



Carbon-Adjust: Carbon-offset Adjusted

Loan Rate Settings for Financing Green Home Improvement Activities*



GREEN HOME FINANCE ACCELERATOR (GHFA) PILOT PHASE REPORT



*Carbon-Adjust is patented by the US Patent and Trademark Office (US PTO) with patent number 12,327,263

About Us

Escrow-Tech Limited is an innovative SME delivering bespoke solutions that leverage digital tools like artificial intelligence (AI), deep learning (DL), natural language processing (NLP) and image recognition in enhancing decision making as regards the optimal allocation of resources. Our research areas span transport, financial services with fiduciary responsibilities, infrastructure, energy, and supply chain. Our strengths include climate finance and business model development, climate risk analysis (physical, transition, regulatory), decarbonisation (residential, commercial, and industrial) and smart cities research. Escrow-Tech has a combined 50 years' worth of experience between staff in developing customer-centric software solutions and data analytics systems at the enterprise level.

Escrow-Tech's role in informing policy and shaping its design especially on optimal resource allocation is in two folds. First, the development of innovative tools and software solutions that can enable end-users aggregate resources in a central space reducing the need for multiple software applications and allowing for better synergy between available resources. Conversely, the building of innovative business models that can promote circularity between counterparties needing access to these aggregated resources to increase efficiency and reduce costs ensuring that prosperity and wealth can be built for all. Beyond this, Escrow-Tech plays an advocacy, by spotting and raising awareness about perverse industry trends and practices that are set up to exploit and disenfranchise end users.

Escrow-Tech Limited is a virtual lead party (VLP) and is a regulated entity; authorised by the Financial Conduct Authority (FCA) as a credit broker. The company is also ISO 9001:2015 and ISO 27001:2022 certified demonstrating commitment to quality offering and sustainable value to end users. Escrow-Tech is deeply vested in innovation, research and development as evidenced by our pool of patents and intellectual property (IP) stack.

In ensuring we can continue to offer value to end users, we continue to expand offerings on our software and hardware products, extracting more benefits for them.

Contact us today at info@escrow-tech.co.uk or visit our website at: <https://www.escrow-tech.co.uk/>

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EXECUTIVE SUMMARY

Carbon-Adjust: Overview

Carbon-Adjust is Escrow-Tech's inaugural enterprise product, designed to create visibility and enable domestic flexibility. Escrow-Tech received funding from the Department for Energy Security and Net Zero's Green Home Finance Accelerator (part of the Net Zero Innovation Portfolio) to develop and pilot Carbon-Adjust.

Carbon-Adjust's core aim is to offer a comprehensive marketplace that integrates flexibility and finance — providing customers with a measurable pathway to reduce both energy bills and their energy-related carbon footprint. It provides flexibility by enabling residents to monitor, control, and adjust the consumption of their domestic electrical appliances in response to signals from the grid or market. Key Carbon-Adjust features include a web and mobile-accessible platform that enables participation in flexibility calls and reward mechanisms, while connecting stakeholders such as service providers, finance, and grid operations.

Components of Carbon-Adjust

Carbon-Adjust consists of four integrated components:

- **Hardware:** Escrow-Tech manufacture and own a range of smart IoT¹ devices, including smart plugs, smart sockets, smart switches, fingerbots,² bluetooth hub and a Wi-Fi temperature sensor.
- **Software:** Web and mobile applications for device query and control.
- **Finance:** Settlement of transactions and merchant claims, alongside access to credit services.
- **Trading:** Acting as a Virtual Lead Party (VLP), communicating flexibility capacity with National Energy System Operator (NESO) or Distribution System Operators (DSOs) as off-takers.³

Project Aim

To address the lack of technology - and finance-driven solutions that leverage domestic resources (like flexibility) to reduce energy bills and carbon footprint for residential homeowners and renters.

¹ Smart IoT (Internet of Things) devices are physical objects embedded with sensors, software, and network connectivity that enable them to collect, exchange, and act on data over the internet.

² Fingerbots are small, smart robotic devices designed to physically press buttons or switches in the home, essentially giving traditional, non-smart appliances a digital upgrade.

³ An off-taker is a party that purchases electricity from a supplier, either directly or through a market intermediary.

Objectives & Outcomes

Objective 1: Build a one-stop shop green finance solution for carbon offset credits, energy-efficiency and flexibility⁴

- Developed proprietary smart plug hardware and obtained UK Conformity Assessed (UKCA) certification to aid the operationalisation of flexibility.
- Built a modern, adaptable marketplace for hardware and services.
- Achieved Quality Management (QS) and Information Security Management System (ISMS) certifications to make the offer more attractive.

Objective 2: Operationalise carbon offset credit management and flexibility

- Extracted and monetised carbon offsets from user-driven flexibility activities.
- Leveraged Artificial Intelligence (AI) to manage smart plug operations.
- Developed unique business models to enable trading of flexibility between residents and energy market participants (e.g., aggregators, suppliers).
- Established settlement and traceability⁵ mechanisms for transactions.
- Collaborated with infrastructure providers like ELEXON⁶ and NESO.
- Signed the Balancing and Settlement Code (BSC) which is administered by ELEXON – the BSC is the legal/contractual framework that governs electricity balancing and imbalance settlement; secured VLP license and integrated with ELEXON.

Objective 3: Enable finance options & operationalise benefits

- Secured Financial Conduct Authority (FCA) authorisation to act as a credit broker.
- Built infrastructure to allow residents to:
 - Access credit when buying products/services.
 - Apply earned benefits from carbon-offset driven flexibility and grid-balancing flexibility to reduce costs

⁴ Through the one-stop shop (OSS), consumers can purchase certified smart devices, link them to Escrow-Tech's platform, and participate in demand-side response schemes. The OSS integrates the hardware, software, and financial tools required to aggregate and trade these small-scale reductions or shifts in demand — which is what is referred to herein as *domestic flexibility*.

⁵ Traceability in electricity flexibility means being able to follow a flexibility action end-to-end—who provided it (which asset); what quantity (MW/MWh); where (connection point/zone); when (time-stamped interval); why (which service/market); and how it was verified and settled—so one can pay the right party, avoid double counting, and (increasingly) attach accurate carbon claims.

⁶ Elexon is Great Britain's *Balancing and Settlement Code Company (BSCCo)*. It administers the Balancing and Settlement Code (BSC)—the rulebook for the Balancing Mechanism and imbalance settlement—by running the central systems that compare contracted positions with metered volumes, calculate imbalance prices/charges, and settle money between parties.

Key Barriers

Carbon-Adjust was designed to tackle three major challenges:

1. **Lack of infrastructure & visibility:** Limited tools⁷ for domestic residents to participate in and benefit from demand-side flexibility.
2. **Limited access to flexibility networks:** Limited ability for non-homeowners and residents without smart meters to join flexibility schemes.
3. **Absence of necessary financing & business models:** Absence of affordable hardware financing and structured settlement models between residents and aggregators.

Response to Barriers

To address these key barriers, Carbon-Adjust includes a series of targeted interventions across infrastructure, access, and financing:

- **Developed infrastructure solutions:** Designed an open-source software (OSS) solution featuring a marketplace and operations hub. This platform provides the foundational digital infrastructure to coordinate and manage energy flexibility participation at scale.
- **Secured a Virtual Lead Party (VLP) license:** Integrated with ELEXON and commenced integration with NESO. This integration connects local flexibility efforts with national market infrastructure, enabling participation in established energy markets.
- **Developed smart plugs to make eligible appliances visible:** Addresses hardware infrastructure gaps by enabling device-level monitoring and control where smart meters are absent.
- **Increased access opportunities:** Decoupled flexibility participation from home and smart meter ownership requirements. This removes the infrastructure dependency on specific dwelling types or existing smart metering, broadening eligibility to residents in apartments.
- **Created a network that operates outside the smart meter infrastructure:** This alternative communication layer substitutes for missing smart grid infrastructure, enabling control and data flow independently.
- **Enabled finance provision:** Secured FCA authorisation as a credit broker. This creates financial infrastructure for delivering incentives, lowering the entry barrier for participants.
- **Developed business models to engage and reward participants:** These models offer sustainable funding pathways, ensuring that flexible energy behaviours are financially supported within the existing market framework.

⁷ Current market offerings typically require devices such as smart meters, EV chargers, solar PV and batteries, and mean that millions of non-homeowners are excluded from participating and/or earning from flexibility.

The project adopted a risk-based approach, deliberately avoiding dependency on partners for core operations. Rather than acting as an appointed representative of existing FCA-authorised firms, authorisation was obtained.

Key Learnings and Insights

The project revealed important insights into the intersection of technology and the retrofit sector, highlighting both challenges and strategic opportunities for innovation:

1. Technology and the Retrofit Sector

- The retrofit sector is still heavily dependent on human effort and material retrofit. Its exposure to supply chain issues and labour shortages potentially limits its ability to scale benefits effortlessly.
- The rise of Buy Now Pay Later and embedded finance solutions has created opportunity to disrupt and improve how retrofit finance solutions are delivered.

Lesson: To stay competitive, Escrow-Tech decided that it must embrace embedded finance, automation, and digital-first solutions.

2. Homeownership and Smart Meter-Centric Models Are Limiting

- Current retrofit focus is on expensive tech (e.g., heat pumps) for homeowners. This approach limits opportunities for owners of apartment residences and low-income households.
- Participation in grid-flexibility services is often limited to homes in possession of smart meters.

Lesson: Business models should:

- Be decoupled from homeownership to diversify reach and minimise inequity.
- Embrace flexibility and shared energy models.⁸
- Use digital platforms to offer scalable, renter-friendly solutions.

3. Regulatory Hurdles Can Delay Innovation

- FCA authorisation is required to offer consumer finance, even where the credit offering is secondary to the offering of the business. In Escrow-Tech's case, a credit broker license from the FCA was required to offer users access to lenders. Escrow-Tech's model involves monetising the carbon offsets generated by users through the use of smart plugs. The value of these offsets is applied to reduce the upfront cost of the smart plugs, thereby lowering the amount users may need to borrow.
- Regulatory delays increased time-to-market and cost.

⁸ "Shared energy" can refer to either the practical, collective use of generated electricity within communities

Escrow-Tech Recommendation:

- FCA authorisation should not be required for offering Buy Now Pay Later as is done in Europe.
- Government and OFGEM should enable easier market entry for innovative SMEs. This can be achieved using a model like the FCA's appointed representative framework. This could help small companies participate in the electricity market under licensed entities (e.g., VLPs, VTPs).

Accomplishments

The project achieved several notable accomplishments:

- **U.S. Patent Secured:** Recognises Carbon-Adjust's originality and strengthens Escrow-Tech's culture of innovation. Intellectual property protection was essential to ensure that the offer remained attractive for follow-up investments, helping to ensure the project team could take the solution to market and be sustainable there.
- **FCA Authorisation Granted:** Validates the unique approach of using carbon offsets to lower the cost of low-carbon tech. It also establishes credibility and readiness to scale as a green finance leader.

Unexpected Outcomes

One unexpected outcome was the rapid approval from the FCA, achieved in just four months—remarkably fast given the complexity of the model and often low approval rates in the industry. This success was made possible by six months of intensive preparation, expert guidance from consultants, and a clear articulation of the project's impact-driven financial models.

Readiness for Commercial Deployment

Carbon-Adjust is nearing readiness for commercial deployment, with the final milestone being the completion of asset registration with NESO. The target launch date is set for September 8, 2025. Post-launch success will be measured by key metrics including strong engagement from end users, high levels of flexibility participation, and the emergence of sustainable purchase patterns across diverse user demographics.

EVIDENCE REPORT

1.0 PILOT PROJECT SUMMARY

1.1 Summary of product developed

Carbon-Adjust is Escrow-Tech's flagship product, set for commercial launch in September 2025. It combines hardware, software, finance, and trading components to help households reduce energy bills and carbon emissions. Carbon-Adjust helps households reduce their energy bills by identifying cost-saving opportunities through personalised assessments of energy use, carbon impact, and tailored upgrade recommendations. The platform provides flexibility by enabling residents to monitor, control, and adjust the consumption of their domestic electrical appliances in response to signals from the grid or market. Key features include a web and mobile-accessible platform that enables participation in flexibility calls and reward mechanisms, while connecting stakeholders such as service providers, finance, and grid operations.

Product Components

Key Carbon-Adjust components include:

- **Hardware:** Custom-made smart devices, such as:
 - Smart plugs, sockets and switches
 - Fingerbots
 - Bluetooth hub
 - Wi-Fi temperature sensor
- **Software:** Web and mobile apps that allow users to control and monitor their smart devices.
- **Finance:** Tools for managing rewards and payments, such as:
 - Settlement of claims for both users and merchants
 - Access to credit services
 - Monetisation of flexibility activities
- **Trading:** As a Virtual Lead Party (VLP), Escrow-Tech communicates flexibility capacity with:
 - NESO (National Energy System Operator)
 - DSOs (Distribution Service Operators)

Goals and Evolution During the Pilot Phase

During the Green Home Finance Accelerator (GHFA) Pilot Phase, Escrow-Tech's goal was to create a marketplace that connects flexibility services and finance tools,

delivering real energy and carbon savings for users. Since the Discovery Phase, Carbon-Adjust has evolved into a fully integrated, standalone product:

- The project team now use software solutions (credit access) from global fintech providers (e.g. Klarna, Stripe) for scalability and minimal disruption.
- Home Improvement Agencies (HIAs)⁹ are now optional merchants on the platform, not core partners.
- Escrow-Tech have removed the product's need for high-street banks or finance partners.
- Flexibility trading is now enhanced through onboarding with ELEXON and integration with NESO.
- Users can now spend their flexibility rewards outside the platform by requesting pay outs to their accounts.

1.2 Target Customer Groups and Marketing Strategy

The product design and marketing strategy addressed three key goals:

- **Decouple the offering from homeownership:** Intentionally designed to broaden accessibility, particularly for residents of apartment buildings who may not own their homes.
- **Ensure affordability:** Making the product financially accessible to a wide range of users.
- **Foster emotional resonance:** Creating a meaningful connection between the product and its users to encourage engagement and loyalty.

Target Audiences

The project team focused on tech-savvy age groups (age 16-54) with high smartphone usage and more likely to own an apartment. See Figures 1 and 2.

Marketing Strategy Evolution

Product messaging changed over time, based on results from a simulation test and internal reviews:

1. **Initial Approach:** Process-Based Marketplace
 - Focused on homeowners (typically detached, semi-detached and terrace homes).
 - Limited reach and poor digital fit
2. **Second Pivot:** Software-Only Product
 - Consumers struggled to grasp its purpose.

⁹ Home Improvement Agencies (HIAs) are local, non-profit organizations that help older, disabled, and vulnerable people make adaptations to their homes as their needs change. They offer a range of services including advice, information, and practical support to help people stay living comfortably in their homes.

3. Third Pivot: – Lifestyle Software

- Difficulty in selling “intangible” solutions to customers.

4. Final Approach: Lifestyle Hardware

- Combines tangible devices (like smartplugs, smart sockets, temperature sensors and fingerbots) with a strong lifestyle appeal (sustainable lifestyles, energy-efficient lifestyles, organisers/planners who want to extend that to their energy usage).
- Aligns with successful strategies used by global brands.

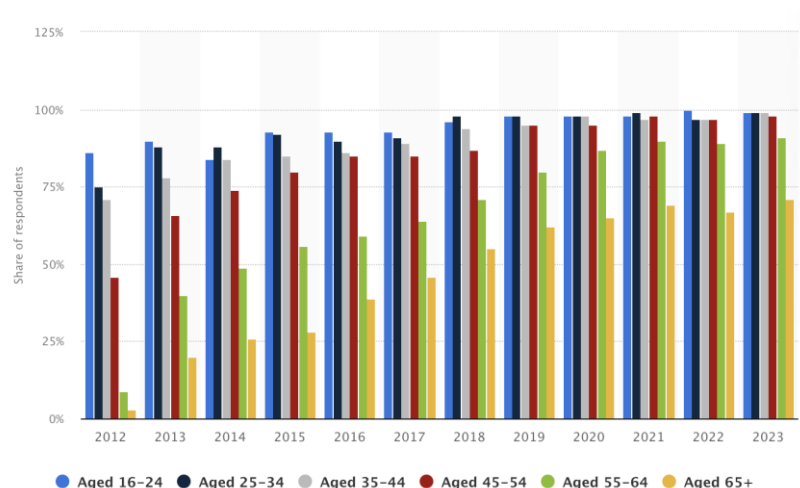


Figure 1: Share of smartphone users in the UK 2012-2023 by age¹⁰

This shift helped the offer better connect Carbon-Adjust to how people live, rather than how homes are retrofitted.

1.3 Customer/market barriers the product sought to address

1. Lack of Visibility and Aggregation Platform for Flexibility

- **Challenge:** Despite the growing use of smart devices and home automation, domestic energy users lacked a platform to aggregate these technologies and contribute meaningfully to balancing the national electricity grid through flexibility.
- **Impact:** Without such a platform, individual investments in smart technologies offered limited value or return.

Carbon-Adjust's Response: Developed a platform to enhance the visibility and aggregation of domestic flexibility resources, making participation more impactful and rewarding.

¹⁰ <https://www.statista.com/statistics/300402/smartphone-usage-in-the-uk-by-age/>

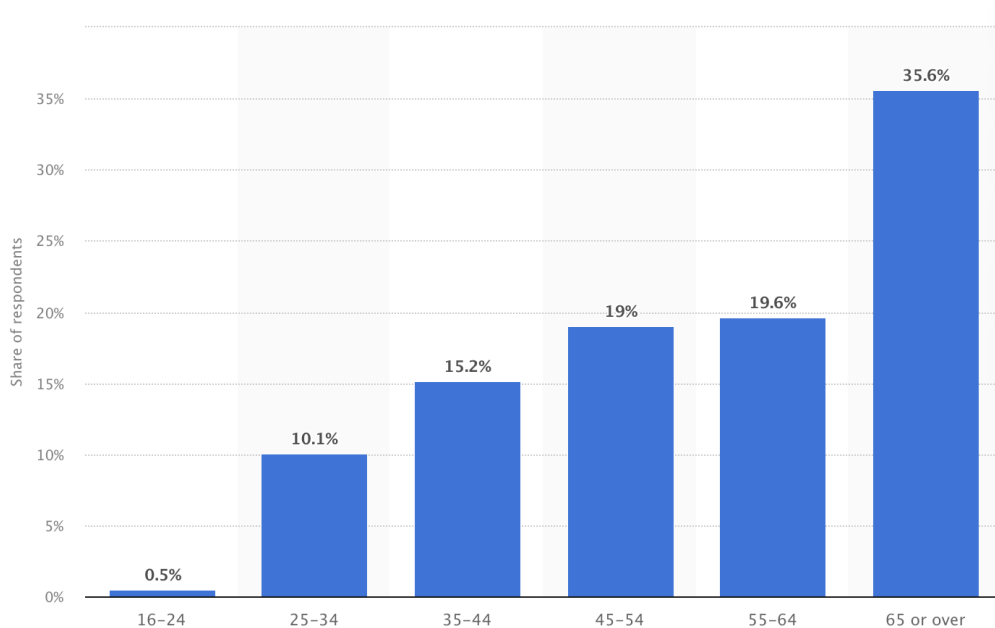


Figure 2: Distribution of homeowners in England in 2023 by age¹¹

2. Exclusion Based on Homeownership and Smart Meter Access

- **Challenge:** Existing flexibility schemes were often limited to:
 - Users with smart meters; and
 - Those who were homeowners (typically of detached, semi-detached and terrace houses), excluding owners of apartment buildings and those using prepaid meters.
- **Carbon-Adjust's Response:** Designed an inclusive model that decouples participation from 'typical' homeownership and smart meter access, opening opportunities for renters (as an unintended consequence) and prepaid meter users.

3. Limited Incentives and Rigid Business Models

- **Challenge:** Current models restrict how consumers with smart meters are rewarded for participating in flexibility. Rewards are typically narrow and inflexible.
- **Carbon-Adjust's Response:** Introducing innovative fintech solutions to enhance incentives:
 - Integrated Buy Now, Pay Later (BNPL) options.
 - Enabling payback rewards system where users can earn from flexibility.
 - Allowing users to spend grid-flexibility derived benefits outside the Carbon-Adjust platform, making rewards more tangible and accessible.

¹¹ Statista, [Distribution of Homeowners in England by Age Group](#), View the statistics on Statista.

1.4 Geographic scope of Carbon-Adjust launch

One major enabler of Carbon-Adjust is the availability of off-takers who can purchase electricity from a generator, either directly or through a market intermediary. This ensures that from launch, the product can start delivering value to Carbon-Adjust users participating in energy flexibility.

In ensuring flexibility can be traded, it is aggregated via Carbon-Adjust with NESO; to do this, Carbon-Adjust assets need to be registered (i.e. smart plugs) with NESO. A key requirement in completing this is demonstrating to NESO an ability to achieve at least 1MW of flexibility capacity at each secondary balancing mechanism unit (BMU).¹²

As Escrow-Tech plans to launch with 5,000 smart plugs, each with a maximum power capacity of 3,120W, a more practical approach is to focus deployment within a targeted geographic area. This strategy helps ensure that, assuming a 20% participation rate using typical 1.5kW appliances (e.g. washing machine, dishwashers, tumble dryers, kettle, electric heaters), the product can realistically achieve the 1MW load requirement.

As a result, the launch has been constrained to residents within Southwest England and South Wales. These regions were selected in part because they fall within the UK's Constrained Managed Zones¹³ (CMZ). A targeted launch in these areas enables participants to access flexibility compensation both through CMZ participation (by DSOs) and through flexibility calls by NESO.

1.5 Product regulatory requirements

The key regulatory and approval requirements needed to operationalise Carbon-Adjust were enabling the use of carbon offsets generated from flexibility services and obtaining Financial Conduct Authority (FCA) authorisation to operate as a credit broker. Without this authorisation, Escrow-Tech cannot operate as a credit broker. As Escrow-Tech is licenced by the FCA, it can offer longer-term Buy Now Pay Later (BNPL) finance options like those provided by Klarna. Additional approval requirements include onboarding with ELEXON, obtaining a virtual lead party (VLP) license (which has been obtained at the end of the Pilot project) and registering assets with NESO. Since the carbon offsets generated on Carbon-Adjust are

¹² The Balancing Mechanism (BM) is the main tool used by the National Electricity System Operator (NESO) to ensure supply and demand remain balanced across Great Britain's electricity network. At the Electricity National Control Centre (ENCC), the BM is used to purchase and secure the precise amount of electricity needed to maintain system balance.

¹³ Constrained Managed Zones (CMZs) are specific areas within the UK's electricity distribution network where Distribution Network Operators (DNOs), transitioning into Distribution System Operators (DSOs), implement flexibility solutions to manage local network constraints. These zones are crucial for integrating distributed energy resources and ensuring grid stability without resorting to traditional infrastructure upgrades.

voluntary, no further regulatory approvals are required beyond compliance with the standards set by the Voluntary Carbon Market (VCM) registry.

1.6 Impacts of regulatory approval requirements

The acquisition of FCA authorisation has positively impacted the credibility of Carbon-Adjust. The project team have noted this in engagement with corporate organisations. It is anticipated that, through authorisation, consumers and other entities (like local authorities) can be confident in the offerings and the safeguards in place to protect and ensure value for money. Securing the VLP license from ELEXON has supported the Pilot by advancing the completion of formalities required for onboarding as a provider of demand-side flexibility services (DFS) to residents across the UK, thereby generating commercial benefits for them.

These regulatory and approval requirements have shaped the delivery of Carbon-Adjust as they have influenced the business model and value proposition while also influencing the user experience and journey through Carbon-Adjust. Additionally, these requirements have also emboldened the project team to be more creative in evolving better offers for consumers on Carbon-Adjust.

It is noted that the UK stands out as one of the few markets where businesses must secure regulatory approval from the FCA to provide consumer financing, even when such activity is secondary to their core operations. There is an absence of soft-touch authorisation options when seeking approval as a VLP with ELEXON and NESO. For instance, the FCA provides for authorised credit brokers (principal firms) to approve appointed representatives (ARs) who can carry out activities within the scope of authorisation of the principal firm. The benefit of this approach is that it reduces the regulatory burden of obtaining direct FCA authorisation, allows small businesses or brokers to operate in the credit space quickly, and it provides a compliant pathway for expanding credit brokerage activities under the oversight of an established principal firm. A similar arrangement is lacking when seeking approval as a VLP. The presence of such mechanisms within the electricity space could reduce administrative burden, thereby accelerating time to market for businesses launching new and innovative solutions.

2.0 PILOT TIMELINE

2.1 Key milestones timeline

The key milestones for the Carbon-Adjust GHFA Pilot Phase project are shown in Table 1 below. The timeline for Carbon-Adjust project was Feb 21, 2024 – June 30, 2025. The product was expected to launch within this timeline. The late start of the project (February 21, 2024, rather than the originally planned December 2023) meant that two months was lost. The period of uncertainty prior to commencement, affected some initial plans prior to the delay, but this was recovered without any major disruption. To ensure that the project could still deliver value within the new timeline, activities were prioritised based upon resource availability and available finance. Additionally, multiple short trials were conducted at an accelerated pace to obtain feedback from consumers and utilise the feedback in shaping the approach taken. This meant running two parallel strands of trials – one with partners/subcontractors and another managed internally within Escrow-Tech.

Noting that it was going to be difficult to vary the remit of partners/subcontractors, the project team adopted an agile strategy that saw a change in approach and business models as feedback was received from the short trials.

Table 1: Key milestones and status for the Pilot Phase of Carbon-Adjust

S/N	Milestone Activity	Status
1	Pre-launch communications	Completed
2	Marketplace development	Completed
3	Business/Finance models	Completed
4	Hardware design & development	Completed
5	Hardware certification	Completed
6	Hardware manufacture	Completed
7	FCA authorisation	Completed
8	CVA qualification (ELEXON)	Completed
9	SVA/PAB qualification (ELEXON)	Completed
10	NESO contract	Completed
11	NESO BMU registration	Ongoing
12	NESO Integration (Final)	Ongoing
13	Payments/Finance integration	Completed
14	Marketing/launch videos	Completed
15	Launch	Not started
16	Engagement activities	Activity runs throughout project
17	Consumer research/evaluation	Activity runs throughout project
18	Project close	Project yet to close

Legend

Completed	Completed
Almost completed	Almost completed
Ongoing	Ongoing
Not started	Not started
Activity runs throughout project	Activity runs throughout project
Project yet to close	Project yet to close

2.2 Impact of delays pilot project delivery

Escrow-Tech initially allocated six months for FCA authorisation but encountered delays due to the need for a robust and clearly articulated Regulatory Business Plan (RBP), which relied heavily on finance, business, and value proposition models.

The proactive development of models—completed months ahead of subcontractor delivery dates—allowed:

- Faster FCA review and acceptance.
- Subcontractors to focus on customer segmentation and adoption, not foundational modelling.

Despite success, securing FCA authorisation pushed back the integration of financing options:

- Integration only began in February 2025.
- Klarna required full FCA authorisation to support financing terms beyond six months.

Hardware Infrastructure Development

Initially, it was planned to use off-the-shelf smart plugs, however, integration issues required a pivot to developing custom hardware.

New Hardware Approach

The project engaged a Chinese manufacturer to:

- Design smart plugs to specification.
- Create prototypes and moulds.
- Obtain UKCA certification (completed in March 2025).
- Mass-produce and ship hardware.

The project identified and integrated with a firmware infrastructure provider (Tuya) to use their SDK¹⁴ for management of plug–platform communication. However, the project encountered a language mismatch as Carbon-Adjust’s app was built using Flutter, while Tuya’s SDK uses Java/C.¹⁵ The project therefore adopted Kotlin (Android) and Swift (iOS) as workarounds.

Regulatory Engagement: ELEXON & NESO

Custom hardware delays hindered early engagement with ELEXON and NESO, but as soon as the moulds were completed, the Pilot took steps to move forward.

Status as of June 2025:

- ELEXON:
 - Acceded and passed Central Volume Allocation (CVA) market qualification tests.

¹⁴ SDK is a Software Development Kit.

¹⁵ Java is a programming language. Java C is the standard Java compiler and part of the Java Development Kit.

- Passed Supplier Volume Allocation (SVA) market qualification and secured approval by Performance Assurance Board (PAB) to become a VLP.
- NESO:
 - Signed the Connection and Use of System Code (CUSC) agreement
 - Received countersigned copy to proceed with onboarding
 - In the process of beginning asset registration.

To accelerate progress Escrow-Tech has:

- Hired a consultancy firm with deep experience in ELEXON/NESO processes.
- Finalised a contract with a third-party software provider to support Electronic Dispatch Logging (EDL) / Electronic Data Transfer (EDT) protocol registration and testing (see Figure 3 for market player interactions).

In summary, Escrow-Tech is now formally recognised and approved to participate in both central (CVA) and supplier (SVA) electricity markets, including acting as a Virtual Lead Party (VLP). With expert support and the right technical infrastructure in place, Escrow-Tech is well-positioned to begin delivering flexibility services into the UK electricity system in the near term.

2.3 Delay impact mitigation strategies

While no project milestones were compressed, an early start on several key activities was initiated, particularly in marketing and evaluation trials, generating timely feedback and refining the overall approach. The success of this parallel trial strategy was demonstrated by the rapid acquisition of the FCA authorisation, which occurred much faster than typical for such an innovative offering.

As a pioneering product, Carbon-Adjust presented unique challenges in securing external support and guidance. The strategic decision to develop a vertically integrated solution, independent of project partners, initially led to an underestimation of the financial investment required for full operationalisation. However, the long-term advantages of this decision have become increasingly apparent.

Maintaining full control over the entire value chain, with little to no reliance on project partners for commercial execution, has enabled faster decision-making and greater agility. It has also eliminated complexities relating to data sharing agreements (DSAs) and intellectual property (IP) rights, streamlining the path to commercialisation. Collectively, these factors have contributed to the robustness and adaptability of Carbon-Adjust, strengthening its position as a resilient and scalable solution in the green finance landscape.

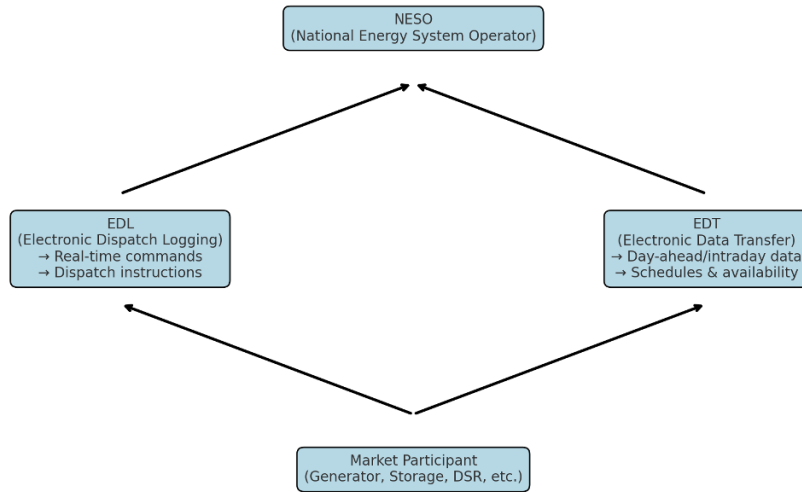


Figure 3: High-level overview of EDL and EDT with NESO

3.0 INTEGRATION AND UTILISATION OF TECHNOLOGY

3.1 Technological solutions supporting product development

Carbon-Adjust was built using a tech stack optimised for scalability, real-time data processing, and AI-driven insights. The key technological components include:

- **Backend:** NestJS (TypeScript) for a modular and scalable backend architecture.
- **Frontend:** React (TypeScript) for an interactive and responsive user interface (UI).
- **Message Queue:** RabbitMQ to manage asynchronous communication between microservices.
- **Real-Time Communication:** Socket.io for WebSocket-based real-time updates.
- **AI Services:** Integrated AI models to provide predictive insights and automated analysis.
- **Deployment & Hosting:** Hosted on a cloud-based infrastructure (Azure).

Carbon-Adjust also leveraged these technologies to facilitate a seamless user experience, enabling real-time adjustments, AI-driven recommendations, and an efficient message-driven architecture. A key part of the Carbon-Adjust offering is the integration of smart plugs (see Figure 4) for flexible dispatch, which allows consumers to be rewarded for their participation in flexibility. The rewards are in the form of money that users can earn by enlisting their devices and participating in flexibility. Participation will require customers to sign-up to use or not use a particular eligible device (like a dishwasher) at a scheduled time. This represents a novel application of existing technology. Based on available evidence, smart plugs have not previously been used for flexible energy dispatch in this manner. The closest comparable solution is the use of pre-installed smart meters, which do not offer device-specific control and therefore lack the flexibility provided by this approach.

A bespoke application was developed using Flutter, incorporating Kotlin for Android and Swift for iOS native components. This customised solution differs from standard smart plug apps as the integration of microservice application programming interfaces (APIs) enable users to manage and control their eligible electrical appliances not only via smartphones but also through web interfaces. AI-driven analytics were incorporated into the application to provide insights into power usage patterns and suggest further optimisations.

Also included is AI-powered automation with machine learning models to predict user behaviour and auto-switch appliances for energy savings and the use of Dual Connectivity (Wi-Fi + Bluetooth Low Energy) to improve efficiency, allowing users to control the plug locally when Wi-Fi is unavailable. The use of voice recognition

technology was also included with the integration of Google Home and Alexa to enhance functionality.

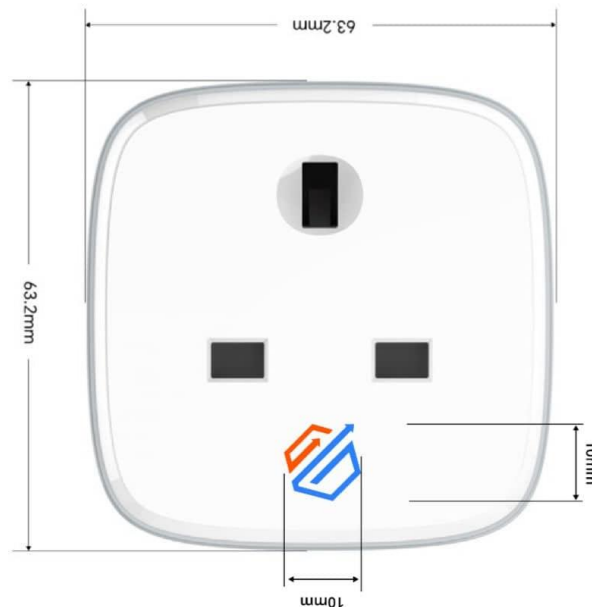


Figure 4: Front-view of the Carbon-Adjust UK smart plug (Model ETLSP1000)

3.2 Performance evaluation of Carbon-Adjust

The project team measured performance and effectiveness using the following metrics:

- **System Uptime:** Achieved 99.8% uptime, ensuring consistent service availability.
- **Message Queue Throughput:** Achieved sustained high throughput under peak load, enabling reliable and timely message processing without bottlenecks.
- **Real-Time Performance:** Maintained sub-second latency for critical operations, ensuring seamless real-time responsiveness across the system.
- **AI Model Accuracy:** The AI model consistently demonstrated high accuracy across test scenarios.
- **Frontend Responsiveness:** Achieved fast load time across key user interfaces, delivering a smooth and responsive user experience.
- **Smart Plug Testing:** To ensure certification and compliance with industry standards, the smart plug underwent a comprehensive 30-day laboratory evaluation. Upon completion of this testing period, the smart plug successfully met all requirements. The device was also evaluated using a Carbon-Adjust proprietary application as well as various other Internet of Things (IoT) platforms, consistently delivering the anticipated results across all tests.

3.3 Unexpected technological challenges

Several technical issues were encountered, all of which were appropriately addressed. Examples are provided below, along with the corresponding resolutions.

1. *AI Service Latency Issues*

- **Issue:** Initial AI predictions had higher latency due to heavy computation.
- **Resolution:** Introduced a caching mechanism for frequently accessed AI inferences and leveraged GPU acceleration¹⁶ for faster processing.

2. *Smart Plug Related Issues*

- **Issue:** The project faced difficulties in developing an IoT platform and infrastructure for device control, as well as acquiring the necessary human expertise to construct this system.
- **Resolution:** These issues were solved by leveraging the Tuya SDK to build the platform. Additionally, specialists were recruited in hardware design and programming, as well as IoT software engineers.

3.4 Learnings from integrating new technologies

The integration of novel technologies provided valuable insights. These include:

- **Scalable Systems:** By decoupling services and enabling asynchronous processing, better reliability and throughput was observed. This demonstrated how an event-driven architecture can improve scalability and performance when building microservices.
- **Real-Time User Experience with Socket.io:** The use of Socket.io enabled real-time interactions that noticeably increased user engagement. Test users benefitted from instant feedback and updates, which improved perceived performance and satisfaction.
- **Continuous AI Optimisation:** Deploying AI-driven features brought clear value but also revealed the need for continuous model tuning and monitoring. AI is not a one-time integration as it requires ongoing iteration. Investing in automated retraining pipelines, better observability, and adaptive feedback mechanisms could further enhance effectiveness and reduce manual overhead.

¹⁶ GPU acceleration refers to using a graphics processing unit (GPU) to speed up computations that are typically handled by the central processing unit (CPU).

3.5 Potential future enhancements

Several technological improvements could further enhance the Carbon-Adjust platform. For instance:

- **Improved Data Streaming and Reliability:** Upgrading the current data handling approach to support higher volumes and more resilient processing could better accommodate future growth and real-time demands.
- **Faster, Localised AI Analysis:** Bringing predictive models closer to end users through edge computing could help reduce response times and improve the speed of personalised insights.
- **Smarter Resource Scaling:** Adopting more dynamic infrastructure would allow the platform to automatically scale resources up or down based on usage, improving efficiency and cost-effectiveness.
- **Reducing Dependency on Third-Party Platforms:** While the current setup has enabled a rapid initial launch, it introduces constraints around debugging and scalability. To address this, a new in-house ecosystem—spanning firmware and cloud infrastructure—is under development and targeted for rollout by December 2025. This will underpin the next generation of hardware devices and support greater control, flexibility, and scale.

4.0 INTEGRATION OF DESIGN OR PROCESS INNOVATIONS

4.1 User-centric design methods

During the Pilot Phase, user-centred research and testing methods were heavily employed to shape the product. This included a simulation trial¹⁷ that walked users through the end-to-end journey on the Carbon-Adjust platform, combined with moderated usability testing sessions. In these sessions, participants were observed as they performed key tasks (from account creation to applying for a retrofit assessment and exploring the community forum) with researchers capturing pain points.

Additional unmoderated trials with reflective interviews were conducted, where users signed up and used the platform on their own before discussing their experience. Beyond usability tests, a 90-minute focus group via Zoom was undertaken, and a survey of 2,000 consumers to test the appeal of the concept. These methods – hands-on trials, focus groups, and large-sample surveys – ensured that design decisions were grounded in real user feedback and behaviour.

Findings from these user-centric methods directly informed the final product design. For example, testing revealed that the platform's unique value - access to carbon offset credits - was not clear to users. Only 36% of trial participants realised carbon offset credits were a feature after using the platform, indicating poor communication. As a result, the final design placed much greater emphasis on explaining *what carbon offset credits are, the benefits they provide, and how to claim them* – addressing the need for clear, relatable language upfront. Participants found the one-stop-shop concept appealing, with 73% indicating that having multiple retrofit services in one place was convenient, but many expressed concerns about how it was implemented.

This feedback pushed the team to better integrate services and communicate the marketplace model more effectively in the final design. During the Pilot Phase simulation trials, some users reported that the site did not “feel professional” or trustworthy. In response, designers refined the user interface, adding high-quality imagery, fixing navigation issues and incorporating trust signals such as customer reviews and accreditations. All these changes were a direct result of iterative design - by identifying pain points through user research, the team was able to refine the platform's content and interface before final launch. As noted from the simulation trials, the core propositions were desirable to users, but to unlock this value, the

¹⁷ The purpose of the trial was to evaluate Carbon-Adjust's end-to-end customer journey and value proposition (esp. carbon offset credits). Design: a simulation trial with 7 steps—from sign-up, package selection and HIA booking, through reviewing a retrofit assessment and carbon offset credit report, to a financing call (definitions and flows set by the research team). Carbon offset credit payments were modelled as 50% upfront + 25% mid-term + 25% near end over 10–15 years; the upfront portion offsets measure costs; later portions reduce a loan/energy bill or fund further measures. Participants: 50 invited; 49 registered, 37 ordered the HIA package (5 more too late), 35 completed the HIA request, 16 had home assessments (most received sample reports due to delays).

platform had to clearly articulate its value proposition, implement the one-stop shop diligently, and offer a more professional experience.

The Carbon-Adjust business model in later development focused on a smart plug and app proposition that rewards users for shifting energy use and engaging in demand side flexibility. This focus on a Demand Side Response (DSR) based model shows how user-centric findings (e.g. reluctance to pay high upfront costs) drove a change in approach. Methods like simulation trials, focus groups, and surveys were critical – they exposed usability issues, value mismatches, and user preferences, allowing the team to iterate the platform’s design and features.

The final Carbon-Adjust product is much more aligned with user needs: it explains its benefits clearly, provides a tailored and trustworthy experience, and even includes advanced features such as the carbon offset monetisation to reduce barriers, all thanks to the pilot’s user-centred design approach.

4.2 Customisation and personalisation features

The Carbon-Adjust platform incorporated several customisation and personalisation features to cater to individual customer needs, especially as the design evolved through the Pilot Phase.

One key personalisation element is the carbon offset credit rewards system itself, which was designed with customisation in mind, offering users different ways to receive and use their rewards. In the final model, customers can choose an *“Instant Reward”* (real-time credits earned from participation in carbon-offset driven flexibility) or a *“Locked-In Reward”* (an upfront credit based on future generated carbon offset credits at a pre-determined fixed price). This feature addresses differing customer preferences: some prefer instant reward (even when reduced), while others value a guaranteed larger payoff even if it’s delayed.

The Pilot research showed that users are willing to accept a mix of upfront and deferred rewards – a preliminary survey found customers were amenable to Escrow-Tech’s proposed ratio (e.g. 50% of credit value upfront and 50% later) for carbon offset credit payments. By incorporating both options, the platform personalises the financing aspect: risk-averse users can lock in savings, whereas non-risk-averse users can watch their carbon offset credits accrue in real time. The results of this design choice are promising.

Participants indicated strong interest in using a carbon offset credit feature if available – 76% agreed that *“if I had access to Carbon offset credits, it would make me more likely to install energy efficiency measures”*. And when given scenarios of different credit payout structures, consumers did not reject future payouts, suggesting the chosen customisation (blending immediate and delayed incentives) would be effective. In essence, offering flexibility in financial rewards increases the platform’s desirability by catering to both short-term and long-term incentive seekers.

Carbon-Adjust incorporates several customisation features designed to enhance user experience and flexibility:

1. Use Case Profiling

- Users can select the specific use case for which the smart plug is being purchased.
- This selection determines the value of the monetised carbon offset benefit (cash equivalent), which is then discounted from the plug's cost.
- Users self-certify the use case, thereby taking responsibility for generating the corresponding carbon offset.

2. Reward Spend Option

- Carbon-Adjust distinguishes between restricted and unrestricted benefits:
 - *Restricted benefits* are usually earned through carbon offset driven flexibility activities and can only be spent within the Carbon-Adjust platform.
 - *Unrestricted benefits* are typically earned through grid-balancing flexibility services and can be spent either on Carbon-Adjust or externally.
- Users are empowered to decide how they spend these unrestricted rewards, including via request for direct cash transfers to their bank accounts.

3. Finance Options for Purchases

- A range of payment methods are supported, including:
 - One-off payments via debit or credit card.
 - Combination payments that blend restricted/unrestricted benefits.
 - Credit options facilitated by Klarna.
- This enables consumers to select the financing method that best fits their needs.

4. Device Dispatch Optimisation

- Optimised processes are in place for the dispatch of smart devices, streamlining delivery and reducing friction for users.

5. Transfers and Sharing

- Users can transfer or share earned credits and rewards with friends and family within the Carbon-Adjust platform.
- This feature reflects typical fintech-driven functionality aimed at community engagement and reward flexibility.

The Pilot Phase incorporated personalisation at multiple levels. The project involved the incorporation of features geared to specific customer needs – clarity, relevance, flexibility, financial incentive, security, and credible advice – and the evidence shows

that when executed well, they boosted user interest and trust in the platform. Quantitatively, the high agreement rates on the platform's convenience and the motivating power of credits attest to the positive results of these design choices.

4.3 Operational process enhancements

During the Pilot Phase, Escrow-Tech introduced and refined several operational processes as part of the Carbon-Adjust service. These new processes were tested in simulated conditions and had notable impacts on efficiency, effectiveness, or service quality:

- **Carbon Offset Monetisation & Validation Process:** A new operational mechanism was introduced to manage how carbon offsets are generated, tracked, and delivered to customers. This involved creating a process for measuring operational carbon offsets via the use of smart plugs, converting those savings into verified carbon offset credits, and then monetising those credits for the user (whether as platform points, energy bill rebates, or loan discounts).
- During the Pilot's research phase, three possible credit pathways were mapped out - platform points, utility bill vouchers, or finance product integration. All three were tested for feasibility. The refined approach that emerged was a hybrid model: in the case of the smart plug flexibility feature, carbon offsets would be generated in real time, validated through integration with energy grid signals and automatically credited to the user's in-app wallet. This method was preferred as it offered a seamless user experience, immediate feedback, and stronger alignment with grid-level demand response incentives, making the benefits of participation more visible and engaging for users.

Establishing this process was crucial for effectiveness - it directly enabled the platform's value proposition - offsetting costs via carbon offsets. The efficiency of this process determined how smoothly users received their incentives. An assessment of the longer-term value that could be derived from carbon offsets for end users necessitated the expansion of the value proposition to include trading the grid-balancing demand-side flexibility potential from smart plug use to NESO. This behind-the-scenes step would allow Escrow-Tech to pool and sell customers' energy use (ramp up or ramp down) and then credit users reliably.

On commercial launch, carbon offsets accrual from participation in demand side flexibility will be made automatic for users – an efficient process where the app runs in the background, and customers simply see their credit balance grow. Escrow-Tech have effectively set up a pipeline that can turn climate-friendly actions into tangible customer benefits – a novel operational flow in the home retrofit space.

- **Merchant Onboarding and Quality Assurance Process:** Another process refined during the Pilot was the onboarding and management of contractors,

retrofit advisors, and other merchants onto the platform. The Pilot engaged with home improvement agencies (HIAs), retrofit coordinators, and installers to gauge their needs and preferences. It became clear that to ensure service quality, Carbon-Adjust must attract high-quality merchants and keep them satisfied. The team introduced a vetting and enlistment process – setting criteria for merchants (e.g. proper certifications, agreement to platform standards) and a system to manage leads they receive.

The verifiable impact of this is yet to be determined. However, it is hoped that these operational changes will improve efficiency on the supply side – matching contractors with the jobs that suit their expertise and location, and volume of work from the platform.

4.4 Challenges in implementing feature iterations

Implementing the new features and improvements during the Pilot was not without challenges. The team encountered several significant hurdles, but each was met with solutions or workarounds informed by testing and stakeholder input:

- **Challenge - Explaining a Novel Value Proposition (carbon offsets):** One of the earliest challenges was that users did not understand carbon offsets or see how the platform's feature worked. During a trial involving 50 households, many participants missed the fact that the platform even offered carbon offsets until it was explicitly explained by a researcher. This meant the unique selling point was essentially hidden, causing users to disengage.

Solution: The project team overcame this challenge by altering the platform's messaging and educational content. They introduced clear, prominent explanations of carbon offset credits – what they are, how they are earned, and how they benefit the user – in the onboarding flow and marketing materials.

- **Challenge - Earning User Trust in the Platform:** Early users expressed distrust toward the pilot platform, noting it did not feel as professional or credible as established services. They were wary of creating an account on a new site and unsure if the platform would deliver on promises. This mistrust was exacerbated by a lack of social proof with no reviews or accreditations displayed, and some technical rough edges/bugs that undermined confidence.

Solution: To overcome this, a series of design and process fixes aimed at building trust and lowering user anxiety. Visually, the interface was polished with high-quality imagery and consistent branding to give a professional impression.

- **Challenge - Technical Integration and Scalability of New Features:**
Implementing the grid-balancing DSR smart plug feature introduced technical and operational complexities. The project team had to ensure that smart plugs could reliably connect to the app, gather real-time energy data, and interface with energy market systems to monetise flexibility. Ensuring a seamless user experience (e.g. plug-and-play device setup, automatic energy shifting) was non-trivial.

Solution: This was mitigated by engaging in parallel research and stakeholder collaboration on DSR integration. Escrow-Tech identified the technical requirements - real-time API integration with the grid, secure remote control of device - and began addressing them one by one. Applying to become a Virtual Lead Party (VLP) was a proactive step to handle market transactions of aggregated flexibility. Additionally, recognising that achieving sufficient scale is key (a handful of devices will not yield meaningful carbon offsets or flexibility value), the project team began planning marketing and partnership initiatives to drive volume.

4.5 Successful design and process innovations

The Pilot successfully introduced innovation in green home finance by developing a new business model where users can trade carbon offsets to reduce the upfront cost smart plugs, while also participating in electricity flexibility through those devices. Escrow-Tech have become the first aggregator in the UK to be registered as a Virtual Lead Party (VLP) by ELEXON to provide the latter (outside of the smart meter infrastructure). This aligns with the GHFA programme aims of developing innovative green home finance solutions and enabling users to carry out home retrofit at lower costs.

Integrating Carbon Offsets as a Financial Incentive

Unlocking the value of carbon offsets for homeowners was a standout innovation. Despite early communication challenges, the concept resonated strongly once understood.

Key outcomes included:

- **User motivation:**
 - In simulation trials, 76% of participants agreed carbon offset access would make them more likely to install energy-efficiency measures.
 - This high agreement shows the power of aligning cost reduction with climate-positive action.
- **Success drivers:**
 - Tackled a core pain point: high upfront retrofit costs.
 - Framed as “found money” – an incentive user didn’t know they had.

- Positioned as a win-win –personal financial gain and climate impact.
- **User feedback:**
 - Once understood, all participants expressed interest in learning more and using the platform for major projects.
 - The offer of carbon offset became a compelling reason to engage with the platform.
- **Flexibility in implementation:**
 - Pilot tested different formats (e.g., upfront discounts, ongoing rewards), which broadened appeal.

This innovation clearly addressed both consumer desirability and relevance, effectively making the case for the platform’s value and purpose.

“One-Stop Shop” Platform Model

The integrated service model - combining assessment, guidance, installation, financing, and community - emerged as another successful design innovation. Key outcomes included:

- **User convenience:**
 - 73% of participants found the “one-stop” approach more practical for managing home energy upgrades.
 - It simplified the complex retrofit journey by reducing friction from having “too many moving parts”.
- **Stakeholder buy-in:**
 - Independent Retrofit Coordinators and Assessors saw the platform as a valuable industry hub.
 - Strong interest in participating reinforced the model’s viability beyond theory.
- **Additional benefits:**
 - Enhanced trust and quality assurance through vetted, curated service providers.
 - Timely offering in a growing but fragmented market.

Pilot feedback highlighted the caveat that success depends on tight service integration and reliable execution.

User-Centric Iterative Design Process

Key highlights from continuous user involvement and rapid iteration to shape a more viable product included:

Process elements:

- Engaged users via focus groups, trials, and surveys.

- Applied feedback to pivot and evolve the platform in real time.

Key enablers:

- Strong feedback loops and data-driven decision-making.
- Willingness to test, iterate, and discard features when necessary.

Examples of impact:

- Addition of tangible smart plug rewards and a broader retrofit marketplace.
- Strategic pause on launching the Kommunita forum, reflecting disciplined prioritisation based on evidence — not assumption.

4.6 Opportunities for future improvement

The Pilot revealed several areas where the Carbon-Adjust platform can evolve to enhance user experience, efficiency, and effectiveness.

Proactive Customer Guidance and Support (“Retrofit Concierge” Service)

Users often felt unsure about their next steps or overwhelmed by available choices. Strengthening guidance could significantly improve completion rates and confidence. Two potential complementary support models include:

- **Digital Guidance (AI-powered):** A virtual assistant/chatbot trained in retrofit advice could answer questions 24/7. It could:
 - Provide definitions to questions such as “What does this mean?”.
 - Offer personalised nudges/reminders.
 - Suggest next steps based on user inputs.
- **Human Concierge (for high-value users):** Assigning a dedicated project coach to guide customers through complex retrofits. Tasks could include:
 - Regular check-ins.
 - Help with contractor coordination.
 - Step-by-step navigation of the process.

Though more resource-intensive, this mirrors successful models in industries like solar installation.

Why it matters:

- Builds trust and confidence, especially for complex or costly projects.
- Reduces user drop-offs by making the journey feel more manageable.
- Turns a digital service into a hybrid experience, enhancing engagement and satisfaction.

Continued User-Centred Design Cycles (Agile Iteration)

The iterative design process proved effective during the Pilot Phase. To sustain that momentum, the following methods will be key towards embedding agility into the product lifecycle:

- **Ongoing beta testing:** Forming a core group of early adopters to test new features and share feedback regularly.
- **Regular usability testing:** Apply “guerrilla” tests for quick, informal user feedback before major releases. This will help to identify friction points early and cost effectively.
- **Data-driven iteration:** Track key performance metrics such as:
 - Percentage of users who complete retrofits.
 - Time from sign-up to project completion.
 - Use inefficiencies as triggers for design sprints.
- **Agile frameworks in practice:** Incorporate sprints, retrospectives, and user stories into daily workflows. Ensure that every cycle improves the product in a structured, measurable way.

Proven success:

- For example, when only 36% of trial users said they would reuse the platform, the team responded by addressing root causes, resulting in a much stronger offering.

Looking Ahead

The combination of enhanced customer support, agile design methods, and rapid iteration will create a solid foundation for long-term impact. By continuing to centre the user experience and responding swiftly to feedback, Carbon-Adjust can evolve into a more intuitive, engaging, and scalable platform. These improvements not only address current friction points, but also future proof the service as Escrow-Tech observes user needs and technologies, and market expectations grow more complex.

5.0 PILOT PARTNERSHIP LEARNINGS

5.1 Project consortium partnership model

The Carbon-Adjust consortium's partnership model enabled robust delivery of a hybrid trial and readiness for commercial launch. Through modular platform design, deep integration of AI and machine learning (ML), and continuous partner collaboration, the consortium succeeded in building a resilient and scalable energy efficiency marketplace poised for growth in the UK and beyond.

Escrow-Tech Limited adopted a hybrid go-to-market strategy that combined research-led trials via the Energy Systems Catapult (ESC) with a phased commercial launch. This dual approach ensured product-market fit while maintaining scientific and stakeholder integrity.

Table 2: Partner Roles Summary Table

Partner	Role
Escrow-Tech Limited	Lead partner; platform development; project management; IP custodian; FCA/VLP license acquisition; commercialisation
Energy Systems Catapult (ESC)	Research trial design, participant feedback management, impact assessment
Furbnow Limited	Retrofit advisory and home energy plan provision
Lendology CIC	Financial product design and homeowner financing support
Modirect Limited	Carbon credit aggregation and end-user education

5.2 Project partnership benefits

The multi-disciplinary expertise contributed by partners enabled a unified platform offering technical advice, financing, and carbon management. Key partner contributions included:

- **Trust & Engagement:** Credibility from partners like Lendology and ESC helped improve trial participation and customer trust.
- **Trial Enhancement:** ESC's behavioural insights enhanced platform refinement.
- **Operational Efficiency:** Centralised platform uses simplified data governance and privacy compliance.

Escrow-Tech has identified the following parameters as being the most relevant for the measurement of partnership success:

- Number of home residents onboarded and retained.
- Engagement metrics (session length, package usage).
- Emission savings calculated under AMS-II.C methodology.
- Trial completion rates and participant feedback scores.

- Flexibility participation rate.

However, given that the full product offering (involving carbon offset monetisation and flexibility operations) is yet to be launched, it is premature to definitively score the partnership by some of these parameters.

5.3 Partnership model improvements

The major changes introduced through partnership engagement was the simplification of the sign-up process and customer journey:

- **Sign up simplification improvements:** Individual users had their account creation process simplified for faster onboarding and less drop-offs.
- **Customer journey reorientation:** The original platform handover model was replaced by a continuous platform engagement model to minimise drop-offs.
- **Process automation:** Partner packages were designed to allow document uploads, meeting bookings, and AI assistant integration within Carbon-Adjust.

To maintain long-term engagement, the new model prioritises timely nudges, embedded guidance, and ongoing value delivery, ensuring users remain supported, informed, and motivated throughout their journey.

5.4 Project partnerships lessons learned

The following key lessons learned emerged from partnership activities during the pilot phase, informing both platform design and strategic direction:

- **Marketplace Models Offer Greater Flexibility and User Engagement:** The original platform design followed a rigid process-bound model. This required users to progress linearly from one vendor to the next, often waiting for approvals before proceeding. Through partnerships, it was observed that this structure caused unnecessary delays and user drop-offs. In contrast, when users were given more freedom to explore options within a marketplace-style interface – such as browsing service providers, comparing offers, and initiating tasks independently, engagement increased noticeably.

Future development: Expanding the marketplace functionality (see Figure 5 - section 12.2), including ratings, transparent pricing, and AI-based recommendations, could further boost autonomy and decision confidence.

- **Centralising User Interactions Improves Retention and Trust:** Several partners initially proposed off-platform interactions (e.g., email chains, external booking systems), but trials revealed that when all interactions – document sharing, communication, and task progress – were contained within the Carbon-Adjust platform, users were more likely to stay engaged and complete the journey. This setup also enabled richer behavioural insights, improved support delivery, and stronger data governance.

Future development: Deepening integration with partner tools and embedding secure messaging, notifications, and nudges will enhance continuity and user trust.

- **R&D and Commercialisation Must Happen Side by Side:** A recurring theme across all partnerships was the value of testing and evolving features in live environments. Partners appreciated the speed with which the team responded to real-world challenges, adapting both technical and operational components quickly. This agile approach helped validate product-market fit and partner readiness.

Future development: Establishing structured testbeds with strategic partners, blending commercial pilots with experimental features.

Drawing on insights from the Pilot, the following recommendations aim to deepen partner alignment, streamline delivery, and build a more scalable and resilient collaboration model for future phases:

- **Establish Early Agreement on a Platform-Centric Approach:** One of the most consistent lessons from the Pilot was the importance of keeping all workflows and user interactions within the Carbon-Adjust platform. Future partnerships should formalise this approach from the outset, ensuring that partner offerings, such as document submissions, service scheduling, and customer communications, are fully embedded into the platform environment.

Impact: This reduces user confusion, increases data coherence, and enables real-time performance tracking across partners.

- **Co-Design Joint Marketing and Acquisition Strategies:** Partnerships that co-developed customer outreach plans achieved broader reach with lower per-partner acquisition costs. Going forward, collaborative marketing campaigns (e.g., shared brand assets, bundled incentives, and cross-promotion through trusted channels) should be developed as a standard component of partnership onboarding.

Impact: Creates a unified market presence, enhances credibility, and builds early customer trust, especially important for retrofit and energy services where trust barriers are high.

- **Embed Continuous Improvement Loops into Partnership Structure:** Rather than treating retrospectives as optional or post-hoc, future collaborations should formalise monthly feedback loops and quarterly co-design workshops involving both operational and product teams. These

sessions can be used to resolve frictions, test new features, and rapidly respond to user feedback.

Impact: Ensures that the partnership evolves dynamically and remains responsive to both user and operational needs, rather than becoming static or transactional.

- **Develop Shared Success Metrics and Transparent Reporting:** Pilot Phase learnings showed that misaligned KPIs created ambiguity in partner performance expectations. In future collaborations, all partners should be involved in co-defining key success metrics (e.g. conversion rates, customer satisfaction, time to completion) and have access to shared dashboards within the platform.

Impact: Enhances accountability, improves decision-making, and ensures that all parties are working towards mutually beneficial outcomes.

6.0 GOVERNANCE FRAMEWORKS

6.1 Escrow-Tech internal governance structure

Escrow-Tech Limited established a robust internal governance structure to oversee the Carbon-Adjust GHFA Pilot Phase project. A dedicated project leadership team was put in place, with clearly defined roles and responsibilities for each member:

- **Project Manager (PM):** Served as the overall project lead and primary liaison to the funder (i.e. DESNZ – Department for Energy Security and Net Zero).
- **Head of Strategy & Growth (HoS&G):** Charged with long-term strategic planning and stakeholder engagement.
- **Chief Financial Officer/Chief Operating Officer (CFO/COO):** Acted as the internal Senior Responsible Officer (SRO) for the Carbon-Adjust product.
- **Heads of Compliance – General (legal and non-finance) & Finance (HoCG & HoCF):** The HoCF oversaw financial compliance, including Anti-Money Laundering (AML) measures and ensuring Carbon-Adjust adheres to finance laws in the UK. The HoCG handled legal compliance, ensuring the platform meets all relevant laws and regulatory standards (e.g. consumer protection, data privacy).
- **Head of Regulations & Research (HoRR):** Focused on other regulatory adherence, such as emission reporting to feed Escrow-Tech's climate emission reduction plan (CERP) strategy and thought leadership.
- **Head of Product Delivery, Planning & Development (HoPPD):** Led the technical development and delivery of the Carbon-Adjust software and hardware.
- **Carbon-Adjust Head of Business Development and Market Entry Operations (CA-HoBD):** Owned Carbon-Adjust as a product and was responsible for managing the product trials, exploring sales and marketing strategies, validating business models, and leading the acquisition of Escrow-Tech's virtual lead party (VLP) licence.

The team structure ensured each critical governance domain (strategic growth, product management, compliance/legal, regulatory, technical delivery, and market engagement) had a clear owner.

6.2 Internal product development workflow

Escrow-Tech adopted a phased workflow to develop Carbon-Adjust from concept to Pilot-ready platform. Each stage had defined leads, timelines, and governance checks to ensure progress, alignment, and quality.

1. Concept Design & Scope Definition (Early 2024)

Carbon-Adjust began as a carbon offset credit tool but evolved - following an internal risk review - into the dual benefits of flexibility for generating carbon offsets and

enabling grid-balancing, aligning better with market needs. Continuous evaluation of the company's model led to more focus on grid-balancing flexibility, forming the basis of the platform's product strategy. This was occasioned by plans to decarbonise the UK electricity's grid by 2030 and the global sentiment on carbon offsets which led to depressed prices for voluntary carbon credits.

2. Iterative Development & Feature Integration (Q2–Q3 2024)

The platform was built in iterations, each reviewed by cross-functional leads (COO, CA-HoBD, etc.) for compliance, feasibility, and fit with pilot goals. Key evaluations included cost-benefit analyses of features like credit and insurance. Governance ensured that only value-aligned, resource-efficient components advanced.

3. Feature Prioritisation & Adjustments (Mid-2024)

Strategic reviews led to the deferral of the insurance module due to regulatory complexity and timeline risks. Leadership removed non-essential features, refocusing on earlier deployment of the marketplace. This governance decision helped prevent delays and maintained focus on core deliverables.

4. Testing, Trials & Feedback Integration (Q3–Q4 2024)

User trials (focus groups, surveys, workshops) highlighted concerns about hidden costs and installer trust. In response, features like transparent pricing and vetted providers were considered. Product and compliance teams oversaw changes to ensure they met scope and regulatory requirements. Feedback was documented and changes approved via internal governance.

5. Regulatory Compliance & Approvals (Mid-2024 – Early 2025)

Regulatory work ran alongside development. Escrow-Tech secured FCA authorisation (filed Sep 2024, approved Jan 2025), UKCA certification for smart plugs (March 2025) and ISO (9001/27001) certifications in April 2025. Each milestone had clear ownership, and delays were managed by adjusting timelines for non-dependent activities. Governance mechanisms ensured approvals did not derail overall progress.

6. Final Deployment & Pilot Launch (Q2 2025)

The final stage focused on operational readiness and launch planning. The VLP license was secured in July 2025. A pre-launch internal review confirmed technical readiness. A sales and marketing plan targeting 5,000 smart plug units over three months was finalised. Governance throughout ensured a focused, agile delivery with deferred features managed to maintain schedule integrity.

6.3 Project governance challenges and mitigations

During the Carbon-Adjust Pilot Phase, several governance challenges arose. Through proactive management and adaptive strategies, the team successfully

mitigated these issues and kept the project on track. Below are the key challenges and how they were addressed.

Adapting the Project Vision

- **Challenge:** The earlier focus on carbon offset operationalisation offered limited monetary value to users and did not justify the investment due to plans to decarbonise the UK electricity grid and global sentiments towards voluntary carbon credits.
- **Response:** Governance led an internal strategic review and risk assessment, which concluded that the platform should broaden focus to grid-balancing flexibility and a broader marketplace model.
 - Focus was increased on complementary features like grid-balancing flexibility and wider service offering, making the platform more attractive and practical.
 - Leadership endorsed and communicated the new vision to all stakeholders, ensuring alignment and avoiding project failure.

Navigating Regulatory and Licensing Requirements

- **Challenge:** Integrating financial and retrofit services added significant regulatory complexity, particularly around licensing (e.g., FCA authorisation).
- **Response:** Efforts were phased and prioritised:
 - Focused first on securing FCA authorisation for credit brokering.
 - Deferred more complex offerings (like insurance) to avoid delaying the Pilot further.
- Internal compliance experts and external advisors ensured the platform operated fully within UK regulations, with all user-facing policies and data processes vetted before launch.

Coordinating Multiple Partners

- **Challenge:** Delivery depended on a diverse consortium — technology, research, finance, and retrofit partners — creating risks of misalignment and delays.
- **Response:**
 - Established formal coordination mechanisms, with the Project Manager acting as chief liaison.
 - Regular consortium meetings aligned timelines, deliverables, and expectations.
 - Assigned Escrow-Tech “owners” to each external dependency to monitor progress and address issues early.

Managing Resources and Timelines

- **Challenge:** Delivering an ambitious £1.4M project (with ~£1M grant funding) on time required strict discipline and coordination across locations and teams.
- **Response:**
 - Instituted bi-monthly internal update calls and progress reports to monitor workstream status.
 - Enforced standardised documentation and strict reporting deadlines to align with milestone claims needed for cashflow.
 - When minor delays arose (e.g., a late report or feature), the team increased effort to catch up, avoiding impact on critical timelines.
 - A culture of dual responsibility — accountability to both project goals and company objectives — fostered ownership and mitigated complacency.

Building User Trust and Adoption

- **Challenge:** Gaining consumer trust for a new platform was critical, especially given user concerns about hidden costs and unfamiliar brands.
- **Response:**
 - Embedded transparency in all customer interactions — clear pricing, no hidden fees, and robust support.
 - Partnered with trusted organisations as partners to lend credibility.
 - Strengthened trust through third-party validations (UKCA certification, FCA authorisation, ISO certifications).
 - Internal reviews of the customer journey ensured identified concerns were addressed before launch.

Summary:

By anticipating and addressing governance challenges across strategy, regulation, coordination, resources, and customer trust, Escrow-Tech successfully kept the Pilot on course and delivered a more robust, credible, and user-friendly platform.

6.4 Risk management, compliance and quality assurance

From the outset, Escrow-Tech embedded clear internal processes to manage financial, regulatory, operational, and reputational risks associated with the Carbon-Adjust Pilot. These governance measures ensured the product and organisation remained compliant, resilient, and ready to scale.

Key Measures and Outcomes

Compliance by Design

- Dedicated compliance leads oversaw development of policies and documentation (e.g., Acceptable Use Policy, Terms & Conditions, Privacy Policy).
- New features and partnerships triggered compliance reviews to ensure alignment with consumer credit rules, advertising standards, and intellectual property protection.
- Continuous review and updates of policies ensured the service evolved without breaching regulations.

Financial Oversight

- A defined set of internal financial controls governed budget planning, expenditure tracking, and grant utilisation, ensuring that all spending remained aligned with project objectives and funding criteria.
- These controls included approval thresholds, monthly budget reconciliation, and dual sign-off procedures to minimise risk of overspend or misuse.
- As a result, all claims submitted to the funder were fully documented, reviewed, and approved in advance — facilitating timely disbursement and high levels of funder confidence.
- Financial models were also developed to test incentive viability (e.g., carbon offset rewards) under various pricing scenarios, ensuring long-term sustainability.

Quality Assurance & Technical Risk Management

- Robust quality assurance was embedded in development sprints, incorporating version control, structured code reviews, and independent security audits.
- Smart plugs and related hardware were subjected to rigorous functional and safety testing, culminating in UKCA certification for regulatory compliance in the UK market.
- User acceptance testing during pilot trials helped identify and resolve usability and performance issues ahead of public launch.

Ongoing Risk Assessment

- Regular internal risk reviews informed strategic pivots — including the incorporation of a marketplace concept and the de-prioritisation of insurance components.
- Key risks, such as scalability, resource availability, and value-for-money, were assessed and documented at each project milestone.

- Use of centralised documentation platforms (e.g., SharePoint, project mailbox) ensured a reliable audit trail, supporting transparency and operational continuity.

Scaling, Data Security, and Communications

- Data handling practices were aligned with General Data Protection Regulation (GDPR) and the UK Data Protection Act, with regular internal checks and updates to maintain compliance.

Summary:

Through structured financial controls, integrated compliance checks, rigorous quality assurance, and proactive risk assessment, Escrow-Tech successfully delivered the Carbon-Adjust Pilot in line with regulatory, operational, and customer expectations - building a solid foundation for scale-up and expanded future innovation.

6.5 Governance lessons learned

The Carbon-Adjust Pilot provided Escrow-Tech with valuable lessons in governance that will inform how to approach future product launches and service expansions.

Some key governance-related insights gained include:

- **Align Early with Market and Regulatory Reality:** One major lesson was the importance of early-stage risk assessment and market validation in shaping project features. The initial approach had to be iterated upon and tested (from a carbon offset credit tool to a broader marketplace) when internal analysis showed misalignment with market needs.
- **Clear Roles and Strong Internal Governance Yield Results:** The Pilot confirmed that having a well-defined governance structure with clear roles is essential. By appointing dedicated heads for strategy, product, compliance (finance and legal), etc., Escrow-Tech created accountability and expertise in all critical areas.
- **Stage-gated Development with Agility:** The iterative, stage-gated workflow used in the Pilot demonstrated the value of structured, yet agile development. By breaking the project into milestones with review checkpoints, the project team maintained control over the project's direction and quality.
- **Proactive Risk and Compliance Management as a Core Practice:** The Pilot's success in navigating regulatory hurdles imparted a clear lesson that early and proactive compliance planning is imperative. Escrow-Tech's decision to embed compliance officers in the core team from day one paid off – obtaining FCA approval and other compliance outputs in time. The project would have been far more challenging if tackled later in the project.
- **Stakeholder Engagement and Feedback Loops:** Another takeaway is the importance of continuous stakeholder engagement – both with end-users and

partners – as part of governance. The Pilot's use of focus groups, surveys, and partner consultations uncovered critical insights (e.g. consumer trust issues, desired features, value propositions) that might have been missed otherwise. Incorporating these insights required some course corrections but resulted in a more robust product.

- **Importance of Communication and Documentation:** Finally, the Pilot highlighted that diligent communication and documentation are the glue of effective governance. Internally, regular meetings and clear documentation of decisions/tasks prevented misalignment and ensured all team members and partners knew their responsibilities. For external governance (reporting to funders like DESNZ), having thorough records and reports meant Escrow-Tech could demonstrate progress and compliance confidently.

7.0 MARKETING RELATED RESEARCH

7.1 Marketing strategy and rationale

The marketing strategy for Carbon-Adjust aims to drive the adoption of 5,000 smart plugs across Bristol and London by positioning the product as the only viable platform for unlocking flexibility¹⁸ potential in deprived residential homes. The strategy employs a dual approach: Direct-to-Consumer (B2C) sales and Business-to-Business (B2B) strategic partnerships.

For the B2C segment, Escrow-Tech is launching a digital-first outreach campaign to attract individual home residents. This includes targeted online advertising and content marketing aimed at educating consumers about flexibility and how its operationalisation can help home residents generate extra income, reduce energy costs and lower carbon footprints. The strategy is designed to drive awareness and demand among end-users by highlighting the convenience of automation, enabling residents to easily and remotely participate in flexibility and earn extra income.

In parallel, the project team are also launching a B2B strategy focused on forming strategic partnerships with industry stakeholders (e.g. home improvement contractors, energy consultants, local authorities, etc.). This approach aims to leverage partners' existing customer bases and credibility. By integrating Carbon-Adjust into their service offerings, the product could gain rapid market penetration and endorsement through B2B channels.

As a secondary strategy, a cold outreach virtual assistance company has been employed – selected for its cost-effectiveness, flexibility, and utility in testing markets and refining messaging. The team also required a provider capable of efficiently generating leads through strong copy and targeting. An activation product sales team (B2C Field Sales) is another strategy under consideration; while costly and labour-intensive, it is considered effective for driving volume sales and short-term brand awareness in consumer zones, particularly where there is strong product-market fit and local demand.

Messaging Strategy

The content strategy prioritises financial benefits, followed by convenience and sustainability — aligning with user research which found cost savings to be the top motivator. Key messaging pillars include:

- "Save Money, Save Energy, Save the Planet."
- "Earn Rewards While Using Energy Smarter."
- "Smart Living Made Easy – with Extra Cash in Your Pocket!"

¹⁸ The typical electrical assets that allow households participate in the flexibility markets are EV chargers and heat pumps [which are lacking in most UK homes] – Centre for Sustainable Energy (2025). "Access to Flexibility – A report for National Grid Distribution System Operator".

These messages tested strongly in early user surveys and Pilot feedback, resonating with many homeowners. Should engagement fall short, messaging will be iterated through A/B (split) testing and emphasis adjusted based on real-time user response.

Communication will consistently emphasise financial benefits first, then sustainability and smart living. Analysis of the Carbon-Adjust 2024 trial launch using Yell indicated that while the marketing campaign generated a substantial online presence and modest traffic, conversion rates in the first six weeks were disappointing. This suggests that while visibility and engagement were achieved, converting interest into tangible actions remains a challenge.

7.2 Target audience and market segments

For the upcoming commercial launch in September 2025, initial launch areas will include Bristol and London. This is to ensure Escrow-Tech can leverage flexibility opportunities from both the distribution system operator (DSO) and NESO. The following target audiences and partners have been identified to support the commercial launch and maximise early adoption:

- **B2C Target Audience:** The marketing plan involves targeting residents of Bristol and London who are interested in reducing their energy bills, reducing their carbon footprint, living more sustainably, and adopting smart home technology. Other cities will eventually be included. Findings from initial field trials and focus group sessions suggests that the 18-54 user group are most likely to be users of Carbon-Adjust.
- **B2B Target Partners:** Real estate agents, property management firms, local authorities (LAs), environmental organisations, colleges and schools/universities (sustainability officers), NHS Trusts (sustainability officers), and Citizens Advice Partnerships & charities.

The following distribution channels have been identified to maximise reach and drive adoption across both consumer and strategic partner segments:

- **B2C (Direct to Consumer):** Social media advertising utilising paid ads on platforms such as Facebook, Instagram, and TikTok, and featuring compelling video content (e.g. short videos, demonstrations, animation videos, savings calculators) and targeted messaging.
- **E-commerce Platform:** Optimising online stores for a seamless purchasing experience, driving traffic through targeted social media ads, landing page optimisation, A/B testing, and remarketing campaigns. Amazon will be the initial site in which this will be operationalised.
- **Leaflet Distribution:** A one-off distribution of 100,000 leaflets via Royal Mail to home residents (all house types) across Bristol and London.
- **B2B (Business-to-Business Strategic Partnerships):** This will involve building relationships with key organisations through tailored outreach, partnership packs, personalised meetings, training sessions, industry event

participation, pilot programs, awareness campaigns, and collaborations on grant applications and social media.

8.0 MARKETING PENETRATION

8.1 Planned market engagement methods

The following B2C methods are scheduled to be employed to engage the market and drive early adoption:

- **B2C:** targeted social ads (Facebook/Instagram/TikTok), video explainers and calculators, Amazon storefront, and a one-off 100k leaflet drop across Bristol and London.

8.2 Product acceptance testing

The following activities were undertaken to test product acceptance and build traction across B2B segments and geographic regions:

- **B2B:** partnerships with councils, vetted installers/contractors, property managers, NHS/education and charities; supported by tailored outreach, meetings, training and pilots.
- **Testing/learning loops:** cold-outreach for rapid copy/targeting tests; field sales considered; early Yell campaign delivered visibility but low conversion—used to refine messaging.
- **Public-sector engagement:** formal preliminary market engagement with city councils to demonstrate capabilities and explore fit.

8.3 Market penetration measurement

The following metrics and methods were used to track market penetration and inform iterative improvements:

- **Funnel & conversion:** Track impressions → clicks → registrations → purchases (learning from early low conversion to iterate).

8.4 Market entry enablers

The following regulatory and trust enablers played a critical role in facilitating market entry and building consumer and stakeholder confidence:

- **Regulatory & trust enablers:** FCA authorisation (credit broker), UKCA/ISO credentials, and Elexon/NESO VLP qualification.

9.0 CUSTOMER EXPERIENCE FROM PILOT TRIALS

9.1 Customer research methods

The Pilot trials used mixed research methods: a simulation of the end-to-end journey of Carbon-Adjust¹⁹ with 50 invited households (49 registered; 37 ordered HIA; 35 completed the HIA request; 16 received home assessments) plus a parallel usability study (6 moderated tests and 4 unmoderated), 10 reflective interviews, and a survey to the 35 journey completers.

9.2 Product trial performance

Overall satisfaction was 73% once reports clarified the carbon-offset value, but the platform under-explained carbon offsets (only 36% learned about them on-platform) and awareness of other services was uneven (e.g., 45% unaware of finance). Only 36% said they would “definitely” use the platform again, and the biggest drop-off occurred at the marketplace step (30% not satisfied with information; 24% failed to progress).

Interest concentrated among customers likely to achieve a net saving from offsets; those considering only low-cost measures, with efficient homes, or finding cheaper quotes elsewhere for home improvements, were less suitable.

9.3 Customer motivators

Progression was motivated by understanding the carbon-offset value after receiving reports from the HIA and the convenience of a one-stop shop (76% said offsets would make them more likely to install; 73% liked the one-stop approach). Non-progression reflected uncertainty about offset value and the competitiveness of quotes, on the Carbon-Adjust platform, plus perceived risk of paying for an assessment without early estimates; only 30% would proceed if offset value was <£250/unit. While participants were pre-screened as already considering energy efficiency upgrades, engagement with Carbon-Adjust increased intent to install — conditional on clear, meaningful offset estimates and competitive offers.

9.4 Customer value proposition understanding

Understanding of the value proposition improved notably after reports were issued: while 73% were satisfied overall once the carbon-offset benefit was clarified, only 36% learned about offsets from the platform itself; awareness of finance and other services was also inconsistent (e.g., 45% unaware of finance). Interest skewed toward households likely to realise a net saving (offset value + competitive quotes);

¹⁹ It is important to note that the test was conducted with an early version of Carbon-Adjust that envisaged a hand-off process involving carbon-offset verification, HIAs and finance partners. The journey included providing actual home surveys for several participants, quantifying the potential carbon offsets that could be generated from implementing the retrofit plan, exploring various compensation options for the carbon offset, and assessing potential loan services from our lender partner.

70% said they would use the platform's finance if it were competitive, with some preferring more value upfront.

9.5 Lessons learned from customer pain points

1. Clarity and Navigation Challenges

- A significant portion of users (30%) were dissatisfied with the clarity of marketplace information, and 24% dropped off at this stage.
- 27% rated the layout and organisation as unsatisfactory. Several users stated they wouldn't have found the required packages without external prompts.

Lesson: Consumers value clear, well-structured information and intuitive navigation. When this is lacking, drop-off increases. Early-stage clarity directly impacts engagement and conversion.

2. Transparency and Communication on Carbon Offsets

- Carbon offset information was under-explained. Users expressed surprise upon receiving the offset report.
- Preferences included:
 - Merged reports
 - Surface-level offset values
 - Plain language (e.g. "% emission reduction")
 - Clear explanation of next steps
 - Inclusion of an FAQ or explanatory video

Lesson: Transparency is critical. Consumers want upfront, understandable information, especially regarding impact. Clear communication builds confidence and reduces friction.

3. Trust, Competitiveness, and Conversion

- Users raised concerns about:
 - Paying for an assessment without upfront estimates
 - The competitiveness of quotes
 - Overall professionalism

These issues reduced progression through the funnel.

Lesson: Trust signals are crucial for conversion. Consumers assess trustworthiness early, based on the presence of upfront cost estimates, clarity of process, and perceived professionalism. Competitive framing and transparent pricing can significantly influence engagement and follow-through.

10.0 COMMERCIAL VIABILITY

10.1 Product commercial vision

Escrow-Tech's long-term aim is to build a nationally scaled, UK-first platform that converts household demand-side flexibility into affordable finance for energy efficient upgrades. Escrow-Tech will prioritise UK consumers, particularly those typically excluded from retrofit finance, by integrating simple, FCA-compliant green-finance options that deliver clear, measurable reductions in energy bills and carbon emissions through accredited providers and smart hardware.

Recognising that the future viability of Escrow-Tech depends largely on its portfolio of intangible assets, there is a focus on safeguarding intellectual property generated by Carbon-Adjust and its future iterations through patents.

As part of product launch plans, the project team are expanding the portfolio of hardware technologies available to end users, including fingerbots, smart sockets (single and double gang), temperature sensors, smart switches, Wi-Fi smart electric kettles, and Wi-Fi electric heater mirrors. These additional devices are key to reaching a broadening audience and enhancing the utility of Carbon-Adjust. These devices enable households to monitor, automate, and remotely control everyday appliances and heating systems without the need for rewiring. This helps users to reduce energy waste, shift usage to be more cost-effective with lower carbon intensity, and the verifying of savings through Carbon-Adjust.

10.2 Operational changes needed to scale

The current infrastructure provider — Tuya — is limited in its offerings, which in turn restricts the ability to scale users and use cases. There is also a constraint on the number of API calls that can be made in monitoring device status. To ensure the product can reach scale without hinderance and expand the utility offered to customers, Escrow-Tech has launched an internal project to design its own hardware ecosystem. This will use off-the-shelf, open-source chips encoded with firmware and supported by an agile cloud infrastructure, enabling greater control of the value-chain. Generation 2 smart devices are expected to launch by December 2025.

Beyond this, the project team will also open access to this infrastructure for third parties interested in sourcing product identification (PID) for their own unique hardware design and device management.

10.3 Remaining commercialisation barriers

To generate commercial value, Escrow-Tech requires an off-taker to accept the flexibility that is generated. Across the UK, NESO and DSOs within constrained managed zones (CMZs) are potential off-takers. To enable the trading of flexibility

with these parties, the project team have qualified as a virtual lead party (VLP) and is finalising the registration of assets with NESO.

10.4 Additional partnerships needed to improve product viability

Additional partnerships are needed to improve the viability of Carbon-Adjust beyond NESO and DSOs include data centre operators and large energy demand users seeking grid integration in constrained areas. Such partnerships will be helpful in enabling the operationalisation of the business model to unlock extra grid capacity.

10.5 Impact of GHFA funding

GHFA funding has played a crucial role in the commercial success of Carbon-Adjust and Escrow-Tech. This support has significantly reduced the risks involved in developing this innovative product. With this funding, a team of experts, consultants, and stakeholders has been assembled, whose contributions have been vital to the project's achievements. It has also enabled the initial securing of intellectual property developed during the Discovery and Pilot Phases.

In addition, GHFA funding has facilitated FCA authorisation, the design and manufacture of the bespoke hardware (smart plugs) required to operationalise Carbon-Adjust's flexibility, and the procurement of essential certifications like UKCA. The funding also enabled the pursuit and attainment of VLP qualification, marking the final step toward the full launch of commercial operations. Without this financial support, overcoming the significant cost barriers associated with entry in this sector would not have been feasible.

Beyond these milestones, GHFA funding has also enabled the development of a wide range of in-house expertise that has been critical to the commercial success of Carbon-Adjust. These skillsets have been refined and expanded through the opportunities provided by this essential funding.

11.0 FINAL REFLECTIONS

11.1 Summary of key insights

Over the past eighteen months, GHFA support has enabled the testing of an integrated approach to domestic flexibility and green finance, helping to identify what enables households and SMEs to succeed. There is strong potential for outcome-focused innovation funding to keep drawing out practical, scalable solutions that lower bills and cut emissions, especially where business-model and digital innovations are involved. In that spirit, it is encouraged that there be continued emphasis on ambitious, evidence-led projects that clearly demonstrate consumer value and carbon impact. Working on Carbon-Adjust as an SME has provided valuable insights into the UK innovation landscape, particularly in relation to achieving the ambitious goals of clean energy by 2030 and net zero by 2050.

The importance of proportionate, agile pathways for testing emerging models has been recognised. Collaboration with OFGEM, ELEXON and the FCA would be welcomed, to explore options such as sandboxes, appointed-representative style routes, or other mechanisms that allow time-limited, well-governed trials, while maintaining consumer protection. Lowering practical barriers to participation can broaden the pool of capable market entrants, stimulate competition, and ultimately deliver better value to households. Alongside this, structured, hands-on support for first-time entrants — on sequencing, certification, trial design and intellectual property — can significantly improve delivery confidence.

11.2 Reflections and alternative approaches

From an innovation process perspective, if starting from scratch, nothing would be done differently. This is because the hard lessons learned while iterating Carbon-Adjust were essential for building in-house expertise, retaining intellectual property, and shaping a scalable business model. This is due to the nascent nature of the field within which the project team are innovating in.

Conversely, for market entry, if starting from scratch, some activities that would have been done differently include:

- **Leading with value sooner:** Make carbon-offsets and grid-balancing flexibility benefits explicit from the first user screen with simple worked examples and typical ranges; most users did not grasp offsets until *after* reports and then interest rose sharply.
- **Tailoring the marketplace:** Ask consumer needs upfront, then show fewer, clearer options with better packaging, detail and progress updates; this is where the biggest drop-off occurred.

- **Starting with low-commitment demand side response, then ladder up:**
Offer smart-plug–based demand-side response as the entry path before asking for paid home assessments, reflecting reluctance to fund HIAs upfront.

These changes reflect where users hesitated due to having issues with a lack of clarity, trust, and choice; where they engaged once informed; and where delivery timelines were most affected.

11.3 Implications of project findings

The Pilot confirmed that Carbon-Adjust’s integrated approach — combining hardware, software, finance and trading — can translate household actions into measurable energy bill and carbon emission reductions, provided the journey is kept simple and value-led. The project team will prioritise clearer, earlier communication of next steps within the application flow, alongside maintaining consistent design across touchpoints to reduce drop-off and user confusion.

Escrow-Tech is now ready for commercialisation, having obtained VLP qualification, which enables flexibility trading with NESO/DSO off-takers in constrained areas. In parallel, the project team is advancing partnerships to support the business model and execute the scale-up plan, including the launch of a second-generation device to overcome third-party constraints. The project team will also continue to strengthen compliance and consumer trust through the certifications and authorisations achieved during the Pilot. Success will be tracked against the product’s core aims of lowering energy bills and reducing emissions for UK households.

11.4 Project conclusions

GHFA support enabled the project team to assemble the core building blocks of Carbon-Adjust - UK-ready hardware and apps, embedded finance features, and a pathway to trade domestic flexibility - positioning the product for UK market launch. Notable foundations include FCA authorisation, UKCA for devices, and VLP qualification.

As the transition from Pilot to scale continues, green-finance integration will focus on frictionless settlement, controlled disbursements, and partnerships that broaden access to upgrades — while ensuring that customers can clearly see how actions in the home translate into savings and verified impact. These steps align with GHFA objectives and provide a clear route to durable, UK-wide uptake.

12.0 APPENDIX

12.1 Credits

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12.2 For Citation Purposes

Escrow-Tech Limited (2025). Carbon-Adjust: Carbon-Offset Adjusted Loan Rate Settings for Financing Green Home Improvement Activities. Green Home Finance Accelerator Pilot Phase Report.

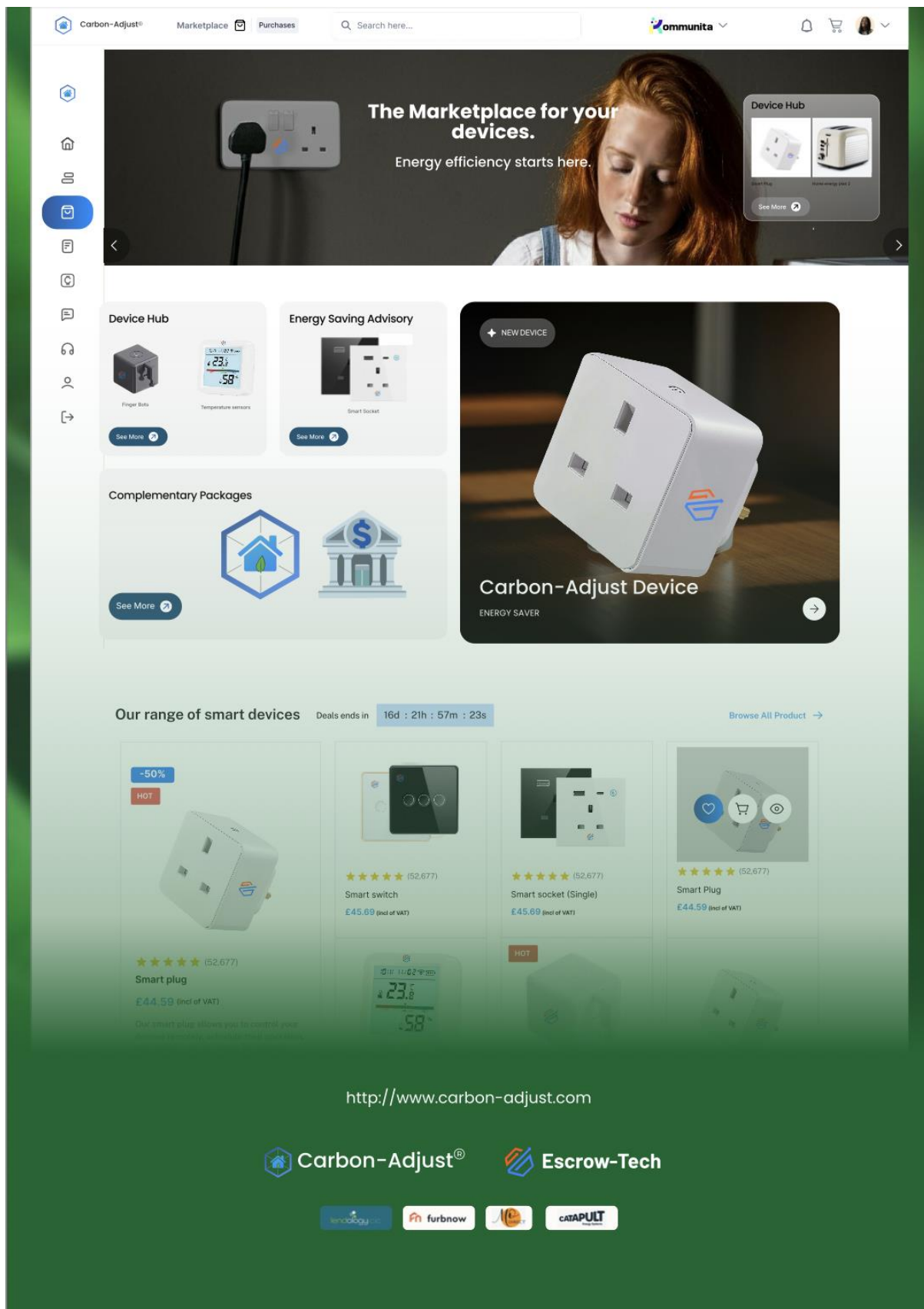


Figure 5: Carbon-Adjust website giving users a pictorial view of the user interface.