payment decision was the extent to which E-CAT would save money overall. An important consideration for the marketing of energy management tools of this type should therefore be the communication of potential cost savings. Another factor linked to this is advocacy between organisations, and users interviewed for the evaluation were broadly positive about the tool and said they would recommend it to other organisations, which may also encourage wider take-up of E-CAT.

Indeed, most pilot businesses had engaged with E-CAT, found it useful and expressed a desire to continue using it after the pilot, also saying that they would recommend it to other businesses. This indicates that a tool like E-CAT has the potential to be used in the wider market and achieve energy savings, provided that target users can be successfully persuaded to sign up to it in the first place.

The evaluation was not able to uncover evidence of the effects of E-CAT on other outcomes, such as revenue generation and brand-perception. Given the reported reduction in energy bills reported by some users, it is reasonable to assume that some organisations will see improved profitability due to lower overheads, although this was not reported by organisations during interviews. This was possibly due to the short timeframe for them to realise savings. One organisation reported that E-CAT was beneficial to their brand image.

> *“The fact that we are trying to be very energy efficient…it suits our brand image, because people almost expect it. It helps to say we are constantly monitoring our use.” – Business owner, Workshop*

However, the evidence base is insufficient on this topic to be able to draw strong conclusions.

4 Conclusions and recommendations

This report explores the extent to which Element Energy's energy management system, E-CAT, was able to support businesses and schools in reducing their energy consumption.

There is clear evidence from the evaluation that E-CAT has benefited users who piloted it, leading to improved energy management practices and associated reductions in consumption. Most users had engaged with E-CAT to an extent, and most of these found it user-friendly: easy to navigate, easy to interpret and well-presented.

The ability to track live energy data from their organisation was something that the majority of users had not previously been able to do, and this aspect of E-CAT has typically been the most well-received by users and most useful in terms of prompting and enabling them to enact change. The tips and recommendations were of interest to some users, and there are clear examples of users putting tips into action to better manage their energy use. Key to the success of tips is the ability to either tell the user something that is directly relevant to their operations and can be actioned on an ongoing basis.

Behaviour change was not evident in all retail and hospitality businesses. Businesses did not change behaviour when they saw little capacity for making reductions in energy use without changing equipment or building efficiency – e.g. in the case of small businesses with only a few basic appliances on the premises (lighting, tills, personal heaters). These users considered that they could improve their energy efficiency through upgrades to insulation and equipment but were deterred from doing so due to the cost and the unlikely or low monetary return on investment in terms of energy savings.

There is limited evidence to suggest that E-CAT in its present form will be effective in driving behaviour change in schools, and two contributing factors in this appear to be: the absence of a means for engaging staff and pupils with E-CAT's data, or incorporating educational aspects in the tool (both of which have been demonstrated to be effective for other energy management tools in the Competition); and the lack of face-to-face support provided. As described above, both schools visited as part of the evaluation had not been using the tool correctly and had therefore not benefitted from it, suggesting that a higher investment of time and support may be needed for schools, which tend to be larger and more complex organisations than the SMEs using E-CAT.

The findings from this report suggest Element Energy could take forwards the following points as it progresses its commercial offer, which may also be relevant for other innovators:

- The cash incentive was key to gaining interest for some users, and without it some users may not have participated in the pilot. As it is unlikely to be commercially viable to provide initial incentives for sign-up, different engagement approaches may be required to gain initial interest from customers.
- Users indicated that the ability to monitor live energy use was attractive to them when initially hearing about E-CAT and this function has had the most positive response, so communicating about this function may be effective.
- Further, the simplicity of E-CAT seems to have been a major driver in the likelihood of take-up and frequency of use – therefore, messaging around this feature might also drive uptake of E-CAT in the future.

- Return on investment is a key consideration for organisations when making decisions on whether to pay for tools and upgrades to improve energy management. Users indicated that they would not pay for an energy management tool like E-CAT, nor for equipment or building upgrades to improve efficiency, unless there was a clear business case in terms of saving money overall. Providing information on the expected return on investment and the timeframe in which this would be realised may be helpful, as would signposting to any available loan or grant scheme.
- The usefulness of tips and recommendations is dependent on how tailored they are to the user's business. While some users had implemented E-CAT tips, others had largely ignored them as they weren't considered relevant to their business (for example, because they related to equipment or appliances that users did not have in their business). Further tailoring of tips to the premises and operations of the business is likely to make them more successful in driving behaviour change.
- The gamification aspect of the E-CAT 'benchmarking' function seems to have worked well for some users; however, in general, there seems to have been a lower-than-desired level of user trust in the benchmark comparison (i.e. users were not always convinced the comparison was relevant / like-for-like). Highlighting how the benchmark is calculated and what organisations it is based on, and what users can do to make sure it is as relevant as possible for their business (by adding details to the 'My Premises' page), may help address this.
- As E-CAT has had comparatively little impact in schools, should Element Energy wish to further target schools with E-CAT, it may consider further tailoring the tool to these sites. Features that can encourage engagement with students, teachers, and other staff in schools (such as educational elements) may improve E-CAT's (future) impact there.

Annex 1 Evaluation Methodology

The research for this evaluation was conducted by Ipsos MORI in conjunction with their consortium partner the Carbon Trust. Ipsos MORI designed the evaluation approach and designed and delivered all aspects of the methodology, except for the energy consumption analysis which was designed and conducted by the Carbon Trust and quality assured by Technopolis Group. The evaluation was led by a dedicated evaluator who followed the implementation of the tool through its design phase (Phase 1), feasibility and initial testing (Phase 2) and roll-out and further testing (Phase 3).[10] The final evaluation report, and reports for the other six case studies, are available on www.gov.uk.

Evaluation approach

This evaluation aimed to evaluate the extent to which E-CAT generated the anticipated outcomes and impacts outlined in the theory of change, as well as the circumstances in which these were achieved. A case and theory-based approach was taken.

In line with the theory-based approach, the evaluation uses the E-CAT theory of change as its framework. The theory of change was initially produced in Autumn 2018 by the Ipsos MORI evaluation team and tailored to the specific details of E-CAT and its objectives. Key inputs into the development of the theory of change were (i) familiarisation interviews between the Ipsos MORI evaluation team and the Element Energy team to discuss E-CAT and its objectives, and (ii) the proposal for the Competition submitted by Element Energy, which detailed E-CAT's features and expected outcomes.

The extent to which anticipated change (i.e. 'outcomes' and 'impacts') took place as observed – and then evidence to demonstrate that E-CAT had contributed to this change – was assessed and is described in this report.

Sources of evidence and fieldwork activities

This evaluation was developed upon the following primary sources of evidence:

An online survey: The survey[11] included between 20-30 questions[12] covering usage habits, attitudes to energy, energy management behaviours, actions taken following engagement with E-CAT and other questions to understand the context of the business or school and the user (such as the business size, user role). Two versions of the survey were administered:

- **Type A Survey:** conducted in two waves: before the pilot started (January to October 2019, depending on when the pilot began for that user) and at least three months after participants had been given access to the tool (January to February 2020). The Type A endline survey was sent to those pilot participants who had (i) completed the baseline

[10] The evaluation lead met regularly with the tool's design team, liaising with them on the evaluation plan, designed the evaluation's methodology, managed the team of data collectors and the development of this report.
[11] An example survey questionnaire used across NDSEMIC projects is included in the evaluation Technical Report, available on www.gov.uk.
[12] The exact questionnaire length for each respondent varied depending on the project and type of participant/organisation.

survey, (ii) agreed to be re-contacted for research (iii) not withdrawn from the pilot[13] since the baseline survey had been completed. The Type A endline survey was sent to 17 participants.

- **Type B Survey:** a single wave conducted post-pilot, administered to pilot participants who had not completed a baseline survey. As a baseline measurement was not available, participants were asked to self-report on any changes in attitudes or behaviours in relation to energy management over the course of the pilot, and whether E-CAT was a factor in these changes.

  The Type B survey was sent to all pilot participants who had not completed the baseline survey, excluding those who had withdrawn from the pilot.

The total responses from both the Type A and Type B surveys was 16 (10 from Type A, six from Type B). A single survey was completed per pilot organisation; the profile of these 16 pilot organisations is as follows:

- Eleven retail businesses.
- Three hospitality businesses.
- One retail and hospitality business (gift shop and café).
- One School.
- Twelve of the surveys were completed by business owners.
- Two were completed by business managers.
- One was completed by a participant in IT support.
- One selected ‘prefer not to say’ when asked about their role.

Qualitative interviews: these were conducted on-site with pilot participants in their school or business, using a discussion guide tailored to E-CAT’s features and intended outcomes.

Visits to pilot sites enabled observation of use of the tool and energy use on site, as well as interviews with the primary tool user. A total of nine qualitative interviews were completed, with participants selected to represent each of the three sectors (retail, hospitality and schools) and different sizes of business. Seven of these were conducted on-site and included observational elements to better understand the context of the organisation and what equipment was used and how. For logistical reasons, two interviews were completed via telephone rather than face to face on-site. These interviews covered all the target sectors for E-CAT: retail (4 interviews), hospitality (3 interviews), and schools (2 interviews).

ECA: An analysis of energy consumption data conducted for all participating pilot sites showed small reductions in average consumption for the education (3%), hospitality (7%) and retail sites (1%). However, strong conclusions could not be drawn, as a start date for the intervention (when users started using the tool) was not available for the majority of sites, and short data

[13] Approximately 15 organisations withdrew from the pilot after being on-boarded. Reasons for withdrawal included; technical issues with installing the required kit, connectivity issues that inhibited data transfer and requests from users to be withdrawn for various reasons (such as staff illness, businesses closing or limiting operations).

periods pre-intervention meant that it was not possible to compare energy use at the same time of year pre and post intervention.

An in-depth ECA (which accounted for other variables which might affect energy use within the site) was conducted for three sites (see case studies in Chapter three). At each, a downward trend in energy consumption was observed which aligned with assertions by the E-CAT users that the tool had supported changes in energy use. However (due to a complete lack of historical data at each site and other data issues at the third), the ECA was limited in its ability to detect impacts and confirm whether the changes had coincided with use of the tool or had been driven by other factors

Project documentation and correspondence: As part of the Competition, Element Energy (and the other Competition Partners) were expected to regularly update BEIS and the Ipsos MORI evaluation team on their delivery progress and learnings via milestone deliverables and pilot project documentation. This was reviewed by Ipsos MORI and has supported the analysis in this report. Additionally, the evaluation team had regular bi-weekly updates with the Competition partner to establish progress with the pilot project and collate necessary information (e.g. recruitment challenges, partnership relationships etc.). Further documentation was made available to the Ipsos MORI evaluation team through Element Energy's end-of-Competition report and in most cases provided useful supplementary information directly to the evaluation team.

Limitations of the methodology

Overall, the limitations of the methodology were primarily as follows:

- **The response rate for qualitative interviews and quantitative surveys**: Despite multiple reminders being sent by both Ipsos MORI and Element Energy, and the offer of a financial incentive for completion, a limited response from certain business types and sectors limits the ability to evaluate E-CAT's impact for these sub-groups. Only one survey response was received from schools, and one of the two qualitative interviews completed with schools was with a user who had experienced issues with connecting the clamp to the energy meter, meaning the live energy data was not available to them on E-CAT. There was also limited data available to assess use within chains; while some of the organisations interviewed were part of chains (one from a chain of convenience stores, one post office), they were independently owned and managed thus not very representative of a 'chain' setup.
- **The length of time that participants were involved in the pilot**: Due to challenges in recruitment, some pilot organisations only had access to E-CAT for 4 months before the evaluation fieldwork was completed. This relatively short timeframe limited the ability of the evaluation team to determine trends in energy consumption, and to evaluate outcomes that may only be realised over a longer timeframe.
- **Incomplete energy data**: A key limitation of the ECA was the lack of historical data for organisations, from which year on year comparisons could be made to determine the impact of E-CAT. In a large number of cases, it was also not possible to ascertain an exact start date for when pilot sites started interacting with E-CAT, which also limited the ability to attribute any observed changes to the impact of E-CAT.

Annex 2 Assessment of E-CAT's contribution to energy savings

Assessing the energy saving potential of smart energy management tools was central to the evaluation, however in the context of the Competition it was not possible to collect a single definitive estimate of impacts and there were a range of challenges in using and interpreting energy consumption data for pilot sites. In recognition of the circumstances involved (limited access to historical data, small sample sizes, no control groups), a mixed-methods approach to evaluating energy savings was taken.

This approach drew on a range of evidence (outlined in Annex 1) to create a summary indicator of the evaluation's confidence that the tools had contributed to energy savings for pilot sites (by comparing the findings of energy consumption analysis, self-reported savings, and evidence of behaviour change from qualitative interviews). An analytical framework that considered both the strength of evidence, and its robustness, was used to produce the indicator (see Table 2 overleaf). The methodology for this described in more detail in the Final Evaluation Technical Report published alongside this evaluation.

On the basis of these assumptions and the evidence available, an analytical 'strength of evidence' framework was developed which, when applied, generated a confidence rating in the evidence of energy savings for each pilot. This confidence rating was illustrated in Table 1 in Chapter three and is recopied at the end of Table 2.

Table 2: E-CAT contribution to energy savings - evidence strength assessment

Evidence 'type'	Description of evidence type	Numerical rating of evidence type
Energy Consumption evidence		
Observed energy consumption reductions – (across all pilot sites, when comparing data over time and against pre-intervention data).	An overall ECA trend analysis was conducted for all sites for which energy data was available. Small reductions in average consumption were observed for the education (3%), hospitality (7%) and retail sites (1%). However, the energy data was poor - a start date for the intervention (when users started using the tool) was not available for the majority of sites, and short data periods pre-intervention meant that it was not possible to compare energy use at the same time of year pre and post intervention.	1[14]
Observed energy consumption reductions that align with user-reported evidence of changes in energy use behaviour. Suggests potential that tool use has contributed to energy savings.	An in-depth ECA (which accounted for other variables which might affect energy use within the site) was conducted for three sites. At each, a downward trend in energy consumption was observed which aligned with assertions by the E-CAT users that the tool had supported changes in energy use. However (due to a complete lack of historical data at each site and other data issues at the third), it was not possible to validate whether the changes had coincided with use of the tool or had been driven by other factors.	4[15]

[14] This group of evidence could be rated as either "not evident" (0), evident but only with red quality rating (1), evident with an amber quality rating (3) or evident with a green quality rating (4.5).
[15] This group of evidence could be rated as either "not evident" (0), evident but only with red quality rating (2), evident with an amber quality rating (4) or evident with a green quality rating (6).

User-reported evidence		
Self-reported energy savings (e.g. user can point to cost reductions in bills) that the user assigns to use of the tool.	At several sites, users reported noticing either reductions in their energy usage or their bills and assigned these changes to use of E-CAT.	4[16]
Multiple users at one site converge in reporting behaviour change, inferred to lead to energy savings, that users assign to use of the tool.	At two sites, more than one user was interviewed, and they converged in reporting energy efficient behaviours that might be expected to lead to a reduction in energy use (which they assigned to using the tool).	2[17]
One user reports behaviour change, inferred to lead to energy savings, that users assign to use of the tool.	Three users reported during qualitative interviews that they had made changes to how they used energy (which they attributed to using E-CAT), which might be inferred to lead to energy savings.	4[18]
Behaviour change reported via survey assigned to use of tool.	Over half (eight out of 15) of E-CAT user businesses responding to the evaluation survey stated that they had implemented (or plans to implement) energy efficiency or clean energy measures as a result of engaging with E-CAT.	3[19]
Theory-based evidence		
Evidence of the assumptions considered necessary for change to occur (as per the theory of change) as anticipated.	The situations observed through the site visits and telephone interviews were also compared to the assumptions underpinning the E-CAT theory of change (e.g. around	2[20]

[16] This group of evidence could be rated as either “not evident” (0), evident at 1-2 sites (2), evident at more than 1-2 sites (4) or evident at most sites consulted (6).
[17] This group of evidence could be rated as either “not evident” (0), evident at 1-2 sites (2), evident at more than 1-2 sites (4) or evident at most sites consulted (6).
[18] This group of evidence could be rated as either “not evident” (0), evident at 1-2 sites (2), evident at more than 1-2 sites (4) or evident at most sites consulted (6).
[19] This group of evidence could be rated as either “not evident” (0), evident at 1-2 sites (1), evident at more than 1-2 sites (2) or evident at most sites consulted (3).
[20] This group of evidence could be rated as either “not evident” (0), evident at 1-2 sites (1), evident at more than 1-2 sites (2) or evident at most sites consulted (3).

This suggests all of the necessary conditions for energy savings are available.	how user interest would be gained and sustained) and were found to have held true in a couple of cases, though not in all.	
No evidence of alternative theories of change for observed, reported or hypothesised energy savings.	At all sites visited, the potential for other factors (e.g. pre-existing efficiency drive, change in building/business operating hours or reduced building use) that might drive change was investigated. At around three sites, E-CAT appeared to have been a key driver of change, but at others alternative explanations could not be ruled out.	2[21]
Overall score (max. of 37.5)[22]		**22**
Averaged score (max of 4.5)[23]		**2.75**
RAG rating		**High**

Table 1 (repeated): Energy savings confidence ratings (E-CAT rated 2.75)

0- 1	Low level of confidence that the tool has contributed to energy savings at any site*
1 – 1.99	Medium level of confidence that the tool has contributed to energy savings in at least some sites
2 – 2.99	**High level of confidence that the tool has contributed to energy savings in at least some sites**
3 to 4.5	Very high level of confidence that the tool has contributed to energy savings in at least some sites

** A low confidence level does not preclude the tool from working in the future, if some adjustments / lessons learned are taken on board.*

[21] This group of evidence could be rated as either "not evident" (0), evident at 1-2 sites (1), evident at more than 1-2 sites (2) or evident at most sites consulted (3).
[22] The maximum overall score differs for some Competition projects as some of the evidence types are not available for some project evaluations.
[23] This is calculated by dividing the maximum possible overall score by the number of evidence types considered (8 in this case) and rounding to the nearest 0.5 decimal.

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