

PROJECT FAIR | AUTOMATIC ASSET REGISTER PHASE 1 REPORT

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FOREWORD FROM DAN

The Flexibility Asset Information Register project, (project FAIR), is a fantastic opportunity for GB to enable flexibility markets through better quality and more accessible data on Low Carbon Technologies (LCTs) and Distributed Energy Resources (DERs). The project will provide value today and in the future by allowing network companies access to a wealth of information about the customer-owned assets that are connected to their networks. This supports network planning cost challenges for the new RIIO ED2 period starting in April and the move towards the more integrated and dynamic networks operations required to achieve net zero by 2050.

Working with our partners Xanda and University of Birmingham during phase 1, the team has undertaken extensive research, stakeholder engagement and several technical development deep dives to understand the issues, challenges and design the proposed solution, that not only meets the BEIS competition objectives but will be beneficial for the industry.

The 4 key principles developed by the project team ensures the project benefits are realised early by leveraging and optimising the existing LCT data. Focusing on delivering the Central Asset Register first allows value to be released early. In the later stages, further value will be realised as new methods of collecting and validating LCT data are incorporated. Our flexible and scalable solution will efficiently enable the rapid delivery of LCT data, before enabling the addition of new real-time data types, as they become available.

Our governance and operating models are based on industry best practices and data standards. This ensures the platform is implemented and operated fairly and transparently, whilst ensuring data protection is always maintained. Data security and safety is a core principle for ElectraLink and will remain a key focus for project FAIR. This mindset ensures we will have the level of security and reliability expected by our stakeholders to drive high-value or even critical use-cases.

Project FAIR leverages and builds upon our combined knowledge of LCT data, data infrastructure development and operation, and data management and optimisation know-how, to provide a truly valuable data service that will deliver tangible benefits for the energy industry and transition to net zero.

I am proud of the solution the project team has developed in phase 1. We at ElectraLink and our partners, Xanda and the University of Birmingham, are fully committed to making this project a success and hope we can take this further in 2023.



DAN HOPKINSON,

CEO

NAVIGATING THE REPORT

The project FAIR report has been structured in 3 parts. The key diagrams within parts 1 and 2 will be available on our website, to allow the reader to view them in detail, especially where some fonts may be smaller due to image size constraints within this report. Additionally, more detailed appendices – part 3 will be available via our website. Please note the part 3 appendices will not be contained with this report only part 1 – Report summary and part 2 - Main report.

Part 1 >

REPORT SUMMARY

Provides a full summary overview of the proposed solution, key facts, benefits, and risks.

Part 2 >

MAIN REPORT

Dives deeper into the detail which sets the scene for the reader, providing an overview of stakeholder engagement and feedback, the proposed solution, the future roadmap and a more in depth review of the barriers, further considerations, and risk.

Part 3 >

DETAILED APPENDICES

These will be available only via the website includes larger versions of the diagrams contained with the main report and detailed documents such as a full system requirement assessment, processes flows, summary stakeholder output reports, governance assessment report, a risk deep dive and short videos from the developed proof of concept.

See appendices here >

REPORT SUMMARY

INTRODUCTION

ElectraLink with our partners Xanda and University of Birmingham have undertaken a detailed proof of concept study to develop a proposed solution for a Low Carbon Technologies (LCT) Central Asset Register (CAR) and Automatic Asset Register (AAR), which was commissioned by the Department of Business, Energy and Industrial Strategy (BEIS), as part of the Government's Net Zero Innovation Portfolio (NZIP), known as the Flexibility Asset Information Register project (project FAIR). Since September 2022, we have undertaken extensive research, stakeholder engagement and undertaken several technical development deep dives to understand the issues, challenges, and to design a solution. This report summary provides an overview of the proposed solution, key technical aspects, the benefits, future, risks, and challenges to support BEIS's decision to move to the next phase of the project.

Understanding where and what LCTs are connected to Great Britain's (GB) electrical network is necessary to support the energy transition and to achieve net zero. Gaining deeper insights into LCT deployment across GB will drive greater innovation for the planning, prioritisation of investments and network operation of different energy networks and support the development of customer optimisation opportunities that will drive value for consumers.

There has already been extensive research into the value of flexible generation and demand to support network operations but having greater knowledge and quality data will help to unlock this value. For example, the Government's Smart Systems and Flexibility Plan 2021 shows that flexibility could also reduce annual energy system costs by £10bn a year by 2050. National Grid ESO stated in May 2022 in its report on Operational Visibility of Distributed Energy Resource (DER), that the increasing volumes of Flexibility resources would provide DSOs and the ESO with the ability to lower costs and deliver up to £150m per annum in savings through greater operational visibility of flexible assets.

Project FAIR has taken the first step to begin the process of recording and identifying all LCT data, and it proposes a solution that can replace the current dispersed, decentralised registration process of LCT assets.

KEY PRINCIPLES

Project FAIR's proposal focuses on delivering 4 key principles, that are founded on the feedback received from our stakeholders and the development process during phase 1. These 4 principles would remain the core focus for subsequent phases and would be continually developed to ensure maximum value is achieved.

- VALUE TODAY & FOR THE FUTURE
- FLEXIBLE & SCALABLE SOLUTION
- ROBUST GOVERNANCE & OPERATING MODEL
- SAFE & SECURE BY DESIGN

LCT +

DER +

BEIS/Ofgem: Smart systems and flexibility plan +

Ofgem Consumer survey 2021 +

NGrid LCT +

REPORT SUMMARY

PROJECT FAIR FOUR CORE PRINCIPLES

VALUE TODAY AND FOR THE FUTURE

Project FAIR will deliver this through:

- Building a strong foundation by developing the Central Asset Register (CAR) first, ahead of the Automatic Asset Register (AAR) will resolve many of the existing problems with today's LCT data and requested by all of our stakeholders
- Developing an LCT asset detection process to identify assets not registered will improve data quality and insights. According to ENA data it is believed that 60% of LCT assets are being missed by the connection notification process.
- Having a central repository for LCT asset registration and detection across the industry and especially for DNOs allows value to be unlocked quickly that will support ED2, planning, flexibility understanding / insights and development of flexibility services, e.g., Loop connections case study in section User types, cases and benefits,
- A clear roadmap with evolving user cases from CAR to AAR with Internet of Things (IoT) communication.
- The use of AWS-managed cloud services and other technologies where infrastructure and processing are managed at scale, ensuring the solution is sustainable and minimising the environmental impact through optimised processes and resource utilisation.

FLEXIBLE AND SCALABLE SOLUTION

Project FAIR will deliver this through:

- The ability to integrate with current and future digitalisation projects such as the ENA Digitalisation of connections, Smart Meter Energy Data Repository, Digital Spine and new smart products and installation applications being developed by the industry such as UKPN Smart Connect App.
- Cloud based, serverless design, so the asset register and framework can cope with significant growth in LCT deployment and the shift from static data to real time dynamic data e.g., National Grid ESO in its Falling Short scenarios predicts 37.5million battery operated cars and vans in the UK by 2050.
- Being modular by design with decoupled services allows for rapid agile change developments to the current system and can also adapt to future industry disruption events. These could be driven by changes in legislation for registration, e.g, LCTs with different characteristics, and development of novel methods to analyse historical datasets to determine the likelihood of a change, such as LCT removal.

REPORT SUMMARY

PROJECT FAIR FOUR CORE PRINCIPLES

ROBUST GOVERNANCE AND OPERATING MODEL

Project FAIR will deliver this through:

- Development of a robust governance framework based on transparency, trust and best practice (i.e. Citizens Advice Clear and in control) for data handling, building on ElectraLink's 25 years of experience.
- Considered and controlled access based on use cases that combine both the governance framework and the technical solution to ensure it is safe and secure.
- Business processes and technical controls that safeguards quality from the beginning and continue to monitor data, system and process quality.
- A credible and tested operating model proposal that transitions from BEIS innovation funding to an industry funded managed service.

SAFE AND SECURE BY DESIGN

Project FAIR will deliver this through:

- Providing a cyber secure data service that puts the protections of parties' data first. It will ensure that best in class architecture and security are implemented at design stage and risks are managed proactively throughout service delivery.
- A solution built on a zero-trust model (as defined by NCSC), where users and services are identified and every request is checked for authentication and authorisation.
- Using our knowledge, experience and by adopting best practice frameworks such as the AWS Well Architected Framework for the architecture and ISO 25010/25012 for the software and data quality requirements, we have incorporated security, resilience, performance and sustainability into every aspect of the solution.

REPORT SUMMARY

PROPOSED SOLUTION

Our proposed solution comprises of a Central Asset Register (CAR) and an Automatic Asset Registration (AAR) that incorporates and expands upon the BEIS competition guidance, our stakeholder feedback, and the design development. The proposed solution will be hosted on the Amazon Web Services (AWS) public cloud. This allows us to leverage the scale and global expertise of AWS to deliver a modular, serverless and robust solution for the CAR and AAR.

Our solution is divided into several components:

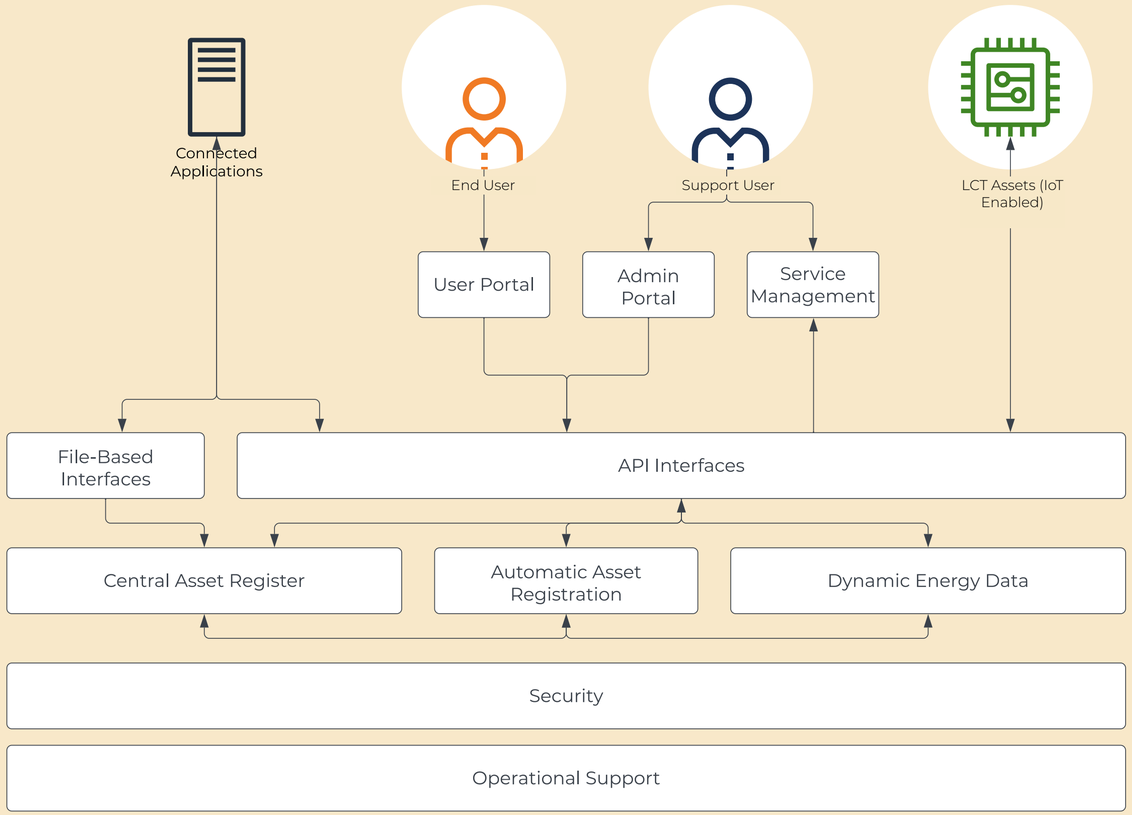
- **Central Asset Register (CAR)** – provided through API and file-based interfaces, this will allow the storage and processing of static asset information, tracking of installations and subsequent changes, the storage and management of customer consent and allow for the performance of detailed data analytics and quality control to support the user benefit case and the wider industry.
- **Automatic Asset Registration (AAR)** – the ability to automatically identify and authenticate each LCT asset and route it to the correct workflow ("connect and notify" or "apply to connect") and to implement the outcome of those processes, either allowing the device to connect and complete the registration or rejecting it and signal back to the DNO's or ENA to complete the connections process.
- **Dynamic Energy Data** – LCT assets will generate large volumes of dynamic energy data and this part of the solution will allow the ingestion, processing, storage, and routing of this data at large scales as LCT's shifts to and Internet of Things (IoT) world and the adoption of LCTs expands.
- **Service Management** – provides the ability to orchestrate and manage workflows from user requests, via governance rule or requested by the user group, e.g., to track a user request and ensure it has the appropriate approvals before they can access the system.
- **User Portal** – this will provide end users access to essential services and capabilities for the platform, from accessing open data to triggering the registration process and access the reporting, analytics, and querying services.
- **Admin Portal** – by logically separating user and admin functionality, we can securely provide access through a web portal for admins to manage organisation and user access (subject to approvals from the governance process) and perform platform management and maintenance tasks.

All the above components are supported by security and operational system capabilities to ensure the solution remains secure and operational throughout its lifecycle. System's health and performance will be monitored, any issues will be detected, analysed, and fixed. System insights will be gained and used to enhance and make improvements overtime as part of the ongoing operating model.

REPORT SUMMARY

Diagram 1 FAIR Logical view shows the logical design view of the solution and how the components interact:

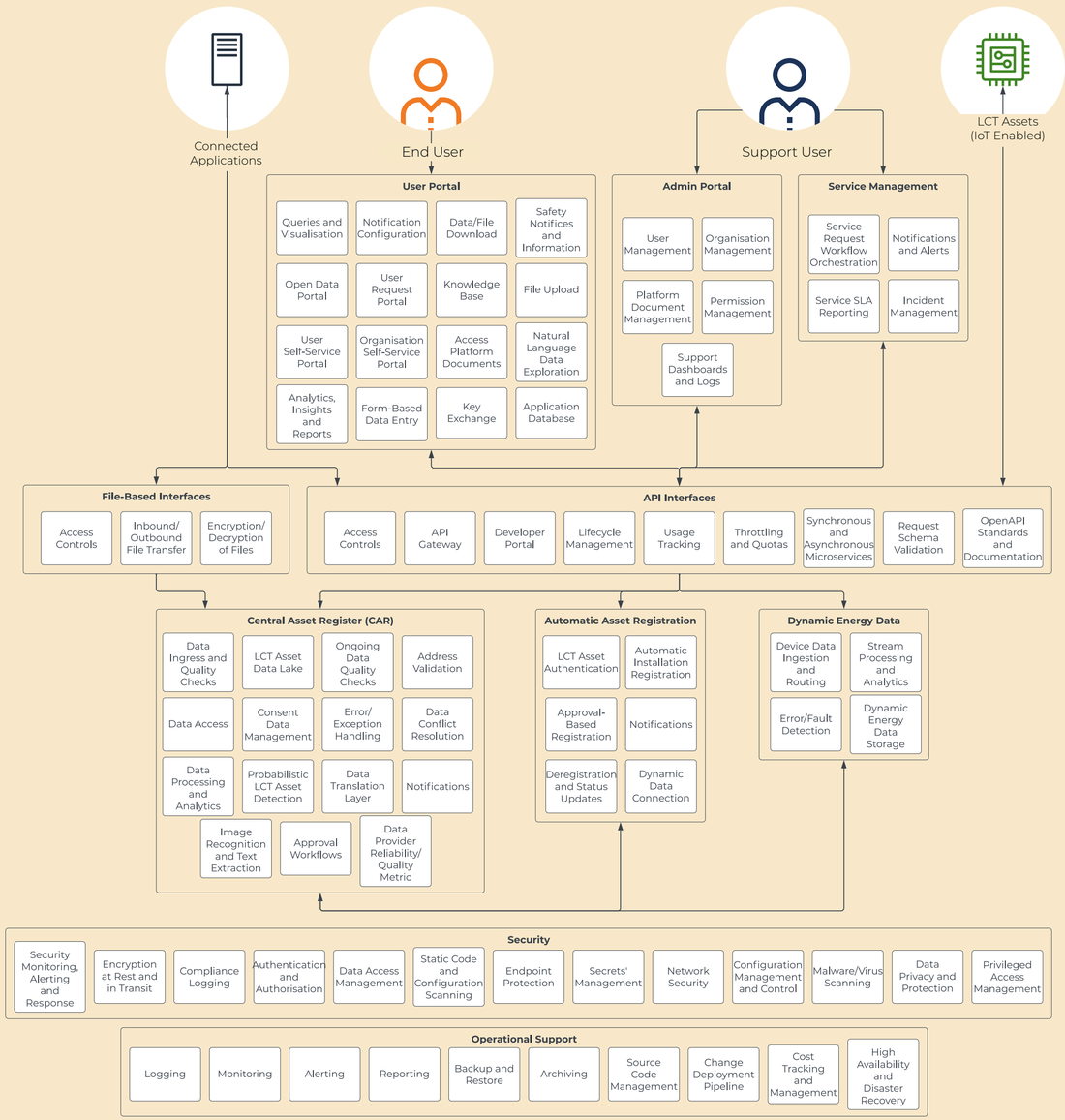
Diagram 1 - FAIR Logical view



REPORT SUMMARY

Diagram 2 FAIR System Capability shows the key capabilities of the proposed solution (that incorporates stakeholder feedback see section Stakeholder views for more details):

Diagram 2 - FAIR System Capability



REPORT SUMMARY

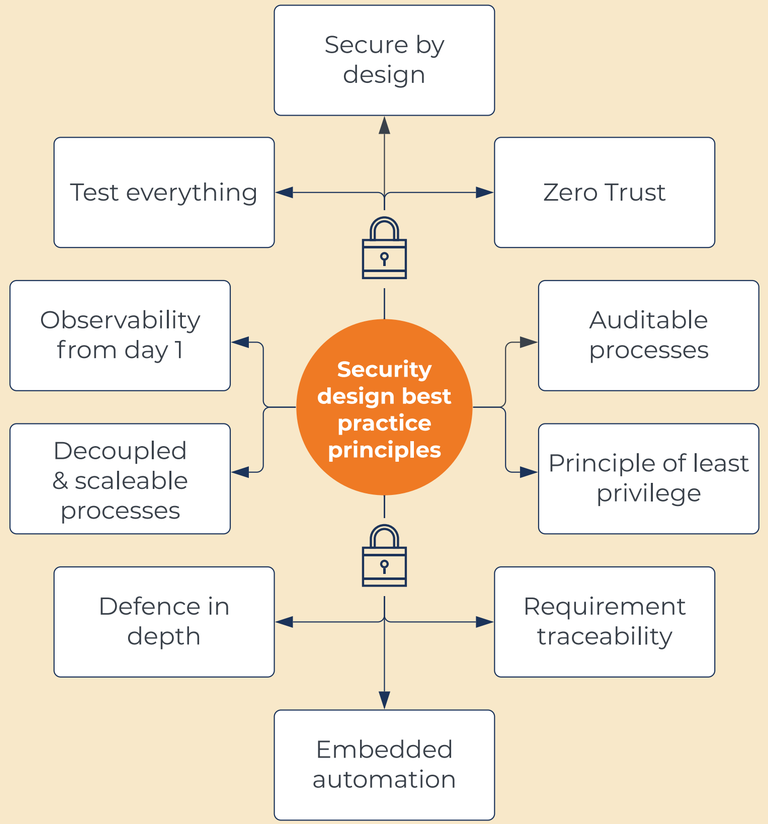
The capabilities provide the key building blocks to deliver the user journeys, user and benefit cases, core system functionality and management. This modular design allows the system to be flexible, efficient, and sustainable to deliver value today and for future development, by capitalising on the existing design features. The capabilities have been designed using a tried and tested set of security and architecture principles, best practice guidelines such as the National Cyber Security Centre Cloud Security Principles and our extensive experience in designing solutions and managing sensitive data. Diagram 3 Security design best practice details the high-level security design and best practice principles, and appendix 1 provides further detailed explanations of each principle.

The proposed solution can ingest and validate LCT asset reference data from manufacturers (data ingress), store it (within a data lake), trigger alerts and send messages to users (notifications) and make information available via API (data access) that will drive value today and in the future. This allows data providers and users to access a single, standardised, machine-readable interface to send and retrieve the data that can dovetail with their own systems and applications. For example, these could include:

- Integration with the DNO connections process either via the proposed ENA digitalisation of connections or via individual DNO connection apps or processes such as UKPN Smart Connect App.
- Incorporation into mobile/web apps used by installers to support and reduce human error, making it easier to manually register an asset (e.g., by providing linked information for related fields in forms, such as a list of manufacturers then returning only their models once one is selected).
- Enabling manufacturers to fully automate the registration process, when a new product or device is approved and, in the future, retrieve that data during the manufacturing process of Internet of Things IoT enabled assets to be used to configure the automatic identification and registration process at the point of integration.

Full technical details of the proposed solution can be found in the Proposed solution technical overview sectionn

Diagram 3 - Security design best practice



REPORT SUMMARY

BENEFITS

Project FAIR can provide significant benefits to users, stakeholders, the industry, and consumers; a full detailed CBA will be undertaken if we are successful in phase 2 and 3. We have grouped the benefits into the following three main categories and linked the benefits to wider industry strategic objectives, findings and recommendations that support the transition to net zero. The core benefits of implementing project FAIR are interrelated and can be collectively achieved if project FAIR is developed and progressed.

The core benefits are:

1. Network planning, connections, and flexibility

Project FAIR can provide improved quality and timely data to enable improved system planning, connections and flexibility services (which is aligned with BEIS's Net Zero strategy, Energy Innovation and Smart Systems and Flexibility Plan and Energy Digitalisation Strategy). Diverse network investment solutions and improved operational efficiencies will provide the cornerstone of modern, efficient energy networks. Smart, flexible services are the means with which the industry can accelerate to achieve the Government's net zero ambitions. We need to connect more renewable generation and LCT's and reduce our dependence fossil fuels. This is a huge challenge for the industry and especially the network and system operators and this has been reflected in both distribution (RIIO ED2 Final determinations November 2022) and transmission (RIIO 2 Final determinations December 2020) regulatory determinations.

Project FAIR can provide data in a higher quality format and more timely manner, which provides the fundamental information to unlock these new services. This can, therefore, enable better planning of the energy system, greater understanding of the impacts and opportunities provided by LCT growth.

Better quality information will allow network and system operators to identify and remove barriers, develop, and enhance flexibility services to support operation at a lower cost and support new network connections. This will improve services to network customers and create new products, services, and jobs in the power sector. Better quality information is a foundation for innovation and will accelerate the deployment of greater levels of LCT's at lower overall network and operations cost.

2. Digitalisation and transparency

Project FAIR can enhance digitalisation and data transparency by delivering the measures recommended by the Energy Data Taskforce. Digitising the registration process for LCTs will create a single source of truth for LCT data today in the CAR. The development of an LCT detection process and analysis techniques will assisting in identify gaps in the information and application of appropriate corrective measures, i.e., improve installer / customer awareness of the requirement to register and explain how to do so. Ultimately moving the solution towards a fully AAR and the integration of IoT. Streamlining and harmonising the data capture and management for LCT data and simplifying the process for registration, by linking processes between other projects across the sector (such as the ENA digitalisation of connections) will provide data confidence, transparency and reduce the likelihood of disruption, and improve the customer experience.

See what BEIS said +

See what Ofgem said +

REPORT SUMMARY

Improved LCT data transparency can also provide important signals to Government and regulators permitting a better understanding of how policies influence behaviours, and therefore help to shape future policy design. This will be particularly useful for vulnerable customers and those in or at risk of fuel poverty. In addition, it provides opportunities for research and development that will drive wider social, economic, and environmental benefits linked to building a net zero future, such as identifying possible education and training gaps to support the greater deployment of LCT's. With increased information transparency, it is possible to create new use and benefit cases by overlaying the CAR and AAR data with other data sets, such as Experian's MOSAIC, EV suitability and EPC rating to help improve DNO demand forecasting, and LCT sales deployment.

Overall, we foresee that improving the data capture and management process, whilst increasing data transparency will provide significant cost efficiencies for the industry and has the potential to develop new insights and understanding that can support the unlocking of new flexibility products and markets.

3. Innovation and removing barriers

Project FAIR can drive innovation and remove barriers to entry supported by Innovate UK's action plans and supports the delivery of the Energy Data Taskforce recommendations (specifically visibility and infrastructure and asset visibility). The benefits of driving innovation and removing barriers have been well researched and documented across many industries and include increased productivity, more competition, reduction in costs, creation of value and establishing new working relationships. This equally applies to our proposed solution because creating a harmonised, co-ordinated, accessible, and central information source for all LCT data in GB will help to remove the current barriers that are based around uncertainty of what type and where LCTs are currently located and encourage greater innovation. Access to higher quality data will accelerate innovation of new benefits cases, services, technologies, and solutions from existing market participants and will help to provide opportunities for new market innovators. The development of new ideas, products, and services (including flexibility services and new customer optimisation services etc) can enhance the market, increase competition and improved market liquidity. This in turn drives improvements for customers. With better quality and transparency of information, businesses can offer innovative new services and products alongside associated offerings such as preventative maintenance, upgrades and linking of services etc.

As well as driving innovation in the market, it will also allow for innovation of data and data analytics, which can then be used to support disruptive technologies and green technologies, thus creating a virtuous feedback loop that drives data driven innovation. Project FAIR is an enabler to unlock these opportunities for the industry and consumers to achieve net zero.

See what the Energy Data Taskforce said +

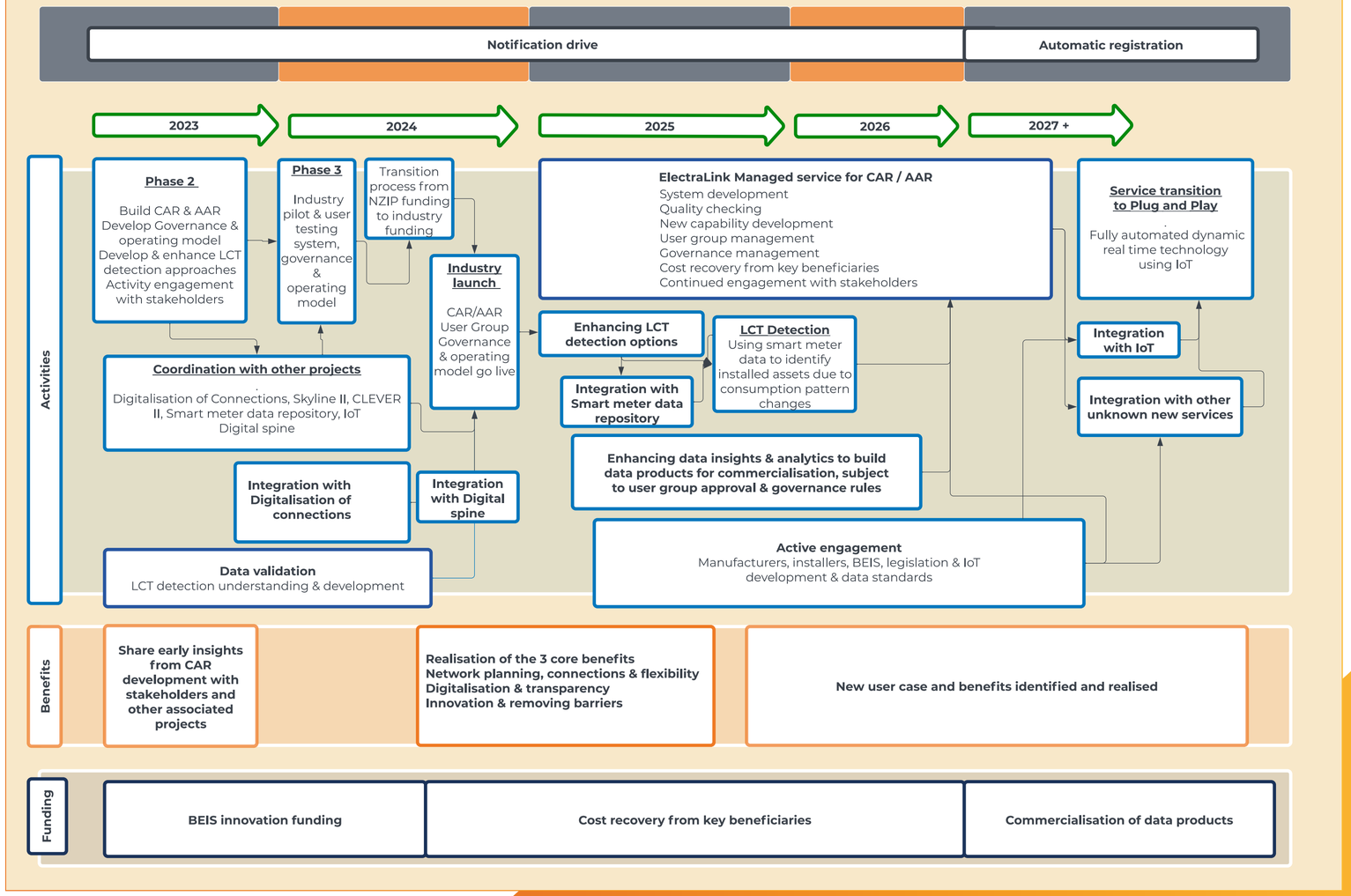
See what the UK Research and Innovation said +

REPORT SUMMARY

PROJECT FAIR'S ROADMAP

Diagram 4 – Project FAIR's Roadmap for project FAIR demonstrates the project can be developed and implemented to drive value and achieve the core benefits. It includes the activities required from phase 2 in 2023 through to an industry launch and the service transition to a fully automated "plug and play" world. In addition, it includes the timing of the benefits and proposed funding transition from innovation funding through to commercialisation of data products. It should be noted that all funding mechanisms would be subject to BEIS and industry agreement see section Proposed governance, standards and operating model for further details.

Diagram 4 – Project FAIR's Roadmap



REPORT SUMMARY

GOVERNANCE, STANDARDS, AND OPERATING MODEL

To support the technical solution, we also propose the development of a robust governance, data standards and operating model that is based on the extensive 25 years' experience ElectraLink has from operating the Data Transfer Service (DTS). The governance frameworks is data driven and focuses on providing access for permitted purposes, especially when managing data that is classified as private or restricted. Our proposed solution includes establishing an ElectraLink managed service, user group, data custodian (BEIS or appropriate nominated party) and all the associated governance documentation and data standards required to support an industry launch of the service in 2024 (as detailed on the roadmap diagram 4). This also includes an enduring funding model that transitions from innovation funding to cost recovery from key beneficiaries to commercialise data products approved by the user group to be sold to third parties, see section Proposed governance, standards and operating model for full details. It should be noted that all funding mechanisms would be subject to BEIS and industry agreement.

BARRIERS, FURTHER CONSIDERATION, AND RISKS

As with all major projects there several barriers, further considerations and risks that must be considered, some that are within the gift of the projects control and others that are not and require intervention from external parties. Barriers, further considerations and risk section, identify and group the most important barriers, considerations, and risks for both the development phase and moving into operations. We have proposed mitigations and recommendations to address the challenges. The grouping in 4 areas have been summarised in the table, full details can be found in the Barriers, further considerations and risks section and an extensive risk deep dive in appendix 2. If project FAIR is taken forward, risk management and mitigation would remain a priority and an area for continued engagement with our stakeholders to ensure all risks are identified, mitigated to a zero or minimal impact and the continuous adoption of best practice.

REPORT SUMMARY

	Area	Barrier, considerations, and risk summary	Mitigation and proposed recommendation summary
1	**Data, consumers, and governance**	There are several potential regulatory and legal barriers to access smart meter data to support key elements of our proposed solution including the LCT detection aspects	We would seek to work with the data owners, BEIS and Ofgem to seek access by clearly articulating why data is needed, how it will be used, to define a permitted purposes and ensure the data is protected via robust governance model and data standards
		Consumer resistance to data sharing	Cultural resistance is difficult to change, we will remain engaged with stakeholders especially Citizen's advice and adopt best practice. Beyond the project scope we will work collaboratively with BEIS, Ofgem, other parties and projects to help explain the complexities of the electricity industry, address consumer concerns and highlight the benefits of sharing data.
2	**Standards and technical**	The project has no legal or authority over the industry, data provider and users to adopt and comply with the data standards that are developed	By engaging with stakeholders, incorporating their feedback, and developing a robust solution that provides benefits to data providers and users we should be able to mitigate the risk and agree standards. However, legislation or regulations may be required if we are unable to reach an agreement.
3	**Other related projects and dependencies**	There are dependencies between project FAIR and other projects such as digitalisation of connections and Smart Meter Energy Data repository which could impact on the development and implementation.	Through communication, coordination and collaboration with the other projects and BEIS this risk can be mitigated to enable smooth integration of all the projects.
4	**Funding**	Agreeing the cost recovery funding mechanism with the key beneficiaries of the CAR and AAR ahead of industry launch	We will continue to work closely with stakeholders to ensure we unlock the benefits. This will include a detailed CBA during phase 2. Using this information, we will seek to develop and agree the future funding mechanism with BEIS and the key beneficiaries before the end of the project.

Conclusion

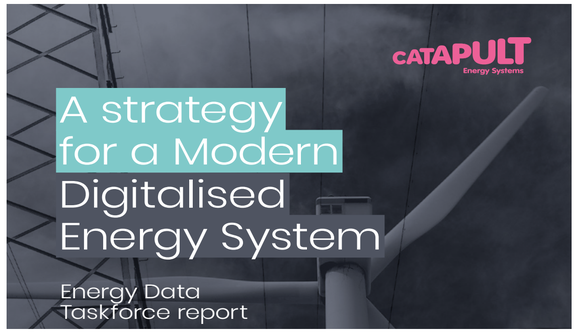
Project FAIR has developed a comprehensive solution which can be developed and implemented to drive value today and in the future. It builds a strong foundation to manage the evolution from a LCT fragmented data state to centralised digitalised process through to the future world that is fully automated and supports real time data exchange from the installed assets via IoT.

The solution delivers one that is flexible and scalable to meet the expected growth of LCT's and is supported by robust governance and operating model and data standards in a securely designed system. The collaborative approach of phase 1 would continue to be adopted in future phases. This would be a key element for operational success to ensure the benefits detailed in this report are fully realised and new user and benefit cases are developed to enhance the value of the solution for data provider and users, the industry, consumers and support the transition to net zero.

SETTING THE SCENE

INTRODUCTION

ElectraLink with our partners Xanda and University of Birmingham have undertaken a detailed proof of concept study to develop a proposed solution for a Low Carbon Technologies (LCT) Central Asset Register (CAR) and Automatic Asset Register (AAR), which was commissioned by the Department of Business, Energy and Industrial Strategy (BEIS), as part of the Government's Net Zero Innovation Portfolio (NZIP), known as the Flexibility Asset Information Register project (project FAIR). Since September 2022, we have undertaken extensive research, stakeholder engagement, undertaken several technical development deep dives to understand the issues and challenges, and designed a solution.



See full report here >

A decarbonised energy system is core to the UK's goal of achieving a wider net zero economy and is a key focus for BEIS. The transition to an energy system that supports net zero can be assisted by many elements including improved coordination to help lower costs, and a deeper understanding of the amount and type of LCTs that are connected to the electricity network. Having greater knowledge of the location and the characteristics of LCTs, such as solar PV or Electric Vehicle (EV) charge points is important to allow network operators to be able to plan networks with greater certainty, and to control the system more dynamically.

A key component for success is greater use of data and digitalisation, that supports timely data driven decision making. In 2021, The Energy Digitalisation Taskforce made several recommendations to unlock the benefits from greater digitalisation in the energy sector.

These included:

- **"Data Visibility:** Understanding the data that exists, the data that is missing, which datasets are important, and making it easier to access and understand data.
- **Infrastructure and Asset Visibility:** Revealing system assets and infrastructure, where they are located and their capabilities, to inform system planning and management.
- **Operational Optimisation:** Enabling operational data to be layered across the assets to support system optimisation and facilitating multiple actors.
- **Open Markets:** Achieving much better price discovery, through unlocking new markets, informed by time, location and service value data.
- **Agile Regulation:** Enabling regulators to adopt a much more agile and risk reflective approach to regulation of the sector, by giving them access to more and better data" .

In 2021, BEIS and Ofgem published the Energy Digitalisation Strategy and the following year BEIS launched a number of innovation competitions under Net Zero Innovation Portfolio (NZIP)including the Automatic Asset Registration (AAR) project, Smart Meter Energy Data Repository, Smart Meter Based Internet of Things Applications and Digital Spine. Each competition focusses on different areas in the energy market but each needs to be able to interact in future to underpin an overall energy digitalisation strategy. This context has been an important focus and consideration as we developed our proposed solution to ensure it is future proof and drives value for consumers.

SETTING THE SCENE

The BEIS objectives for AAR are to:

- "Develop a Solution to asset registration that ensures small-scale, low-carbon energy assets are automatically registered with the relevant authorities upon installation.
- Develop a Central Asset Register/ Portal Solution, capable of collecting and managing consumer consent and securely communicating energy asset data from registered energy assets through machine-readable interfaces.
- Demonstrate how Automatic Asset Registration technology and a Central Asset Register can enable real-time exchange of dynamic energy asset data through machine-readable interfaces.
- Provide evidence to inform future policy and regulation with respect to collecting, sharing and using energy asset data"

To achieve these objectives, it was essential to fully understand the current LCT and DER data landscape. DER status for assets over 100 MW in capacity is already publicly available from the Embedded Capacity Registers and half-hourly data for these assets is available from ElectraLink and is currently provided to National Grid ESO.

CURRENT DATA ISSUES FOR LCT AND DER ASSETS

Historically, LCT data has typically been in a fragmented and disparate state across different organisations, not widely available and generally only used by those who have collected the data. Predominantly, the existing LCT data resides individually within the six GB DNOs and is collected when customers or installers connect new LCTs. In addition, through our extensive stakeholder engagement, which is discussed in detail in the Stakeholder views section some data holders deemed the LCT data that they hold to be a commercial advantage and would be unwilling to provide the information without compensation.

The Energy Network Association (ENA) application form helps capture data for the DNOs via the process and standards of G98 and for large installations, G99.

In parallel to the forms from the ENA, customers and installers can also contact their DNO directly, where they will be provided with guidance, advice and the relevant documentation including the relevant ENA application form that should be completed as part of any LCT installation.

The DNO and ENA forms are generally electronic document forms with limited or no processes digitalisation. However, steps are being taken by the DNOs and the broader industry to digitalise these processes and improve customer experience, data capture and quality. For example, UKPN and its Smart Connect App, SPEN with innovation project IDentify, National Grid Distribution with the development of Instant Self- service for EV charger applications (via their digital strategy and roadmap) and the ENA is working on a digitalisation of connections project.

The current available data sources have several limitations due to a lack of awareness and understanding, for example, they rely on the installer and/or consumer notification, and this requires the installer/consumer to have certain level of awareness of the notifications process.

In addition, the processes are complicated and assume a level of prior industry understanding. This results in many new assets not being notified.

When new asset information is captured, it is often in an inconsistent format. This makes it difficult to access and share. Existing processes also typically assume a static state, as there are limited or no processes for unregistering an asset if it goes offline or moves location, e.g., an EV charge point being moved to another property due to the asset owner moving house. This leads to an erosion of data quality over time.

Finally, any legacy assets connected prior to using the installation processes detailed in this section have a risk of not appearing in the current registers.

G98 and G99 process +

ENA Digitisation of Connections +

Smart Connect +

SETTING THE SCENE

LCT registration requirement less than 1MW

> Which energy devices need to be registered with the DNO?

- solar photovoltaic (PV)
- electric vehicle (EV) charge point
- heat pump
- battery storage

> Who is responsible?

Responsibility is on the asset owner, but the installer must notify the DNO

Asset owners must ensure that their installer notifies the DNO. It is the asset owner's responsibility to ensure that the DNO has received this notification and, in the case when the asset is classified as 'apply to connect', authorisation must be granted before installation.

Installers must understand the asset requirements to determine whether the DNO needs to be informed before or after installation. Once the installer has determined whether the connection is 'connect and notify' or 'apply to connect', they must follow the relevant process.

Both Ofgem and ENA provide guidance and access to the relevant registration forms, and as discussed there are plans to digitalise this process in the future.

Asset type less 1MW	Which process	When
• Solar PV* • Battery* • Heat pump** • Electric vehicle charge	Connect and notify (G98 Application)	Register within 28 days of installation *If installer is part of certification scheme, they may be required to also register with the scheme. Theses vary from scheme to scheme usually 10 to 30 days of installation ** If heat pump installer is MCS certified, they must also register MCS's Microgeneration Installation Database (MID) within 10 days of installation.
Battery Storage combined with generation i.e. Solar PV	• Apply to connect • (G99 Form A1-2 application form)	• Apply before connection to seek approval from the DNO • Registration will be via connections process

However, there are also data opportunities from current data sources. For example, there are datasets held by Ofgem that hold details of LCTs that receive some form of subsidy, which importantly has address data that could allow LCTs to be linked to MPANs. This data is not publicly available due to its sensitive nature. This demonstrates there is data that is likely to be of good quality that could be made available under the appropriate licensing and protection to help inform the location of existing LCTs. This is useful for building up a dataset of properties that have some form of LCT connected, but also importantly to highlight properties that do not have an LCT. This is important to create training data for machine learning approaches that can be used for LCT detection that leverages ElectraLink's unique historical datasets that have detailed data going back prior to roll-out of the vast majority of LCTs.

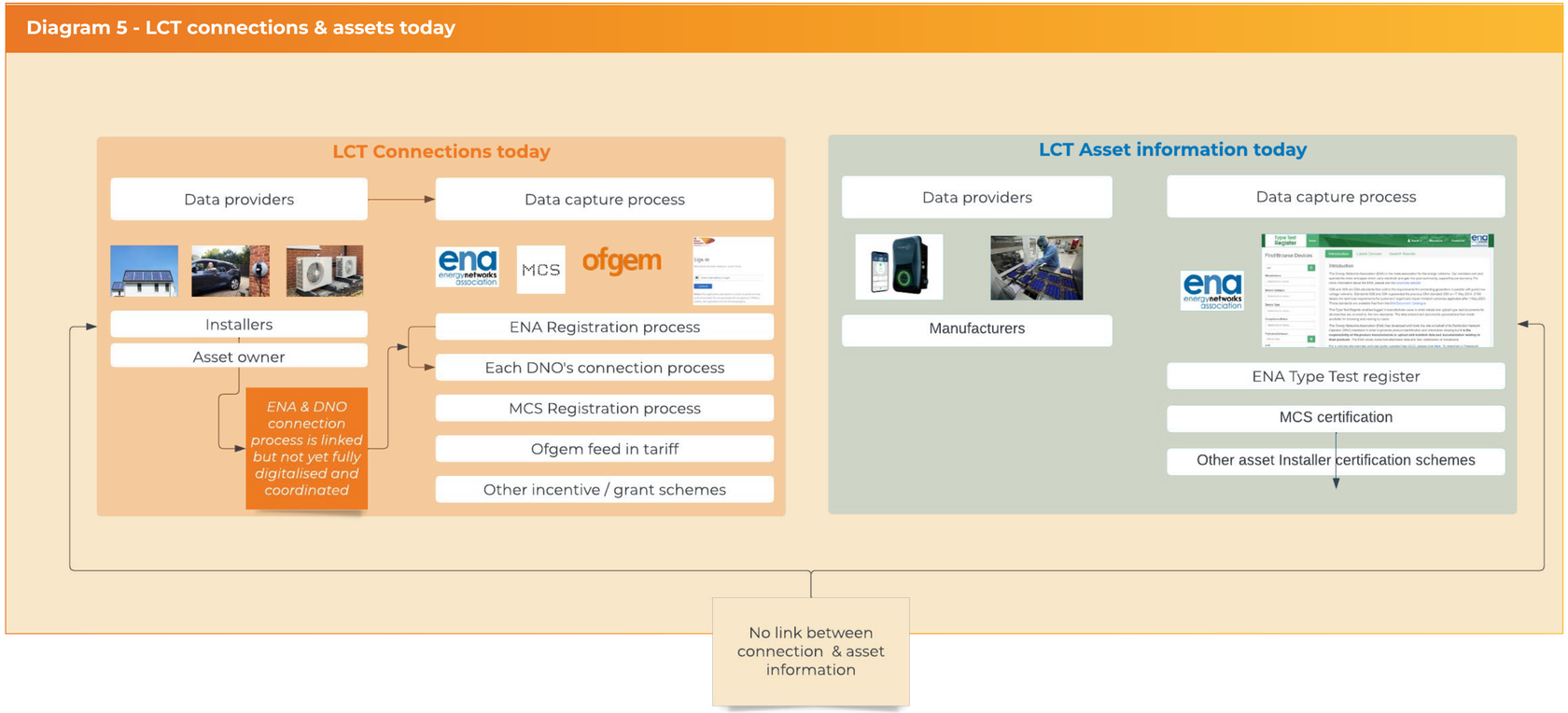
SETTING THE SCENE

The diagram 5 LCT connections and assets describe the status of LCT connections and LCT asset information today and highlights how the processes are not connected or coordinated at present. For LCT connections only the ENA and DNO data capture processes are linked but are not yet fully digitalised.

Consequently, this is one of the driving reasons to have a CAR and AAR to overcome the variability of historical asset registration, address the data gaps and unlock new opportunities.

Project FAIR proposed solution will not address all the challenegs today but go a long way. The industry will need to improve education and the requirement to register with installlers and the assets owners. Ensure data standards are agreed and systems and apps intergrate smoothly, these challenges have been considered and incooprated into our proposed solution.

Diagram 5 - LCT connections & assets today



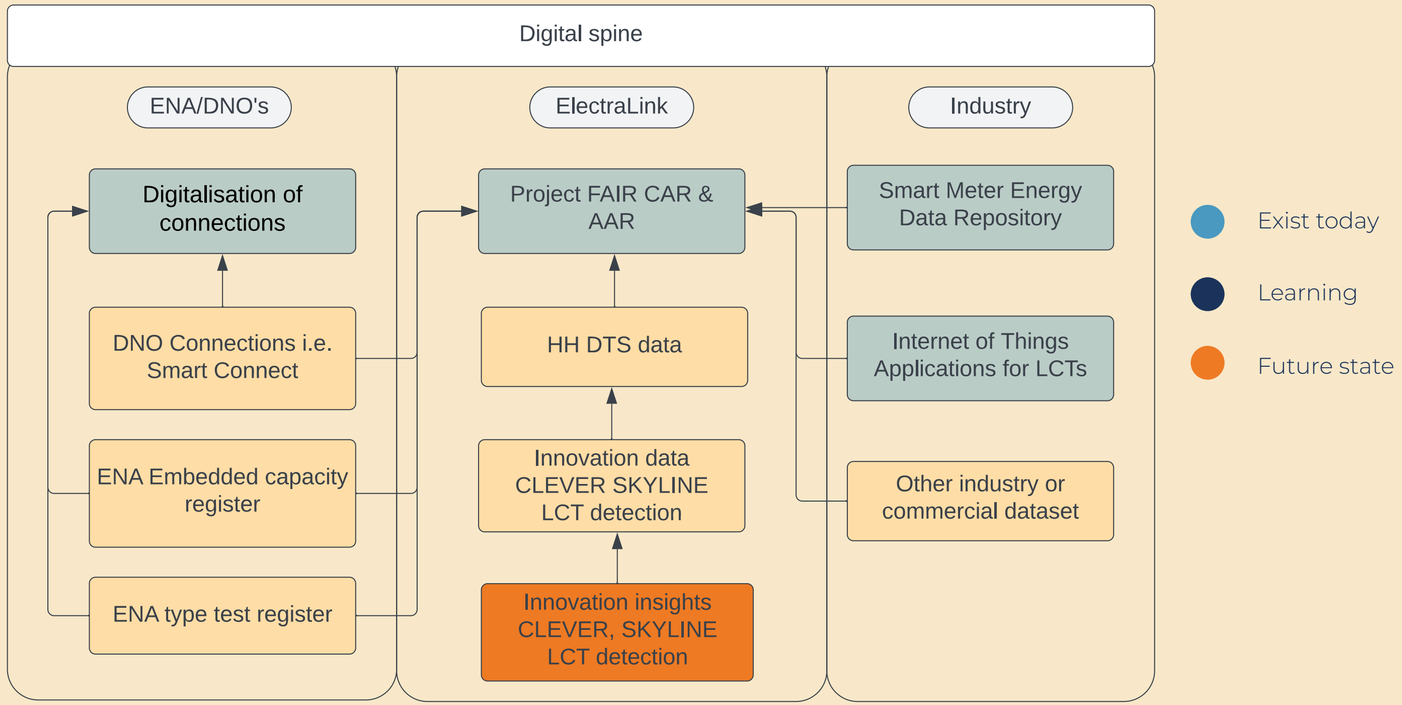
SETTING THE SCENE

OVERCOMING THE CHALLENGES OF A FRAGMENTED SYSTEM

While developing the project FAIR solution, we understand that the CAR and AAR register needs to integrate and coordinate with current and future data processes to achieve maximum value. This section sets the scene for the current related digitalisation development work being undertaken by BEIS, ENA and the DNOs. The diagram 6 Data Landscape shows how project FAIR can and will be able to integrate and function with these developments, this is further detailed in section Proposed solution technical summary. It is vital that project FAIR understands, ingrates and adopts best practice from the current digitisation projects to ensure maximum value is delivered today and in the future.

The next two page provides a summary of the other projects in the industry and how they relate to project FAIR.

Diagram 6 - Data Landscape



SETTING THE SCENE

Find out more about SMI

Smart Metering Inventory

Description: The DCC maintains a Smart Metering Inventory (SMI), which is an electronic database of devices which records information such as the device type; device ID and device model.

What It Delivers: The SMI is updated in real time when new assets are added, or statuses have changed (e.g. removal or replacement of an asset).

How it links to FAIR: The SMI could feed into FAIR by updating and tracking the roll out of smart devices, and with the CAR, this could create a more realistic view of the operating status of devices or installation information of device prior to the integration with the Smart meter energy data repository.

Find out more about SERL

Smart Energy Research Lab

Description: Smart Energy Research Lab (SERL) developed and maintain an 'Observatory' dataset consisting of half-hourly and daily electricity and gas consumption and tariff smart meter data for a stratified random sample of 13,000 consenting participating homes in GB. Data is linked to weather, EPC and demographic/ building survey datasets and shared with accredited researchers on approved projects.

What It Delivers: Research into domestic energy use by SERL consortium projects and external SERL-approved projects.

How it links to FAIR: FAIR could link with the SERL Observatory dataset to enable further development of the solution and undertake more research and analysis, e.g. evaluating the impact of heat pumps on domestic energy consumption, monitoring the uptake of low-carbon technologies, etc.

Find out more about Project Clever

CLEVER (Customer-Led Electric Vehicle Registration)

Description: CLEVER tests the appetite of EV drivers and heat pump owners to participate in a consumer led LCT registration process to support increasing the visibility of EV and heat pump proliferation on the LV network.

What It Delivers: An understanding and map of what data is essential for DNOs, and what data LCT owners are willing to provide. Also what type of incentives could be utilised to increase visibility of EV and heat pump demand, and to guard against loss of visibility due to customer events, such as a house move.

How it links to FAIR: CLEVER will help DNOs to better understand how and where EVs and heat pumps are likely to be connected to the network, which supports their demand forecasting, future energy scenario development (DFES) and network planning functions, to provide better service and value to their customers. This information can used by FAIR when developing the solution and governance details.

SETTING THE SCENE

Find out more about SEDR

Smart Meter Data Repository

Description: The Smart Meter Energy Data Repository (SEDR) Programme aims to support innovation to determine the technical and commercial feasibility of a smart meter energy data repository (data lake).

What It Delivers: It aims to provide a single secure cloud-based repository of smart meter energy data that would offer potential consumer benefits including those related to flexibility services and other energy data related services that are currently unrealised, or unrealisable.

How it links to FAIR: Smart Meter Energy data repository needs to link or be integrated with CAR and AAR to support the LCT detection processes and future development of our proposed solution.

Find out more about ECR

Embedded Capacity Register

Description: The Embedded Capacity Register (ECR), formerly known as the System Wide Resource Register (SWRR), lists all generation, storage and flexible demand resources where the installed generation capacity, export capacity or the import capacity is greater than or equal to 1MW.

What It Delivers: This register aims to allow customers and stakeholders to better understand the opportunities and constraints in the network, to improve and inform their decisions and allow further innovative and solutions to be provided, to help manage the network.

How it links to FAIR: Each DNO hosts a register which provides accessible information at a local and national level. The FAIR could absorb or connect with these registers to provide one centralised register for all LCT across GB.

Find out more about Project Skyline

Project Skyline

Description: Development of an early notification system to alert DNOs of the likelihood of an EV charger being connected to the LV networks (whether via a charger or by virtue of a three-pin plug).

What It Delivers: It provides DNOs with an understanding of where EVs are being charged on local LV electricity networks , in order to facilitate planning and investment.

How it links to FAIR: Access to EV enquiry data to allow DNOs to provide their customers with better value for money through better long-term investment decisions as a result of improved demand forecasting and network planning data.

SETTING THE SCENE

PROJECT FAIR APPROACH TO ACHIEVE VALUE TODAY AND IN THE FUTURE

Why the CAR first

Delivering value has been one of the core principles for project FAIR, as a consequence we have chosen to prioritise the development of the first CAR as this will form the foundation of the AAR and future developments.

There are currently many barriers to achieving a clear view of LCTs across GB and our approach in close collaboration with our stakeholders (see section Stakeholder views for details) has been to address these issues first by:

1. Understanding the present LCT data landscape in detail
   - Who holds LCT data?
   - What does it contain? and
   - What format is it in?
2. Understanding how project FAIR could connect to the data
   - How can it be acquired, accessed and processed?
   - How digitalised and transparent is the data?
   - How can quality and accessibility be improved?
3. Finding ways to combine the data sets effectively to yield a single version of the truth for LCT installation data
   - Where are the gaps?
   - How can we improve insights and understanding?

This insight has helped us build the proposed solution (focusing on the CAR first) and a clear and achievable roadmap for the future that can deliver real, practical value for both LCT data providers and users in the early stages of the project. Project FAIRs roadmap section focuses on the future and how the solution can and will evolve overtime by integrating with new data solutions, both ours and the current innovation projects, such as Digitalisation of Connections, Smart Meter Energy Data Repository, Smart Meter Based Internet of Things Applications, Digital Spine and beyond. See previous pages for a summary of these projects and how they link with project FAIR.

We have structured project FAIR around the delivery of 4 key principles. We understand that it will take time to deliver the full benefits of project FAIR due to the technological and commercial barriers, hence our approach of delivering the CAR before the AAR ensure value is delivered to value to the market as soon as possible.

SETTING THE SCENE

PROJECT FAIR FOUR CORE PRINCIPLES

VALUE TODAY AND FOR THE FUTURE

Project FAIR will deliver this through:

- Building a strong foundation by developing the Central Asset Register (CAR) first, ahead of the Automatic Asset Register (AAR) will resolve many of the existing problems with today's LCT data and requested by all of our stakeholders
- Developing an LCT asset detection process to identify assets not registered will improve data quality and insights. According to ENA data it is believed that 60% of LCT assets are being missed by the connection notification process.
- Having a central repository for LCT asset registration and detection across the industry and especially for DNOs allows value to be unlocked quickly that will support ED2, planning, flexibility understanding / insights and development of flexibility services, e.g., Loop connections case study in section User types, cases and benefits,
- A clear roadmap with evolving user cases from CAR to AAR with Internet of Things (IoT) communication.
- The use of AWS-managed cloud services and other technologies where infrastructure and processing are managed at scale, ensuring the solution is sustainable and minimising the environmental impact through optimised processes and resource utilisation.

FLEXIBLE AND SCALABLE SOLUTION

Project FAIR will deliver this through:

- The ability to integrate with current and future digitalisation projects such as the ENA Digitalisation of connections, Smart Meter Energy Data Repository, Digital Spine and new smart products and installation applications being developed by the industry such as UKPN Smart Connect App.
- Cloud based, serverless design, so the asset register and framework can cope with significant growth in LCT deployment and the shift from static data to real time dynamic data e.g., National Grid ESO in its Falling Short scenarios predicts 37.5million battery operated cars and vans in the UK by 2050.
- Being modular by design with decoupled services allows for rapid agile change developments to the current system and can also adapt to future industry disruption events. These could be driven by changes in legislation for registration, e.g, LCTs with different characteristics, and development of novel methods to analyse historical datasets to determine the likelihood of a change, such as LCT removal.

SETTING THE SCENE

PROJECT FAIR FOUR CORE PRINCIPLES

ROBUST GOVERNANCE AND OPERATING MODEL

Project FAIR will deliver this through:

- Development of a robust governance framework based on transparency, trust and best practice (i.e. Citizens Advice Clear and in control) for data handling, building on ElectraLink's 25 years of experience.
- Considered and controlled access based on use cases that combine both the governance framework and the technical solution to ensure it is safe and secure.
- Business processes and technical controls that safeguards quality from the beginning and continue to monitor data, system and process quality.
- A credible and tested operating model proposal that transitions from BEIS innovation funding to an industry funded managed service.

SAFE AND SECURE BY DESIGN

Project FAIR will deliver this through:

- Providing a cyber secure data service that puts the protections of parties' data first. It will ensure that best in class architecture and security are implemented at design stage and risks are managed proactively throughout service delivery.
- A solution built on a zero-trust model (as defined by NCSC), where users and services are identified and every request is checked for authentication and authorisation.
- Using our knowledge, experience and by adopting best practice frameworks such as the AWS Well Architected Framework for the architecture and ISO 25010/25012 for the software and data quality requirements, we have incorporated security, resilience, performance and sustainability into every aspect of the solution.

STAKEHOLDER VIEWS

Collaboration and coordination with stakeholders has been a priority for project FAIR. Stakeholder engagement is critical to achieve maximum value from phase 1 through to implementation. We focused on understanding the needs of the stakeholders, prioritising their requirements and using this information to shape our solution. Our aim is to deliver value both today and in the future.

We have engaged with a variety of stakeholders - as listed in this section - to ensure that we have obtained a holistic and balanced view of the benefits and impacts of centralised LCT data across varying user groups. This included DNO's, trade associations, the DCC, governing bodies, certification schemes, universities, the fire brigade and the environmental agency. Each stakeholder completed a survey, and follow up interview to explore and clarify the responses. A copy of the engagement survey can be found in appendix 3.

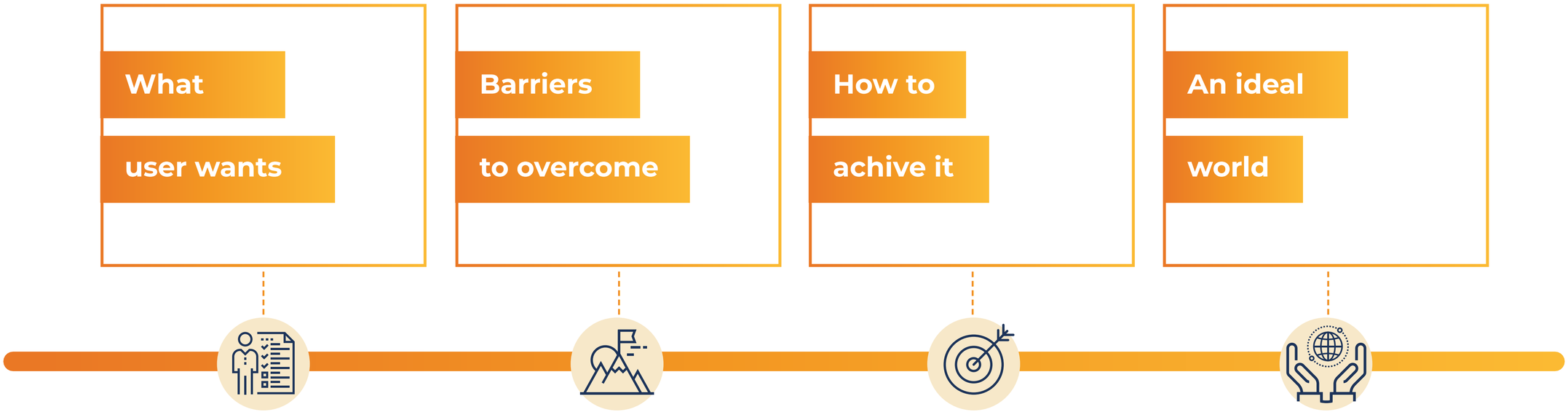
To ensure we continued to build strong relationships with our stakeholders, we provided a participant engagement report in November 2022. A copy of the full stakeholder engagement report can be found in appendix 4

The aim of our engagement was to understand how businesses who already manage LCT data and asset registers have considered security, data privacy and governance. During our discussions, we focused on identifying the key requirements for the CAR and AAR and how stakeholders would use the LCT data.

Distribution Network Operators (DNOs)	Trade Associations	Other
· Electricity North West Limited · Scottish and Southern Energy Networks · Scottish Power Energy Networks · UK Power Networks · Western Power Distribution / National Grid Electricity Distribution	· British Electrotechnical and Allied Manufacturers Association (BEAMA) · Energy Networks Association (ENA)	· Citizens Advice · Microgeneration Certification Scheme (MCS) · National Grid ESO (Electricity Systems Operator) · ECA (Installer) · Data and Communications Company (DCC) · Fire Brigade (Plaistow Fire Station) · Loughborough University · UCL · Electric Miles · Land Registry · Environmental Agency

STAKEHOLDER VIEWS

Stakeholder feedback has been grouped into 4 common themes:



STAKEHOLDER VIEWS

1. What users want

Stakeholders highlighted several common areas they wanted our solution to deliver, including:

- the prioritisation of data quality to ensure it is accurate, complete, relevant, and kept up to date,
- adoption of standardised processes and data standards that are agreed with the industry and ensure interoperability with other industry processes and data sets (including a standardised API that is well documented and discoverable to avoid costly and complex integration processes),
- clear principles for accountability and ownership of data and transparency for the customer,
- defined roles, responsibilities, ownership, authority and accountability for data, governance, and standards,
- recognised security standards and fully data protection compliant,
- security that is always maintained, and
- providing updates in real time.

2. Barriers to overcome and how to achieve success

In the section Setting the Scene, we highlighted the current issues and challenges with LCT data. This was validated by the information we received during our stakeholder engagement, which stated that LCT data today is inconsistent, incomplete, lacks standardisation and does not provide a holistic view.

Building on this, there were two common themes established by all our stakeholders which links closely with user wants and has been a key element in the design of our proposed solution.

These are:

i) data quality and

ii) fit for purpose processes and data standards to ensure that the CAR and AAR provides value for users and the industry.

In addition, one participant raised a further barrier which may have an impact on the subsequent phase of the project and implementation regarding funding of a solution. Specifically, it was queried how the funding would work for development and testing of the solution for impacted companies and any other work they would have to do to share the data via the chosen solution. This issue is discussed in more detail in the Barriers, further considerations and risks section.

STAKEHOLDER VIEWS

Barriers and solutions identified through stakeholder engagement

Theme	Identified barriers	Impact	Solutions
Data quality	Poor data capture by installers	Not all the necessary information is being captured	Standardised format for data capture (provision of schemas, validation criteria, etc)
	Inaccurate data	Poor data quality	Data cleanse and source prioritisation
	Inconsistency in processes	Differing processes for installers and manufacturers, as well as DNOs can cause confusion especially with responsibilities	Using API access to enable integration with other systems scripted processes. Common names and terminology for Grid Supply Points, generation types etc. Application of agreed data standards
Processes and Standards	Absence of mandated standards	Data is provided in different ways by each provider with only basic commonalities	Standardised format for data capture and governance principles
	Poor compliance from asset owners in providing/updating data	The existing data sources have limitations. They rely on notifications, but there is no process for unregistering an asset if it goes offline or moves location. Legacy assets may not have been recorded and new assets may be missed if process isn't followed	Use of ElectraLink's electricity consumption and generation data lake in conjunction with other relevant datasets to validate the data in FAIR through a probabilistic LCT detection system at address level
	Poor customer understanding of data purposes	Lack of understanding can cause resistance and disengagement with processes and even raise concerns around privacy	Clear communications to consumers with further information of data privacy, purposes, and retention
	Too many interfaces	Data is disaggregated with each provider having its own process and web portal	Interaction from industry stakeholders should all be accessible in one standardised process and format
	Very manual processes (use of email, spreadsheets and web portals, for example)	Lack of consistency and automation makes it a time consuming and inconsistent format	Use of an API platform
	No current verification of installations registered, or auditing of data inputted	Lack of incentive for installers to tell the networks if an asset has been fitted results in it poor data quality	Use of a standardised process across installers and manufacturers to ensure an audit trail

STAKEHOLDER VIEWS

4. An ideal world

Stakeholders responded to a variety of questions about their vision for a CAR and AAR now and in the future. Four common themes emerged:

1. Data

2. User access

3. Purpose

4. Governance

The tables summarise each 'ideal world' requirement identified by stakeholders and links to how we have incorporated the feedback into the proposed solution for project FAIR. Full details are contained in the Proposed solution technical overview section and details of the functional and non-functional requirements in appendix 5.

Stakeholder data requirements You said...	**Our proposed solution We have...**
• Centralise LCT installation information • API based solution with the ability to integrate data into their internal systems • Standardise format and naming conventions, aligned with other industry publications • Be reliable and consistently structured data covering all asset types • Secure and compliant • Update in real time • Options for reporting and analysis	• Single master reference data set for all LCT assets • Ability to update data in the CAR but with appropriate processing and cleansing to ensure quality • Timestamped versions for audit and quality control • API (as well as other formats) for both data providers (inputs) and data user (output) – see User types, cases and benefits section for further details • Standardise CAR and AAR scheme design, documented and transparent • Adoption of best practice security measures • Detailed assessment and options for data reporting and analytics supported by benefits use cases

Stakeholder user access requirements You said...	**Our proposed solution We have...**
• Role-based permissions defined with corresponding governance and data standards in place to provide the appropriate monitoring and control	• System controls in place to limit access to data and functionality based upon user type and governance rules / processes • Multiple factor authentication for access • Ability to revoke access from a user who breaches governance rule or misuses the system • Organisation and user profiles defined by the business rules and logic within the system in accordance with governance processes and rules, with the ability to update if new governance rules are approved by the user group • Tools to support organisation with the administration, monitor their user access etc. • Ability to hide / encrypt sensitive date from unauthorised user access

STAKEHOLDER VIEWS

Stakeholder purpose requirements You said...	Our proposed solution We have...
• Gather statistics to help steer government, groups, committees etc. • Disseminate data faster and more accurately • Provide information on technical data relating to the equipment installed • Understand and model technologies • Contain asset details with credentials to simplify change of service provider • Provide usage information for the device and the ability to interact with devices	• Defined data providers and data users – see User types, cases and benefits section for further details • Developed user and benefits cases based on feedback from stakeholders to drive value • Cloud based design to support speed, flexibility and the expected rapid growth in LCT's and associated LCT data • Extensive data quality checking, processing, and cleansing to ensure accuracy • Analytic tools to support users based upon their permissions including the ability to run queries, visualisation of data, and modify • Supporting business processes - proposed ElectraLink managed service if implemented to support all users of the system including security, development, and administrative support • Standardise data scheme with full asset details (see see Proposed solution technical overview section) and modular in design which allows updates and new fields to be added to the CAR as LCT equipment evolves • LCT probability detection to identify assets yet to be registered to improve data quality • Roadmap for the future to include AAR and IoT
Stakeholder governance requirements You said...	**Our proposed solution We have...**
• Ensure data protection compliance • Have secure servers where data is hosted • Principles of ownership, accountabilities, and responsibilities • Govern how service users and service providers access and provide data • Set a clear baseline of minimum expected standards from users • Ensure application of standards and conventions • Ensure correct data is inputted in a timely manner, with updates if amendments are made	• Clear and transparent data standards, governance and user rules • User group to oversee governance • Safe and secure by design • Cyber safe and adoption of zero trust model • Implementation of best practice and ISO standards • Ability to revoke access, if users fail to meet expected standards • Standardise approach based on Open Data principles and Data first • Standardise schema and metadata • Transparent technical and non-technical documentation to support user group and governance decisions

The stakeholder holder feedback has been instrumental in helping shape our ideas from our initial proposal and throughout phase 1. All stakeholders expressed an interest in being kept informed during phase 1 development and we have continued to engage and test ideas beyond the formal survey and interview process. We will continue to build on those relationships if project FAIR is to be developed in phase 2.

USER TYPES, CASE AND BENEFIT

To achieve the best outcomes for project FAIR, we have classified users into two main types.

1. Data providers (inputs for the CAR) and
2. Data users (outputs), as described in the diagram 7 Data providers and user below

   For each user type we have undertaken a detailed assessment which can found in appendix 6 which is a detailed governance assessment report.

For the data providers classification, the assessment identifies users, describes their role, status, use case and the expected permissions required.

All permissions would be documented and described within the governance rules, data standards and processes that would be managed via the user group and the ElectraLink proposed managed service administration, if implemented.

diagram 7 - Data providers and user



DATA PROVIDERS

Data providers are those organisations who currently hold LCT data and those who may hold LCT data in the future. These range from energy suppliers, government, and the regulator, to distribution network operators and the wider energy market.



DATA USERS

Data users are those organisations or individuals who seek to access data via a central asset register, their motivations will range from improving customer experience, increasing affordability, innovation and improving service quality via access to LCT data.

For data users, as per the feedback from our stakeholders, we recommend having different levels of access for different users. For example, full access user, moderated access user or restricted access user. A full access user could have access to all data at a disaggregated level. Users that may fall into this category are BEIS or Ofgem, likewise they may be able to provide data to specific third parties on a use case basis or as part of an industry study, project, or report.

A moderated and open access user may have access to a mix of aggregated and disaggregated levels for specific data and the ability to apply to access wider data sets e.g. a DNO seeking to understand the impact of EVs and heat pumps their network locality. A restricted and open access user could have access to broader data insights or open data at an aggregated level and free access to all open data sets e.g. academia, consultancies and wider market participants.

All users as part of the governance framework would be subjected to the test of legitimate use, as well as a requirement to provide a justification for the data they are seeking to access, the purpose, how data will be controlled or who it will be shared with, the proposed governance model is detailed further in proposed governance, standards and operating model section.

Project FAIR can provide significant benefits to users, stakeholders, the industry, and consumers; a full detailed CBA will be undertaken if we are successful in phase 2 and 3. We have grouped the benefits into the following three main categories and linked the benefits to wider industry strategic objectives, findings and recommendations that support the transition to net zero. The core benefits of implementing project FAIR are interrelated and can be collectively achieved if project FAIR is developed and progressed.

USER TYPES, CASE AND BENEFIT

The core benefits are:

1. Network planning, connections, and flexibility

Project FAIR can provide improved quality and timely data to enable improved system planning, connections and flexibility services (which is aligned with BEIS's Net Zero strategy, Energy Innovation and Smart Systems and Flexibility Plan and Energy Digitalisation Strategy). Diverse network investment solutions and improved operational efficiencies will provide the cornerstone of modern, efficient energy networks. Smart, flexible services are the means with which the industry can accelerate to achieve the Government's net zero ambitions. We need to connect more renewable generation and LCT's and reduce our dependence fossil fuels. This is a huge challenge for the industry and especially the network and system operators and this has been reflected in both distribution (RIIO ED2 Final determinations November 2022) and transmission (RIIO 2 Final determinations December 2020) regulatory determinations.

See what Beis said +

Project FAIR can provide data in a higher quality format and more timely manner, which provides the fundamental information to unlock these new services. This can, therefore, enable better planning of the energy system, greater understanding of the impacts and opportunities provided by LCT growth.

Better quality information will allow network and system operators to identify and remove barriers as well as to develop and enhance flexibility service to support operation and smooth out price spikes while supporting new network connections. This will improve services to network customers and create new products, services and jobs, services in the utilities sector.

This next section specifically focuses on how we can provide value today and in the future for DNO's (and the transition to DSO), who would be both a data provider and user associated with network planning, connections and flexibility services.

See what the Ofgem said +

The benefits include:

- Assist in the identification of the data gaps between installed LCTs and registered LCT's (the ENA currently estimated 40% of LCT's installed today are registered), which will support network planning and development of new flexibility services.
- Improve LCT data quality and understand how to support and improve network forecasting and planning – See case study from Scottish Power Networks on Loop flow connections and the benefits of understand the location of LCT's.
- Supporting the network connections process when integrated with the digitalisation of connections project to cope with the expected rapid growth over the coming years.
- Help develop insights and understanding of the load profiles and behaviours of LCT's through the LCT detection development work and insights capabilities. These insights can then be used in the planning and development of new and existing flexibility services.
- Ability to manage safety notifications from manufactures, installers and DNOs to the asset owner i.e., product recall or updates etc.
- Ability to link data sets with other sources such as vulnerable customers and offer support during storms or other issues that impact the DNO network.
- Identify disconnections or movement of assets that could impact network planning or the availability of flexibility in an area.

As the solution evolves through our road map, see Project FAIR's roadmap section for more details, from static data to dynamic data it can be used to:

- inform 'just in time' network investment based on accurate insight
- raise opportunities for active network dispatching for flexibility services, if device is connected via IoT in the future
- inform network utilisation and active network management, planning and forecasting
- support with fault finding and resolution

USER TYPES, CASE AND BENEFIT

In addition, to the DNOs, project FAIR can provide benefits for other data providers and users, such flexibility service aggregators, community groups or landlords to understand the potential flexibility capability of the installed LCT's in an area and to develop new customer optimisation services and tools.

- Ability to manage safety notifications from manufactures, installers and DNOs to the asset owner i.e., product recall or updates etc.
- Ability to link data sets with other sources such as vulnerable customers and offer support during storms or other issues that impact the DNO network.
- Identify disconnections or movement of assets that could impact network planning or the availability of flexibility in an area.

Case study | Scottish Power Electricity Networks Reinforcement of LV Services (Looped Connections)

Description	Challenge	What it delivers	How it links to FAIR
This project was proposed by SPEN as part of the RIIO ED2 submission and further information is available in SPEN report Reinforcement of LV Services. SPEN's project involves a targeted replacement program to replace 43.4k looped services. This aims to provide a coordinated approach which will reduce customer impact, reduce delays, and be more cost-effective. The LV network is the section of the network that runs from local substations to just outside customers' homes. From here, an individual service cable runs up to the customer's house to the customer's electricity meter. In circa. 20% of cases, these service cables are shared between two or more adjacent properties (called a 'looped' service). Customers are more dependent on this group of assets than any other, as they will immediately lose supply if any of these fails.	To achieve net zero, household electricity consumption will be significantly increased. Customer connected via a looped service are unable to accommodate the additional loading, especially from LCT and must be upgraded. SPEN have identified 0.5 million looped services in SP Distribution (SPD) and SP Manweb (SPM). Looped services can exceed their rating by up to 3x when LCTs connect, causing them to be dangerously overloaded. Over 500,000 of SPEN customers are supplied by looped service cables. Without intervention, customers will experience severe restrictions and power cuts, network infrastructure may be damaged, and there is an increased risk of safety issues.	The proposed solution is to install new services to un-loop the shared service so that each property is supplied by its own individual service.	Once the CAR is created this can be used by SPEN to provider the following benefits • Detailed understanding of where LCTs are, to allow SPEN (and other DNO's who have looped services) to compare a with loop flows on their system and take action. • LCT detection can help identify any potential safety risks where LCTs are installed via loop flows on their system but not registered to allow SPEN (other DNO's) to take action. • Greater LCT data insights on location and type can then be used to improve forecasting and predict future grow on the network and map this to areas with looped service or other network challenges.

USER TYPES, CASE AND BENEFIT

2. Digitalisation and transparency

Project FAIR can enhance digitalisation and data transparency by delivering the measures recommended by the Energy Data Taskforce. Digitising the registration process for LCTs will create a single source of truth for LCT data today in the CAR. The development of an LCT detection process and analysis techniques will assisting in identify gaps in the information and application of appropriate corrective measures, i.e., improve installer / customer awareness of the requirement to register and explain how to do so. Ultimately moving the solution towards a fully AAR and the integration of IoT.

Streamlining and harmonising the data capture and management for LCT data and simplifying the process for registration, by linking processes between other projects across the sector (such as the ENA digitalisation of connections) will provide data confidence, transparency and reduce the likelihood of disruption, and improve the customer experience.

Improved LCT data transparency can also provide important signals to government and regulators permitting a better understanding of how policies influence behaviours, and therefore help to shape future policy design. This will be particularly useful for vulnerable customers and those in or at risk of fuel poverty. In addition, it provides opportunities for research and development that will drive wider social, economic, and environmental benefits linked to building a net zero future, such as identifying possible education and training gaps to support the greater deployment of LCT's. With increased information transparency, it is possible to create new use and benefit cases by overlaying the CAR and AAR data with other data sets, such as Experian's MOSAIC, EV suitability and EPC rating to help improve DNO demand forecasting, and LCT sales deployment .

Overall, we foresee that improving the data capture and management process, whilst increasing data transparency will provide significant cost efficiencies for the industry and has the potential to develop new insights and understanding that can support the unlocking of new flexibility products and markets.

Specific benefit examples for data providers include:

- Feedback on installation data and trends, that are within the governance rule and ensuring personal data remains confidential. This can enable manufacturers and installers to forecast and develop insights into future sales by location that can support production and resource planning.
- For installers, the use of data standards to provide prepopulated fields will not only improve time efficiencies in completing the necessary registration documentation but also the reduction of errors to maintain and ensure quality.
- Again, for installers, feedback on the input quality of information received and identification of trends, such as the need to provide additional training for some installers based on quality issues or missing data.
- Having both mandatory and non-mandatory fields, we can monitor data input, review and seek feedback from both data providers and users to identify if more data capture is needed, whether rules need to be updated or if new fields need to be made mandatory or vice versa in coordination with the user group and governance rules and data standards.
- Ability to monitor, process and capture data duplications and /or conflicts and share this information with the data providers (i.e. installer vs digitalisation of connections) to identify potential issues quickly and take action to resolve them to ensure data quality is maintained.
- The ability to provide manufacturer updates to the installed assets owners (subject to governance rules) which may include safety updates, recalls or faults etc.
- Feedback for any disconnections, which again will help manufacturers and installers to forecast and develop insights to support production and resource planning.

USER TYPES, CASE AND BENEFIT

- The ability to identify and track stolen and counterfeit devices. For example, if a counterfeit device is using an existing asset registration or devices have been stolen and then installed, it would be possible to track especially when we shift to a “plug and play” IoT world. This improves security and safety while protecting brand damage and losses due to counterfeit goods of a lower quality, ensuring safety of asset owners if counterfeit or stolen assets do not meet safety standards or are installed incorrectly.
- Ability to support and help maintain warranties and maintenance schedule for manufacturer, installer, and the asset owner. This helps to support manufacturers forecasting for spare parts etc., installers to plan resources for both new installations and maintenance, and provides comfort to the asset owner to ensure asset remains in good working order.
- In the future, as we shift from static to dynamic data, it is possible for manufacturers to use this data to analyse the performance of the asset and support future developments for new products or to improve the installed assets performance.

Digitalisation and transparency provide significant benefits to data users as well as data providers. Increased transparency and sharing of data allows for further insights, research, and innovation as discussed later in this section. Below are further example of how data users can be supported:

- Ability to monitor trends across different type of LCT’s, location, disconnection etc. and make aggregated data more widely available (subject to ensuring privacy is maintain and in accordance with the governance rules and data standards) increases understanding, market analysis and provides opportunities to develop associated products and services.
- Access to accurate, up to date accurate LCT data will support academic research not only for LCT’s but also for associated projects with the industry and beyond that require such data input.
- Digitalisation, standardisation and transparency gives the industry confidence and creates a master reference point for associated industry flows, for example CAR and the linkages with the type test register (or possible combining of the two to provide efficiencies) and the integration with digitalisation or connections. In the future, as we shift from static to dynamic data it is possible for asset owners or a service provider on their behalf (subject to consent) to use this data to analyse the performance of the asset its energy usage etc to identify efficient savings, allow the development of customer optimisation services and tools i.e., participation in flexibility services or further investments in other LCT or associated assets.
- Linked to the previous bullet point, monitoring asset performance can provider asset owners with information to identify errors or fault detection, (e.g., if a heat pump is connected to the network but not working correctly) and manage warranties, servicing, and maintenance to ensure that assets are performing.

USER TYPES, CASE AND BENEFIT

3. Innovation and removing barriers

Project FAIR can drive innovation and remove barriers to entry supported by Innovate UK's action plans and supports the delivery of the Energy Data Taskforce recommendations (specifically visibility and infrastructure and asset visibility). The benefits of driving innovation and removing barriers have been well researched and documented across many industries and include increased productivity, more competition, reduction in costs, creation of value and establishing new working relationships. This equally applies to our proposed solution because creating a harmonised, co-ordinated, accessible, and central information source for all LCT data in GB will help to reduce the current barriers that are based around uncertainty of what type and where LCTs are currently located and encourage greater innovation. Access to higher quality data will accelerate innovation of new benefits cases, services, technologies, and solutions from existing market participants and will help to provide opportunities for new market innovators. The development of new ideas, products, and services (including flexibility services and new customer optimisation services etc) can enhance the market, increase competition and improved market liquidity. This in turn drives improvements for customers. With better quality and transparency of information, businesses can offer innovative new services and products alongside associated offerings such as preventative maintenance, upgrades and linking of services etc. As well as driving innovation in the market, it will also allow for innovation of data and data analytics, which can then be used to support disruptive technologies and green technologies, thus creating a virtuous feedback loop that drives data driven innovation. Project FAIR is an enabler to unlock these opportunities for the industry and consumers to achieve net zero.

Specifically, for data providers project FAIR with the development of a standard API that can integrate with installer apps or working Digitalisation of Connections projects can remove market barriers for new installers entering the market as they would be able to access a prebuilt standardised product and service to allow for quick and easy registration.

See what the UK Research and Innovation said +

As we move toward a IoT world with easier access to real time data, the data will provide greater insights regarding how the asset is performing. This would allow manufacturers to make improvements and innovations in design, for example, mapping performance data with weather data to identify, if there are any issues or challenges when the asset operates in more extreme weather conditions, or whether the micro climate due to location within GB has an impact (i.e. city installations vs rural).

There is a clear correlation between access to accurate up to date information and innovation. The insights that project FAIR could be used to support the latest innovation focus for modelling power network and systems as well as digital twinning etc. Using this, data users can develop new ideas and concepts, linked to the first core benefit, network planning, connections and flexibility.

See what the Energy Data Taskforce said +

Access to data may allow innovators to create new products and services for customers, for example creating new apps that monitor a customer's home or a number of properties (i.e. landlords or housing associations) that identify any performance challenges, customer energy optimisation services and tools, ways to access more flexibility services or new time of use tariffs to provide cost savings. Another example includes creating new security products to protect assets and support recovery if stolen which could include working with the police and other agencies.

Finally, as we move towards IoT with data and technological innovations, the LCT detection and quality checking aspects of the project will continue to be of benefit to bridge the gap between now and a "plug and play" future. Until all legacy assets are decommissioned there will be a need to ensure registration is maintained and checked, for example the re-sale of second-hand assets that are reinstalled on different properties when the owners choose to upgrade.

PROPOSED GOVERNANCE & OPERATING MODEL

GB energy market is unique, it has been unbundled, opened up to competition where possible and adopts a lighter touch approach to legislation and regulations compared to other markets in Europe and across the world. For example, regulations are often focused on core principles and outcome rather that being fully detailed and prescriptive. This allows the industry participates to collaborate to determine the details and be flexible to adapt the details without the need to amend the legislation or regulations as, the core principles and outcomes remain the same.

For project FAIR to be successful it needs to be secure, well designed and scalable solution but also have a robust governance, clear and transparent data standards and resilient operating model that are based on the core principle and deliver the outcomes set out in current legislation and regulatory framework without the need for new legislation. ElectraLink has vast experience of the GB energy market and has been operating the Data Transfer Service (DTS) service for 25 years and has extensive governance and operating model experience, has developed and lead the way in creating quality data standards which can and has be applied to enhance the proposed solution.

Case study about DTS and user group:

Description	What it delivers	How it links to FAIR
ElectraLink currently operate the DTS which underpins the competitive GB electricity, gas, and water markets, enabling participants to work together to exchange information about their customers. The DTS provides a managed file transfer service that allows market participants to share data efficiently and securely to perform their roles in the market. This information interchange facilitates a wide range of business-critical processes including change of supplier, metering, and settlement. The DTS User Group is a representative group of the users of the DTN that oversees ElectraLink's delivery of the DTN and the governance of the data within. The DTS User Group guides ElectraLink in the needs of the users, use of the data, data standards and votes on changes to the service.	The purpose of the DTS User Group is a forum for representing the views of users on any matter relating to the DTS services, the Data Transfer Services Agreement (DTSA the core legal document that underpins the service, governance and data standards) , the Data Transfer Handbook, the Data Transfer Network, the data within and the Technical Standards, including, relevant powers, considering, approving or rejecting changes.	We can utilise learning from our 25 years of experience in operating the DTS and its User Group to support the development of appropriate governance solutions, data standards and protections for project FAIR.

PROPOSED GOVERNANCE & OPERATING MODEL

PROPOSED GOVERNANCE MODEL

To develop a robust governance arrangement and agreed data standards you must first understand that data and ask the following questions:

- What data?
- For what purpose?
- Who is the data being shared with?

User types, cases and benefits section provides details regarding user types and benefits, appendix 6 provides a full detailed assessment of data and governance principles which is summarised in the table. We have assessed and classified each data type, static and dynamic. Identified where the data would come from and who the data processor would be, but more importantly we have classified that data as either public, private, or restricted.

The table below provides a description and examples.

Classification	Description	Examples of static data	Examples of dynamic data
Public	Little to no risk of direct customer impact if data is accessed or shared	Manufacturers product sales specification	N/A
Private	Represents a moderate level of risk and impact particularly when combined with other data	Manufacturer and model Date of installation Asset serial number	N/A
Restricted	Represents potentially significant risk impact to customer or classified as Personally Identifiable Information (PII)	Postcode of asset location Meter Point Administration Number ('MPAN')	Status – charge or discharge Voltage / current Mode or state

Classification of data is vital when managing permissions, data access, consent and agreeing data standards and forms the core principles of a governance regime.

This is to ensure data security especially for restricted data. When developing the governance principles, data standards and proposed framework for project FAIR we adopted the following high level data governance route map:

1. Establish a purpose – What data, for what purpose and to who?
2. Data provider considerations – Different categories of provider, how are benefits shared? Any regulatory or legal barriers?
3. Data user consideration – Who are the data users? What risk? What are their role based permissions? Any regulatory or legal barriers?
4. Data custodian considerations – Due diligence, assurance and delivering quality
5. Relationships – What do relationships between participants look like?

PROPOSED GOVERNANCE & OPERATING MODEL

DATA TRUST

For project FAIR we are proposing that a data trust model is developed to address to the questions and govern all data aspects. This is the one of the most effective routes to address each question from the data governance route map listed in this section above.

Sensitivities can be found in practice when defining appropriate legal and governance structures, and when defining data standards and data sharing arrangements at a corporate or industry level. These issues range from cultural to competitive and offer the best option for the data contained within the CAR and AAR.

Data Trusts are a mechanism to enable the sharing of information through an independent intermediary (similar to the DTS User Group), where participants (both data providers and users) can feel more secure because oversight is undertaken by an independent group to the day to day management and development of the data service.

For project FAIR we would recommend that BEIS or a BEIS nominated party (such as Ofgem) could act as the role of data steward or custodian, managing LCT data on behalf of the industry, with elected data providers and users forming an independent governance or user group. With supporting pre-defined governance parameters with clear roles and responsibilities, rules and processes that would be administered as part of an operational ElectraLink managed service and defined data standards.

Appropriate legal and governance protections including agreements, standards, rules and processes would need to be developed as part of phase 2, if we are successful. To ensure the necessary oversight, monitoring and permissions, standards and compliance are established prior to any industry launch beyond phase 3 of the BEIS project.

Data Trust +

Project FAIR CAR & AAR User Group proposal +

EXPLORING DATA USER ACCESS

In order to test which users should be able to access which data, we are proposing that a detailed governance test should be developed, and that test should be is based on the criteria listed below.

- Test of legitimate use
- Role in the market e.g., commercial (consultancies) or service based (DNOs)
- What data, at what granularity and any aggregation and anonymisation required
- Use cases for which access to the data is required and value this enables e.g. system management (ESO)
- Compliance with principles of best practice data handling and standards
- Compliance with project FAIR governance rules, requirements, standards and associated processes

This governance test would ensure that the available data is only provided to those with a legitimate purpose to access it, ensuring the stability, security and levels of data management and governance that are expected of industry data services.

Differing levels of user access could be considered to control access to relevant data and to ensure that only those users with the relevant permissions or agreed use cases can access data for specific purposes, this would be then moderated by the user group and data custodian under the governance framework.

Examples of initial user types include:

- A full access user, for example could have access to all data at a disaggregated level. Users that may fall into this category are BEIS or Ofgem, likewise they may be able to provide data to specific third parties on a use case basis or as part of an industry study, project or report.
- A moderated + open access user may have access to a mix of aggregated and disaggregated levels for specific data and the ability to apply to access wider data sets e.g. a DNO seeking to understand the impact of EVs and Heat Pumps at a network locality.
- A restricted + open access user could have access to broader data insights or open data at an aggregated level and free access to all open data sets e.g. Academia, consultancies and wider market participants.

PROPOSED GOVERNANCE & OPERATING MODEL

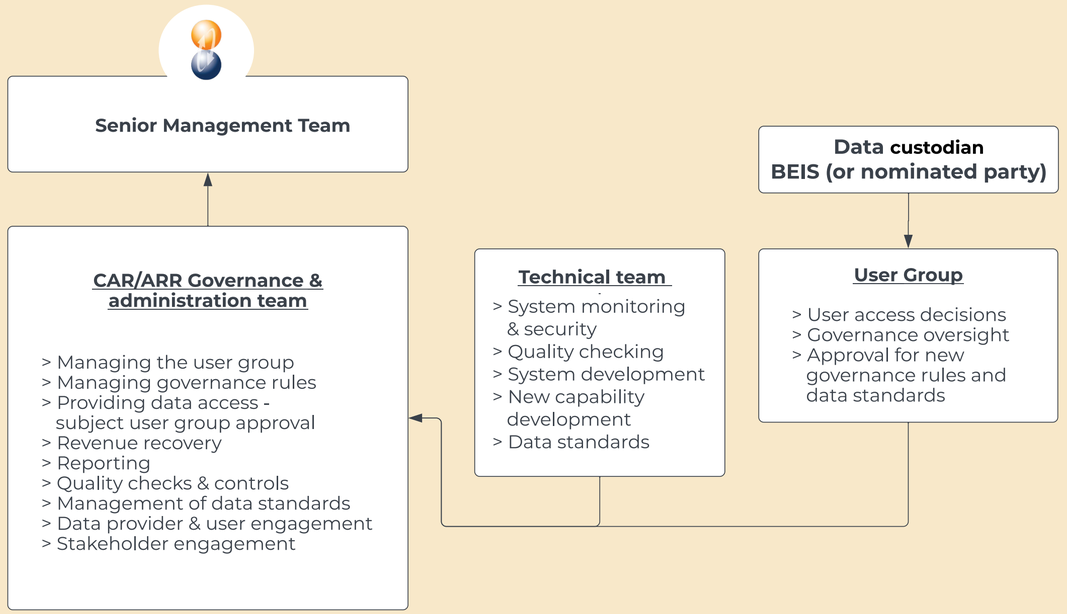
In addition, to providing access, the rules would also cover the removal of access. For example, prior to any industry launch beyond phase 3, we would ensure that all governance terms of the ElectraLink managing service, is in place from day one for all pre agreed data providers and users given relevant access to the service. Any new providers and users would be granted accession to the service based on user group approval and in lined with the agreed governance controls i.e. where data is presumed open it will be available to all in accordance with the agreed data standards, e.g., aggregated data on LCT penetration in GB. Alternately where data is restricted, its sensitivity will be assessed and accession provided to those parties who have a legitimate case to access it e.g. property level data.

Phase 1 has outlined the initial governance and standards proposal and in phase 2 we would develop our proposal, seeking stakeholder input and expert legal advice to ensure a robust governance arrangement is fully designed and developed that is ready for operation beyond phase 3, as detailed in in project FAIR Roadmap section:

OPERATING MODEL

Alongside the proposed governance model, we are recommending that a similar model to the DTS is adopted for the administration, system development, oversight, management and administration of the governance rules, data standards and user group, quality checks, new capability development, data provider and user engagement, wider stakeholder and industry engagement and revenue recovery. Phase 1 has defined the proposed technical solution and the proposed principles for governance including a roadmap, in phase 2 this information can be used to develop a suitable managed service operating model which can be tested with data providers and users, BEIS and other stakeholders. Diagram 8 Operating model shows the high level operating structure that could be developed during phase 2 and put in place for industry launch.

Diagram 8 - Operating model shows



PROPOSED GOVERNANCE & OPERATING MODEL

Best practice from within ElectraLink and the industry can be applied and used to understand the detailed running costs of the service, undertake a detailed Cost benefit Analysis (CBA) during phase 2. The CBA would build upon the benefits cases detailed in this report, (such as Government's Smart Systems and Flexibility Plan shows that flexibility could also reduce annual energy system costs by £10bn a year by 2050) we can use this to identify how project FAIR directly and indirectly supports the realisation of the flexibility opportunity.

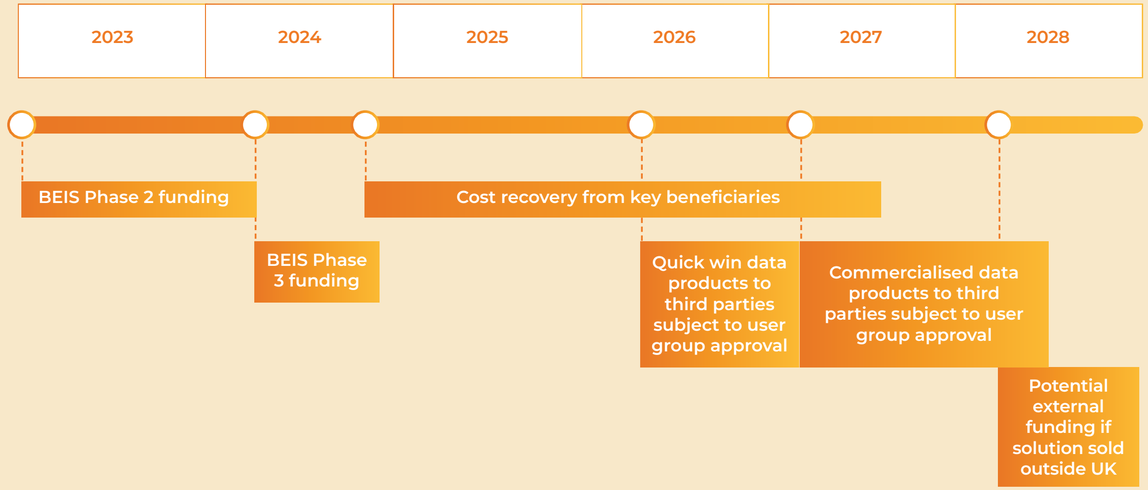
FUNDING MECHANISM

To deliver the benefits of project FAIR an enduring funding mechanism is required to shift from innovation funding to business as usual. To ensure success we need to identify a target operating model that is based on data and digitalisation that provides benefits to the key beneficiaries. Our initial view is that the DNO's and ESO would be the initial key beneficiaries, but this is subject to further discussion and agreement with BEIS and impacted parities. The justification for this view is that the LCT data the CAR and AAR supports and providers benefits to the operation of the system and network owners (as detailed in User types, cases and benefits section). The benefits of the CAR and AAR closely align with the objectives of the RIIO price control frameworks put in place for the ESO and the Distribution networks over for the next 5 years. For example, all DNOs have Output Delivery Incentives (ODI) for connections and DSO transition that's includes the facilitation of flexibility services.

We will develop a comprehensive CBA in phase 2 which includes detailed managed service approach, operational mechanism and costs including governance, technical AWS run costs, expected development costs for the future. Alongside our road map we are proposing a phase transition for funding, from innovation funding to cost recovery from key beneficiaries to commercialise data products approved by the user group to be sold to third parties.

Diagram 9 funding transition details how we propose to manage the funding transition overtime and the Barriers, further consideration and risk section, highlights the risks and our proposed mitigations to achieve the first stage of a cost recovery mechanism prior to the proposed solution being implemented.

Diagram 9 - Funding transition



PROPOSED GOVERNANCE & OPERATING MODEL

The cost recovery impact could be supplemented by the potential of “quick win” data products that could be combine with existing ElectraLink data sets with the CAR LCT data, subject to governance rules and user group approval. For example, we already provider the ESO with data relating to the visibility of larger embedded generating assets that are processed through the current industry settlement arrangements. The CAR LCT data could be combined and aggregated and sold to third parties in a similar way.

Further data products can be developed, and value generated for example the growth of organisations such as Price Comparison Websites (PCWs), Third Party Intermediaries (TPIs) and Suppliers. Many of these organisations purchase API data from ElectraLink today via our role operating the DTS and with approval from the DTS user group.

However, this will require project FAIR building upon ElectraLink’s expertise and experience, other interrelated projects (such as digitalisation of connections, digital spine and Smart meter energy data repository), key market participates (such as the ECOES, DES and DCC etc.) with the support of BEIS and Ofgem to work together to ensure we standardised data were possible, improve the range of digital and data services that drives value for the consumer.

We are confident of the long-term success of the proposed solution and the benefits it will provide, however the cost recovery investment in part may be required until the long-term revenue streams (2026 and beyond) fully materialise. Any funding mechanism must be agreed with the impacted parties with full support of BEIS and Ofgem.

Ofgem RIIO ED2 objectives +

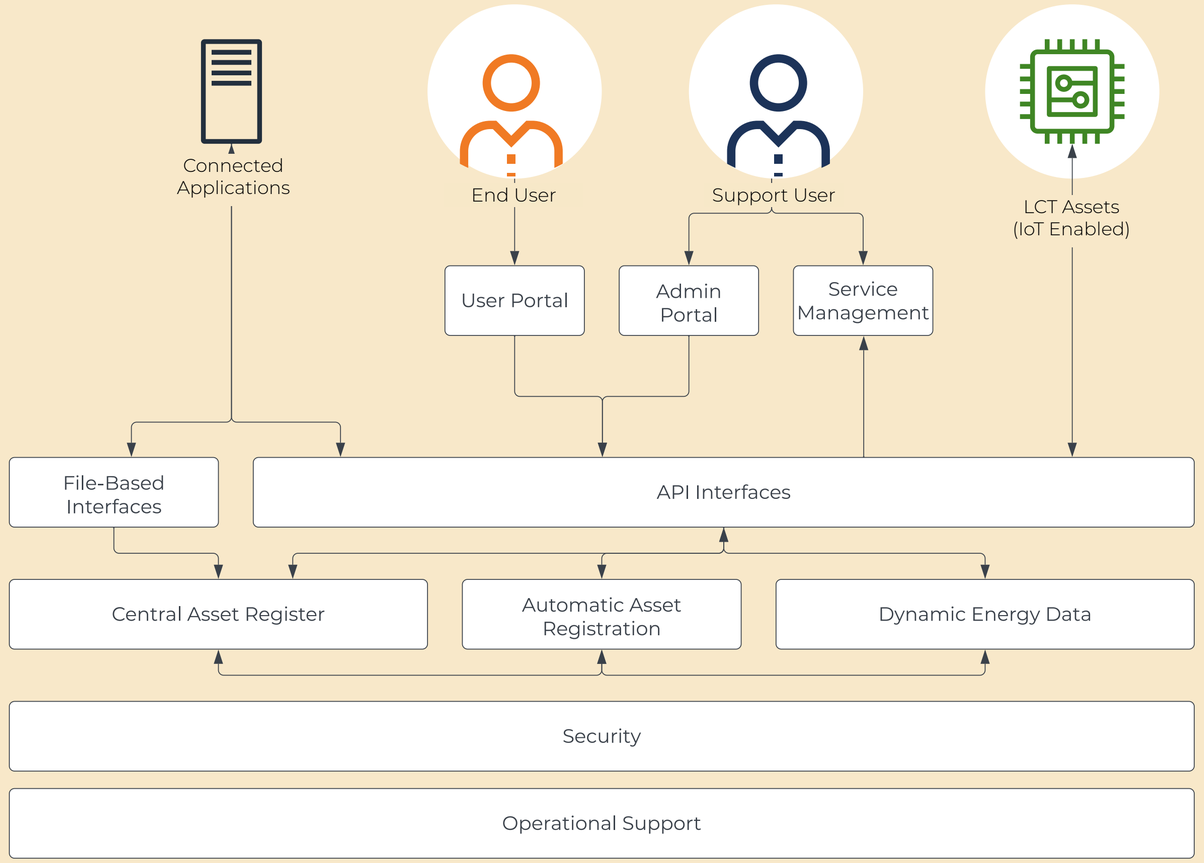
PROPOSED SOLUTION TECHNICAL OVERVIEW

LOGICAL ARCHITECTURE

The proposed solution has been designed to meet the requirements provided by BEIS in the competition guidance as well as to deliver our stakeholder requirements and incorporate the learning from our phase 1 technical development deep dives. The diagram 10 logical architecture shows that these high-level components encapsulate the key functionality of the solution and how they interact. A detailed breakdown of the functional and non-functional requirements is included in appendix 5.

The ISO25010 and ISO25012 standards for software product quality and quality of data product, respectively, were used as a basis for the non-functional requirements to ensure alignment with best practice.

Diagram 10 - Logical architecture



PROPOSED SOLUTION TECHNICAL OVERVIEW

The table below provides a summary of each component included with diagram 10 logical architecture:

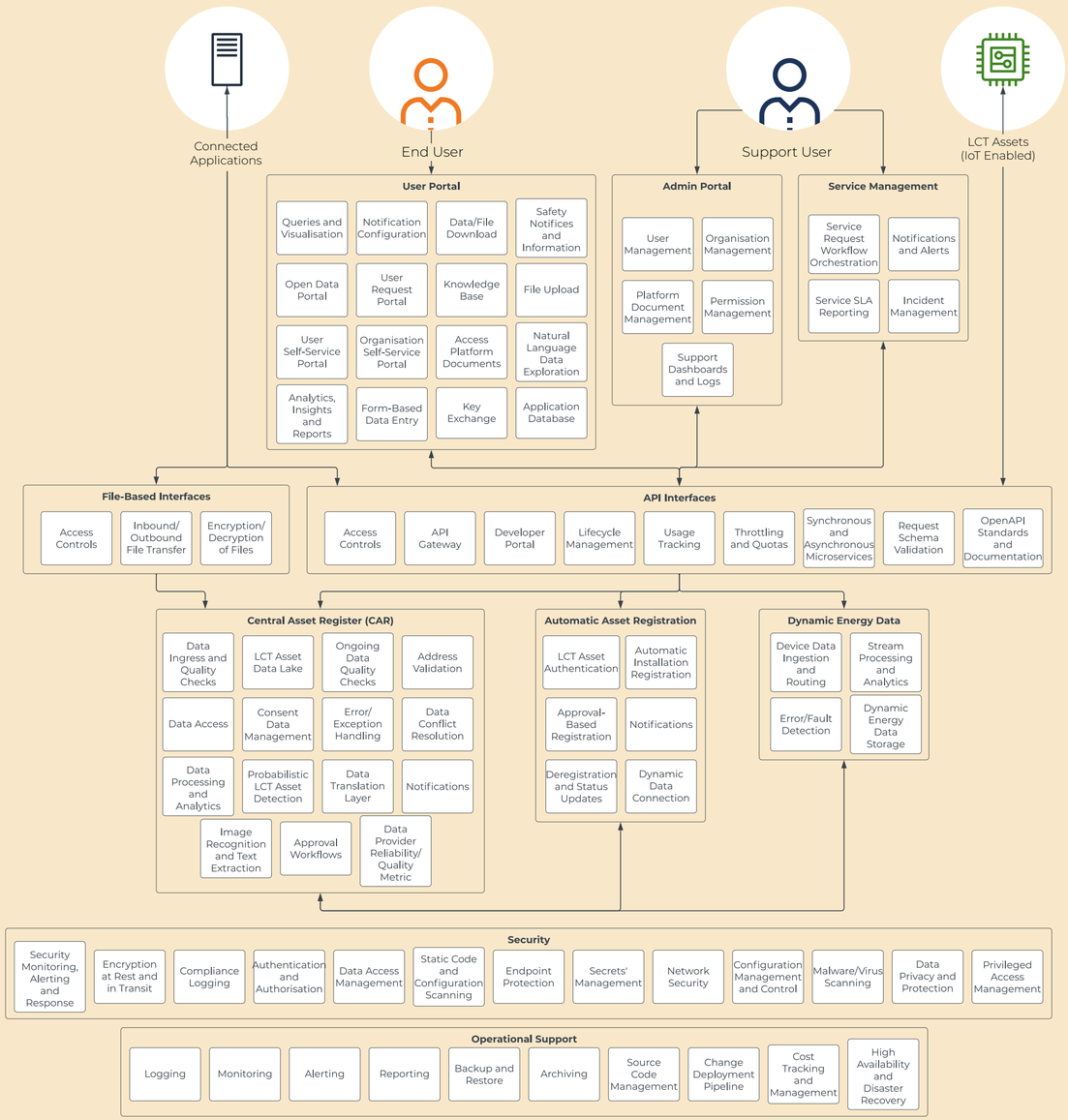
Component	Description
User Portal	Subject to user permissions, this provides users the ability to access the key capabilities of the proposed solution in a user friendly manner. It enables users to perform data activities, such as data analytics and updating the database with new information. It provides access to self-service capabilities for an organisation and /or users to manage their accounts including removing users. Other key features include the ability to query and visualise their permitted data including the ability to extract and develop insights (all subject to an identity-based permissions structure that limits them to only what they are approved to see by the governance process).
Admin Portal	Support teams can use this portal to perform system and user administration tasks. From checking operational dashboards to understanding system health and the state of business processes. It will also offer user and organisation access management (as defined by the governance framework) and the ability to maintain different aspects of the platform such as the data terms and conditions.
Service Management	Allows for incidents and other service requests to be raised and tracked throughout their lifecycle. Through a direct integration with the operational monitoring solution, tickets can be automatically raised for technical issues, enabling a proactive approach to identifying and fixing issues prior to customer notification. The functionality will be built on existing ElectraLink platforms (Jira Service Desk and OpsGenie) and the technical support teams to allow for adoption of best practice, efficiencies and cost savings.
API Interfaces	Machine-readable API interfaces are a critical component required to digitalise the energy industry and are a key focus from BEIS and our stakeholders. This component includes several microservices delivered through RESTful APIs with a standardised interface. API interfaces will be subject to strong security controls to protect against unauthorised usage or abuse. They will be built against a defined, agreed and change-controlled specification with self-discoverable documentation to enable a smooth onboarding process for new users and easier modification for existing ones. The choice of technologies used to implement this allows for cost-efficient scalability alongside enhanced performance and reliability at current and future volumes without the need for detailed capacity planning. This removes barriers and allows for easy integration with new projects such as the digitalisation of connections therefore supporting the industry to transition and realise the benefits of APIs, which include lower operating costs, access to new a better features and capabilities.
File-Based Interfaces	This is a time limited component and included to support the legacy issues with LCT data based on our experience in other innovation projects (i.e. Skyline) and feedback from our stakeholders. This interface layer will allow the sending and receiving of batch files as a way of supporting users with legacy systems that can't be easily or quickly changed to integrate with the APIs. This helps remove barriers and smooth the transition for the industry, from file-based batch processes to real time APIs.
Central Asset Register (CAR)	This will hold all reference data for LCT assets and their installations and provides the core capabilities for ingesting this data into the platform. The CAR will hold the LCT data available for data providers and users, including proactively notifying them of relevant changes or events. Utilising the agreed CAR schema will enforce standardisation and consistency across all data providers to ensure quality and integrity checks will be performed. During and after ingress, data will be processed to provide the aggregated output (or otherwise manipulated results) in the format required for the different use cases, as well as enabling access to the raw data for those users who are permitted access. Importantly, the data will be secured within the CAR and access will be provided in In accordance with the governance framework and approved by the user group. The CAR will include an API layer, to allow the capabilities to be provided to user portal, as well as enabling machine-to-machine access for onboarded clients. LCT asset detection process and tools are closely linked with the CAR component to determine the likelihood of an LCT being connected at a property. Combining the CAR and ElectraLink's historical half hourly datasets (and in the future smart meter data via the Smart Meter Energy Data repository) will enable this innovative data analytics approach to be tested and piloted.
Automatic Asset Registration (AAR)	This component enables the automatic registration and additional updating of LCT assets throughout their lifetime, from initial installation to decommissioning and removal, without the need for installer or asset owner completing a manual form entry.
Dynamic Energy Data	Building on the technical capabilities and processes delivered by the AAR component, once an LCT asset has been registered, this part of the solution would enable the real-time streaming of events from the assets to a data pipeline. Stream analytics would be built in, enabling additional aggregation and other processing to be performed on the data as it arrives. The resultant data will be stored alongside the raw event data in the same data lake and made available for the innovative and future-facing use cases. In parallel to this, the events will be routed to the relevant network operators and owners (i.e. DNOs) to support network operations such as flexibility services and other active network management activities. In the future, the use case of interacting with the LCT assets could also be extended and integrated with this capability to enable the active network management and other functions to truly deliver a smart, responsive and sustainable grid without the need for new infrastructure projects.

PROPOSED SOLUTION TECHNICAL OVERVIEW

Each of these components supports specific solution capabilities but when integrated and combined together, support the multiple benefits cases and other usage scenarios. See User types, cases and benefits section for further details.

To aide additional understanding of the proposed solution, the following diagram 11 key components demonstrates the high-level components broken down into their constituent capabilities. You can find more information of each capability detailed in appendix 7, detailed capability summary.

Diagram 11 - Key components



PROPOSED SOLUTION TECHNICAL OVERVIEW

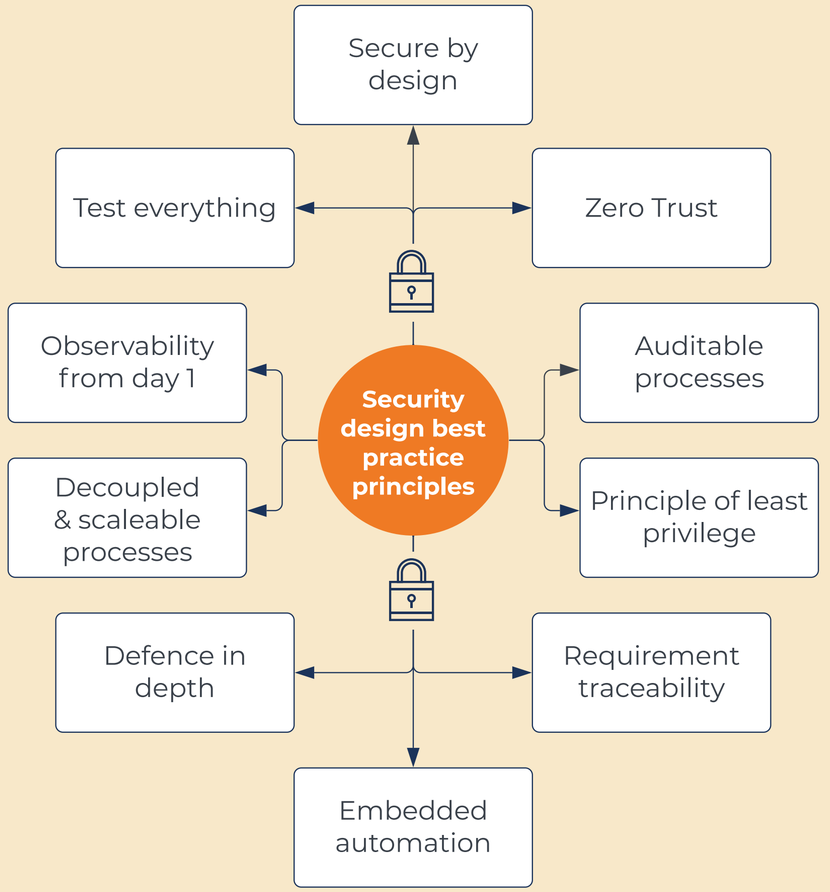
SECURITY FRAMEWORK

'Safe and secure by design' has been fully incorporated in the proposed solution. Below, diagram 12 security design best practice details the high-level security design and best practice principles, and appendix 1 provides further explanation of each principle. We have also incorporated best practice guidance from National Cyber Security Centre (NCSC).

We have adopted these principles and undertaken a robust Zero Trust threat modelling and risk management exercise to ensure that potential issues are identified, analysed and mitigated. This means every service and user that interacts with the solution or is a part of its internal workings must be uniquely identified so that every request they make can be authenticated.

If Project FAIR is implemented, we will adopt a continuous cycle of threat analysis, have a living Data Privacy Impact Assessment (DPIA), and run regular code scanning and checking to ensure any vulnerabilities are identified early and mitigated.

Diagram 12 - Security design best practice principles



PROPOSED SOLUTION TECHNICAL OVERVIEW

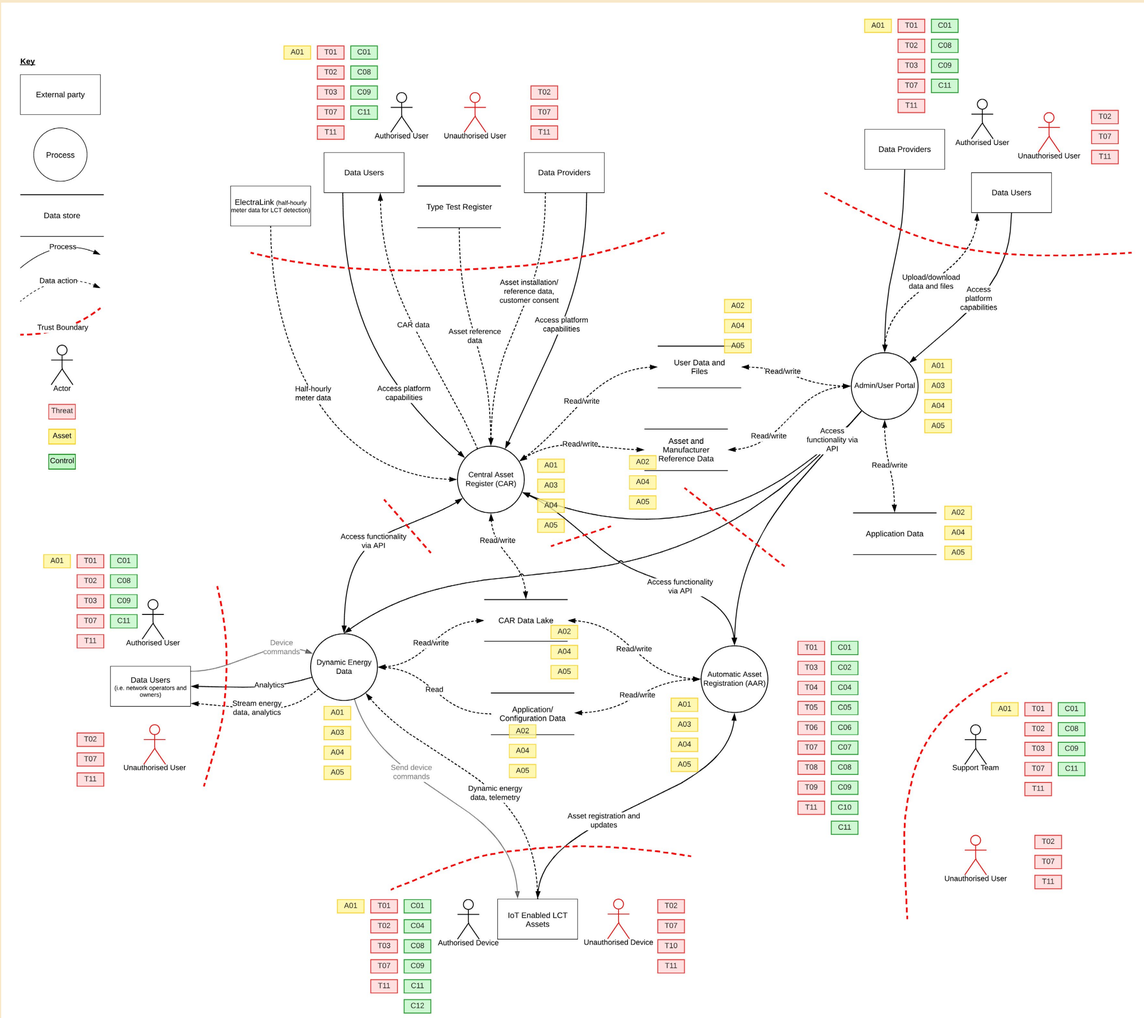
The diagram 13 Security threat model details the security threat modelling for the proposed solution with key processes, actors and data stores identified. Their interactions have been mapped at a high level and the key risks, assets and controls have been determined. This is a complex diagram but necessary to ensure we achieve our core principle of safe and secure by design.

The security threat model diagram 13 shows the key components of the solution, the main databases, and the connections to external datasets. The trust boundaries (the dotted red lines) indicate where there is a change in the level of trust in the data and how it is handled in the context of a Zero Trust model. It indicates where data is passed between processes (e.g. from the public internet to the application network) not whether one part of the application is more trusted than another.

A detailed threat analysis is contained in appendix 8, including information on the specific identified assets, threats and controls.

Zero Trust

Diagram 13 - Security threat model



PROPOSED SOLUTION TECHNICAL OVERVIEW

HIGH-LEVEL TECHNICAL ARCHITECTURE

This following section provides a more technical understanding of the architecture and why we are proposing an AWS cloud-based solution.

Why an AWS environment?

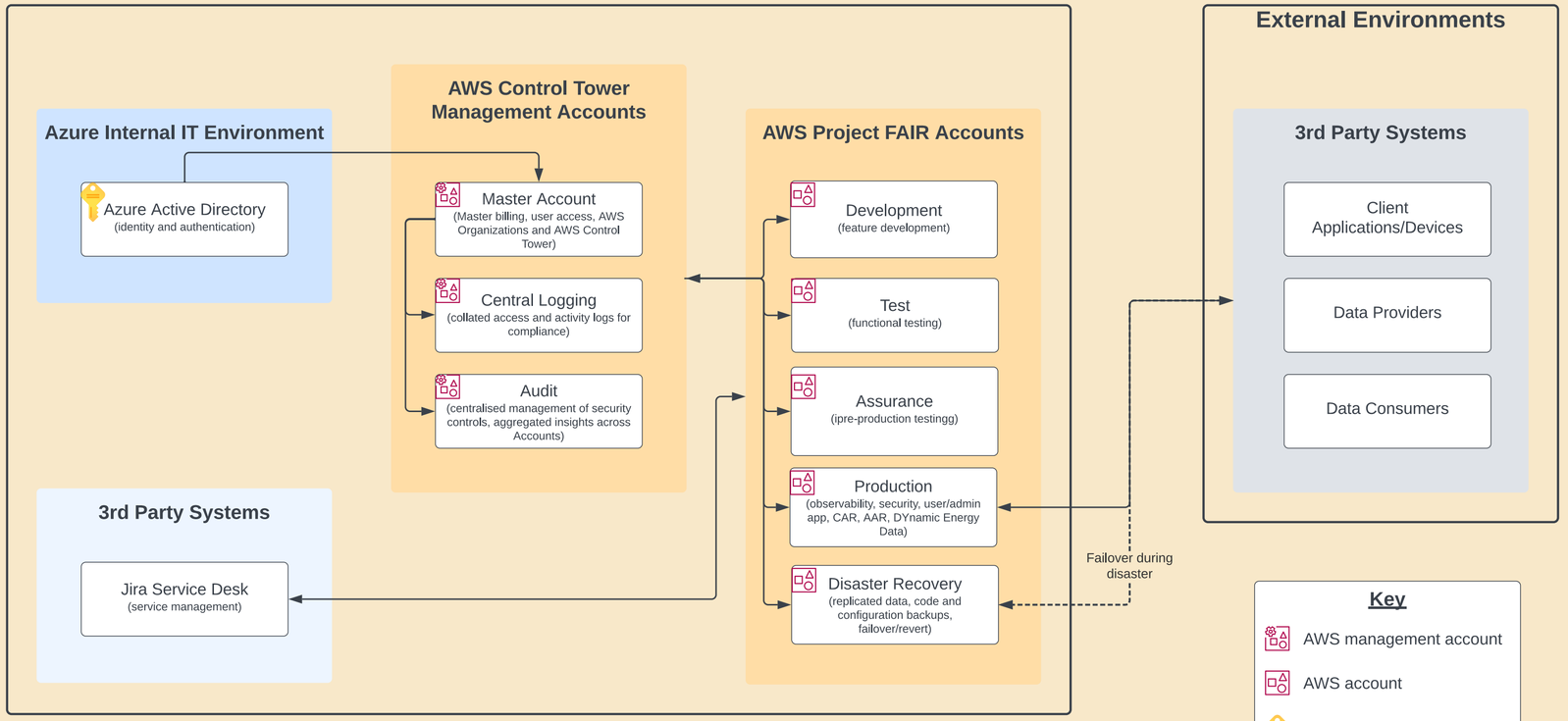
AWS public cloud was chosen as the platform to deliver the proposed solution because it:

- is highly reliable with many data centers,
- has more regions and network points of presence than its competitors,
- allows the leveraging of expertise and economies of scale on a global basis,
- is a market leader with a world class support framework – such as the AWS Well Architected Framework, this includes sustainability which aligns with the energy industry net zero ambitions and ElectraLink's vision and values.

In addition, we have successfully and extensively used AWS for other projects and have developed a deep understanding of developing and supporting products and services in AWS.

AWS

Diagram 14 - Project FAIR account



PROPOSED SOLUTION TECHNICAL OVERVIEW

AWS Well Architected Framework and its 6 pillars combined with best practice and our expertise have been used to guide the design and proposed solution. This allows us to compare the developed service against those standards to validate and ensure compliance to provide BEIS and stakeholders confidence that the solution is of the highest standard.

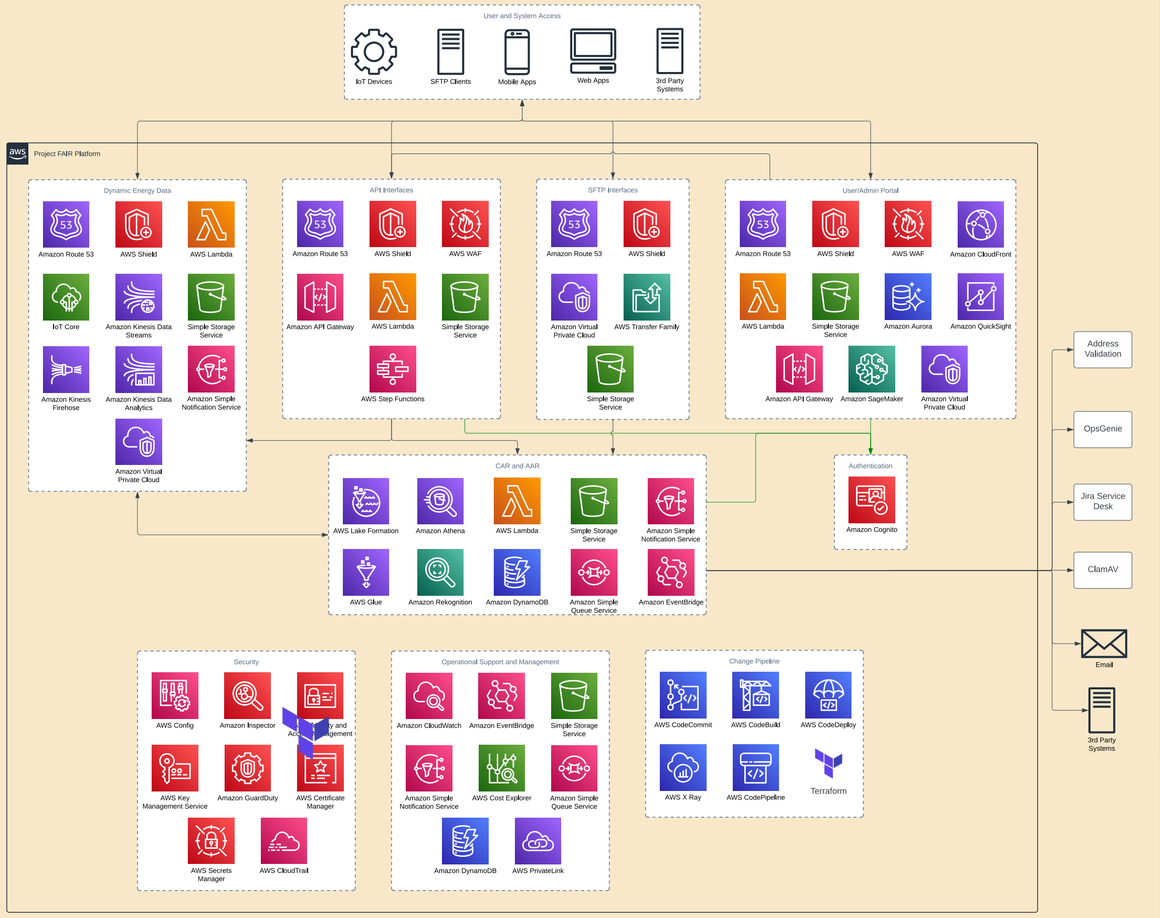
ElectraLink has and continues to use AWS Control Tower to create a secure and centrally managed multi-account environment. Here dedicated management accounts centralise core features, such as security monitoring and configuration management, compliance logging and user access. This is done via ElectraLink's corporate identity provider, Azure AD, and benefits from additional security controls.

Management accounts will be connected to a set of project accounts for the solution environments: Development, Test, Assurance, Production and Disaster Recovery. Diagram 14 project FAIR account shows how project FAIR accounts could be included within the wider the context of ElectraLink's IT estate.

For example, the Jira Service Desk would provide the core service management capabilities and is a Software-as-a-Service (SaaS) product that allows the creation and management of support tickets and issue tracking.

If implemented, we would operate the project accounts in GB with disaster recovery, operating in Ireland, this provides cross-region failover capabilities in the event of a significant issue and ensures security and quick recovery. This approach to design provides cost efficiencies with in-house expertise and streamlining of processes whilst ensuring project FAIR remains discrete in its own account, separate from other accounts and services that ElectraLink operates. In addition, the use of serverless and managed services reduces energy consumption and promotes energy efficiency to help achieve net zero.

Diagram 15 - Technical architecture



LCT DETECTION ROADMAP

SOLUTION DESIGN

Diagram 15 Technical architecture, outlines the high-level technical architecture, the key AWS and external services, and how they interact to deliver the solution. Details of each AWS service are included in appendix 9 AWS service summary.

A microservices architecture pattern has been used. Each service is an isolated unit of functionality, enabling them to be combined and used to deliver the use cases. Each service can operate and scale independently, so heavy traffic on one will not impact the others, leading to better resource and cost efficiency. This approach allows the system to be fault tolerant and reliable. If an issue arises, each independent service will handle failure gracefully with defined error handling and exception processes to ensure support teams are alerted to any issues without impacting the complete solution.

All changes, modifications or updates to the services or architecture will be governed and approved by the governance framework and the user group. Technically, these approved changes, modifications and updates will be undertaken through the admin portal (i.e., the onboarding of new users or the modifying of their access levels) or via a controlled change delivery process (i.e., changes to the CAR schema). This ensures only the relevant service is impacted and prevents any scope creep or other service being impact providing the user group with confidence and control over the system.

The Project FAIR solution delivers significant benefits as detailed User types, cases and benefits section. Only 40% of LCTs are currently being registered today. Until we transition to an IoT world where the LCT assets themselves communicate with the CAR and AAR we need to develop processes and probabilistic techniques to identify LCT assets that have been installed but not registered, either due to legacy reasons or lack of awareness regarding the registration process.

During phase 1, working closely with our partners we focused on understanding methods and approaches to include a probability or confidence score to the connection of an LCT at a MPAN specific level that would be tracked over time. This flag or indicator would be included with the overall design.

The indicators would provide a confidence /likelihood/probability rating of whether an LCT asset is connected to an MPAN but has not yet been registered. Over time this indicator could be updated as more information becomes available or as new techniques are developed or even removed if action is taken to contact the asset owner and the asset is then registered. This technology will allow for tailored techniques and machine model learning capability to be implemented as well as the ability to identify if an LCT asset has been removed, decommissioned or even stolen.

Our LCT detection work in developed in 2019 firstly investigated what reference datasets are or could be available to help train a machine learning model. This included ElectraLink's vast data set from the half hourly meter reads via the DTS dating back to 2012. The use of ElectraLink's electricity consumption and generation data lake, in conjunction with other relevant datasets was used to identify EVs, Solar PV and heat pumps, and would be used to validate the LCT data in Project FAIR through a probabilistic detection system at an address level that is linked to MPANs.

The technology is based on the assumption and expectation that when LCTs are installed at an address, the historical pattern of demand or generation will change. Changes in electrical demand due to the installation and connection of LCTs can be difficult to determine, as demand changes can be masked by adaptive behaviour due to a changed pricing, tenancy or other factors. This lack of certainty when using electrical demand, for example, as a proxy to determine connection of LCTs is the main reason for the use of a more granular probability score rather than an LCT merely having a binary connected or not connected value.

A source that contains higher certainty data for LCT generating technologies (solar, wind, hydro) can be found in the export meter data that ElectraLink already holds.

LCT DETECTION ROADMAP

If there is export through an export meter, this would indicate with a higher probability that some type of generator is linked to that MPAN, likely to be an LCT, if the MPAN is at a domestic level. ElectraLink's historical datasets can be analysed (where available) to determine the type of generation (solar, wind, hydro, battery or a combination) and potentially provide insights on the scale of the installation too.

For new MPANs that already have LCTs connected, there would be no historical data to compare across a timeframe, therefore the demand or generation profile can be compared to profiles across a range of features such as proximity to other MPANs with LCT connections, and correlation of the demand and generation profiles to other profiles that have already been crosschecked with datasets such as Ofgem's feed-in-tariff register.

Figure 1 Average power usage with and without LCT's show how profiles for different LCTs can be developed and understood over time. The first one shows average power for a domestic meter without an LCT and the second when a heat pump is connected. The third when solar PV is connected.

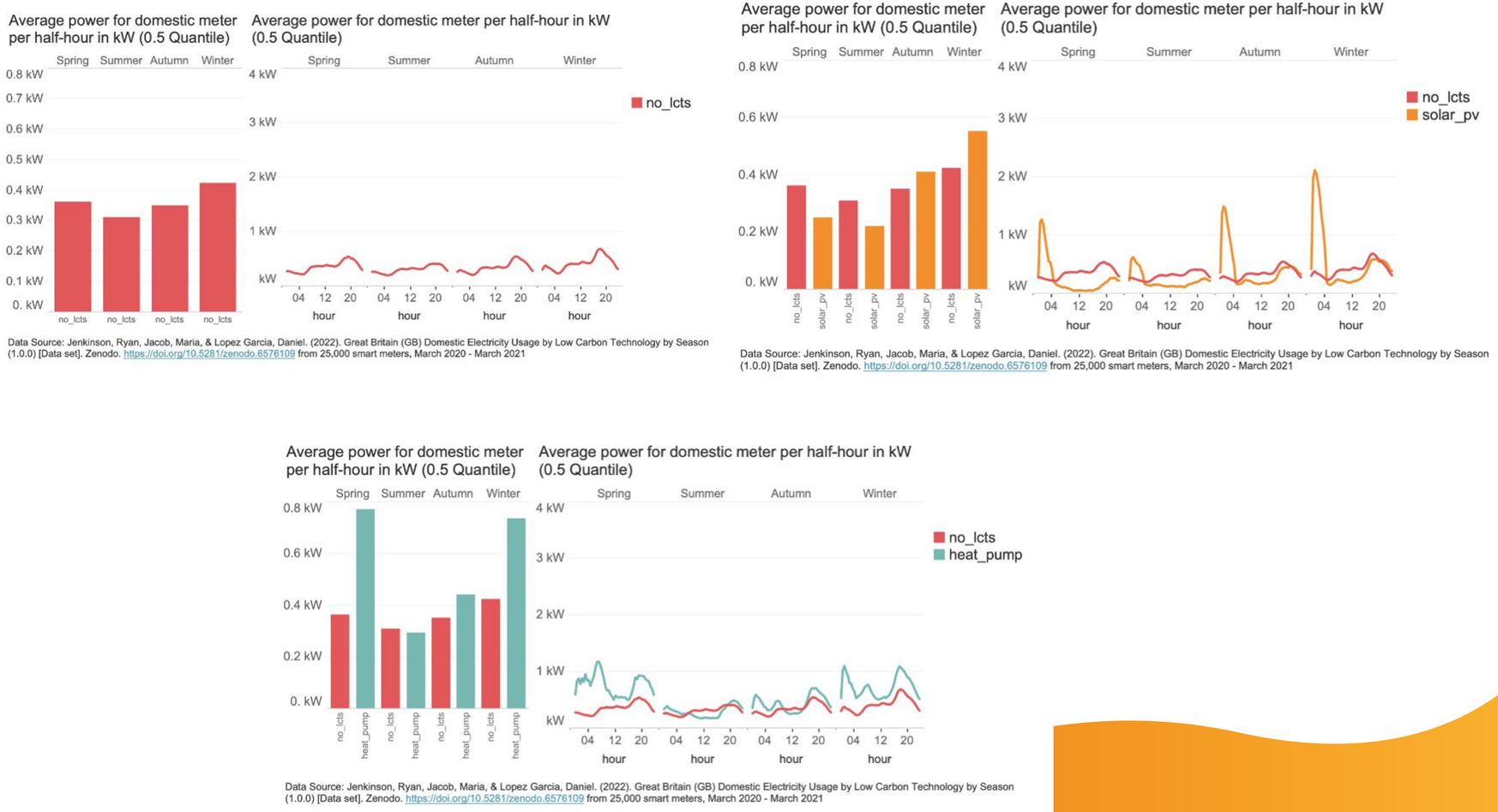


Figure 1

LCT DETECTION ROADMAP

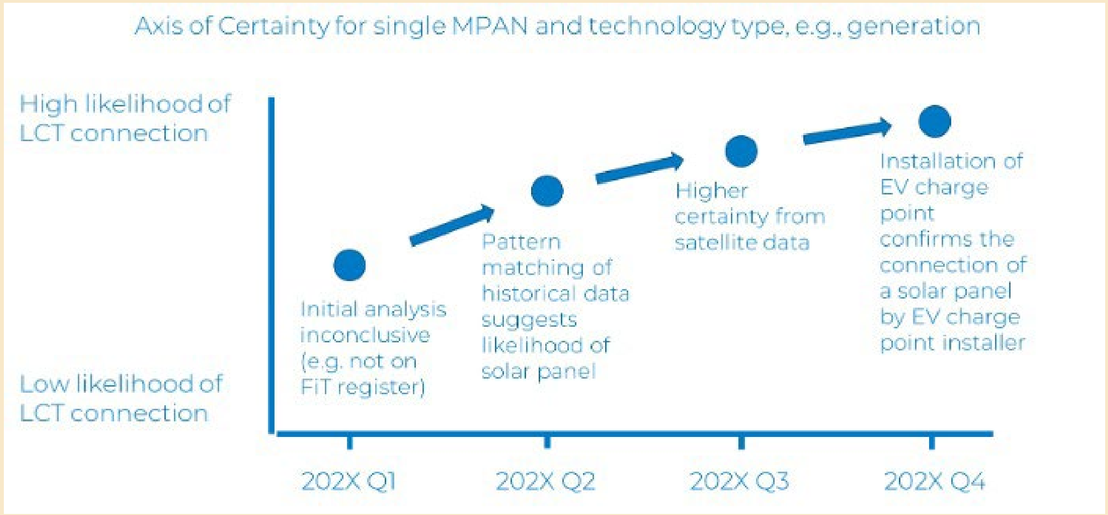
Leveraging ElectraLink's existing data provides several advantages including the likelihood that reporting errors within the export metering are corrected. This is because export meter problems are likely to have been resolved when metered values report a lower-than-expected output. This is due to the loss of revenue that would happen if this was the case, and thus the likelihood of an LCT owner raising this with their supplier to resolve metering or other connection problems increases.

A key aspect of the process will be the comparison of ElectraLink's consumption and generation data against datasets from other sources. This proposes that initially a window of analysis will be used to generate the likelihood of an LCT being connected to an MPAN, for example, the analysis will be undertaken once a quarter, and the percentage likelihood value will remain until such time as it is updated. Separating the pattern matching of LCTs to MPANs from the hour-to-hour ingestion and validation of data provides flexibility in future approaches and ensure it is mapping longer term shifts or changes over time (i.e., not a weather linked anomaly, due to a cold snap).

Having a separate process allows a richer and more creative approach to LCT detection to be piloted for geographical areas (rural versus urban) and technology types. Each MPAN could have a range of values for each technology theme such as generation, heating demand or transport, or potentially just a single value at the start that implies that an LCT of some sort is either connected or not in some scale of probability.

Diagram 16 LCT detection probability over time details how probably and certainly can change over time.

Diagram 16 - LCT detection probability over time



LCT DETECTION ROADMAP

COMBINING ELECTRALINK DATA AND OTHER DATA SOURCES

To enhance and develop the process, we focused on understanding what other data set could be used in conjunction with ElectraLink data to develop the LCT detection process and methodology. It should be noted we have not completed the data analysis for project FAIR but focused on the process and approach.

'ACCREDITED STATION' DATA

The 'Accredited Station' data from the Renewable Energy Guarantees of Origin (REGO), Renewable Obligation (RO) and Climate Change Levy (CCL) dataset is a rich source of data with site names, capacity, date of commissioning and typically a postcode as part of a site address (https://renewablesandchp.ofgem.gov.uk/Default.aspx). For solar installations in the REGO dataset, there are values that range from 0.4 kW to 50000 kW with nearly 31000 installations in total – the table REGO Accredited Station data for Solar PV in UK. Many of these are of a commercial scale, and an expectation is that the majority of these would also be detailed on the appropriate DNO embedded capacity registers.

Cross checking installation data against these registers would provide insights on the level of consistency across different datasets.

This data can also be cross-checked with the data that ElectraLink holds on historical dynamic data (metered demand) to build a valuable comparison dataset of capacities against exports for various locations in GB. If this proves successful, it can also be undertaken for 'Accredited Station' forms of generation such as wind, hydro, biogas, biomass and help to build a range of real-world profiles that can be associated with various capacities of generating technology.

The use of real-world data to create a range of profiles from export meters and import meters is thought to be one of the most valuable ways of detailing the range of outputs for a given set of technologies, locations and reported capacities.

The reason for this is an expectation of a range of problems with the reporting of legacy system capacities, so, using real-world data opposed to synthetic data helps to limit the variability of the measurements.

This approach allows project FAIR to build confidence overtime, develop deeper insight and support LCT detection until all legacy assets without an IoT chip are no longer installed on the network.

REGO Accredited Station data for Solar PV in UK

	Number of Solar PV Installations	Total capacity of Solar PV installations	Average capacity of Solar PV installations
England	8121	6695 MW	824 kW
Scotland	330	78 MW	238 kW
Wales	446	662 MW	1485 kW
Northern Ireland	22005	275 MW	12.5 kW
Total	30902	7712 MW	249 kW

LCT DETECTION ROADMAP

TIME-SERIES ANALYSIS

Time-series analysis against historical meteorological data could also potentially provide an evidence base of the degradation over time of various technologies, which is helpful to consider against the lifetime of the technology to ensure the quality of the LCT validation remains as high as possible.

A variation would be expected to be found across similar capacities, not only due to the degradation, but also as self-usage would reduce the amount of electricity that is exported. However, cross checking export data with the certificates issued for generation will provide additional insights on the levels of generation of various capacity of technologies; less variation would be expected to be seen here in comparison to exports.

Edge cases and outliers will be highlighted for further detailed data discovery using other datasets such as DNO capacity registers, Feed-in-Tariff data, valuation office data, local authority planning data, satellite data and potentially smart meter data for those edge cases. Much of this data detective work can be manual in nature, so several different approaches would be investigated in future phases. For example, cooperative machine learning combined with more traditional statistical methods provide scope for novel approaches.

A similar exercise can be attempted with the Feed-in-Tariff data from Ofgem, although, the publicly available data only has a partial postcode and Lower Super Output Area (LSOA) codes. A direct request to Ofgem could provide address data, but this would be subject to appropriate governance and controls. With address data, an MPAN should be able to be allocated against a Feed-in-Tariff installation, and similar to the REGO data analysis described, this provides the basis for analysis of the variation of exports and generation for capacities of technologies and areas of GB. Again, edge cases and outliers are interesting to investigate with other datasets, to be able to build up a profile of expected output of technologies of certain scales in certain parts of GB.

A dataset of time-series profiles for installations for various capacities and locations on a regular basis (perhaps monthly or quarterly), provides the basis to consider the profiles of MPANs that are not known to have LCT generation, or to compare those that are thought to have, but may no longer. This profile dataset is a critical part of the AAR to be able to compare legacy changes in demand or export at MPANs, and changes that could be difficult to pick up through any other means. An example of this is a fault occurring on domestic Solar PV installation that significantly degrades its output as it is felt unlikely that this would ever be reported.

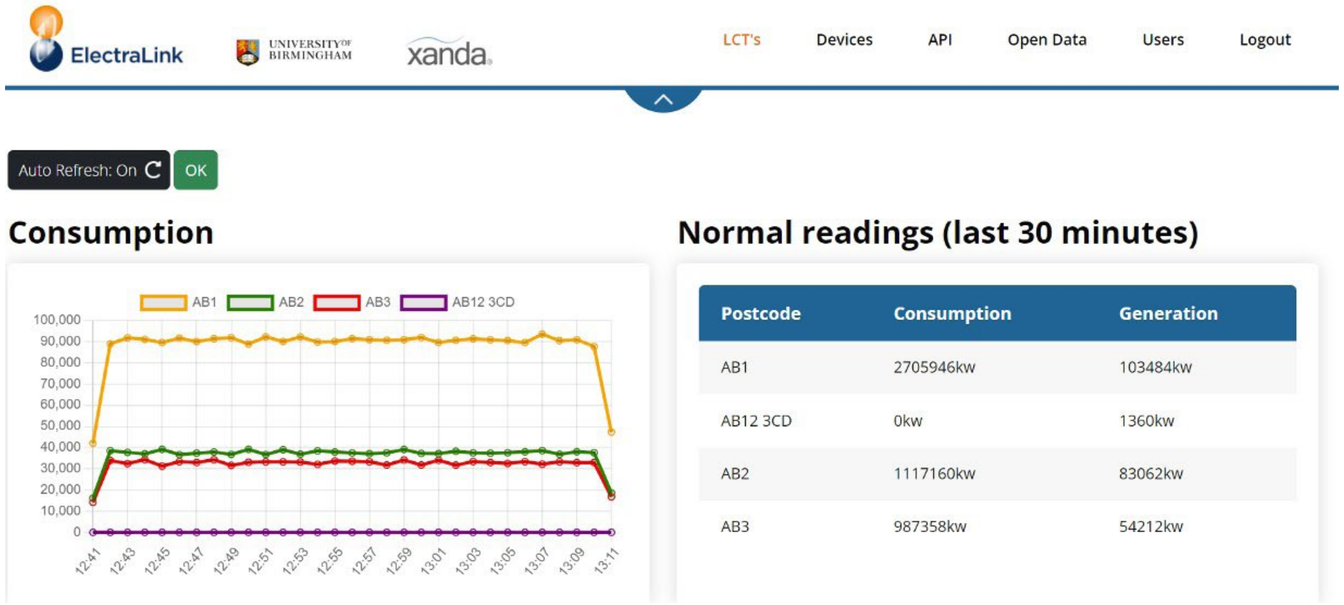
During phase 1 we also identified other sources of data that could be utilised but these have not yet been explored. For example, electricity suppliers hold data on types of tariffs which may help to indicate the presence of certain types of LCTs such as tariffs that have a specific focus on EV charging (with lower overnight rates) which would provide a higher certainty indication of an EV charge point at that MPAN. Further exploration and analysis would be undertaken in phase 2 and would continue to be developed if project FAIR were implemented.

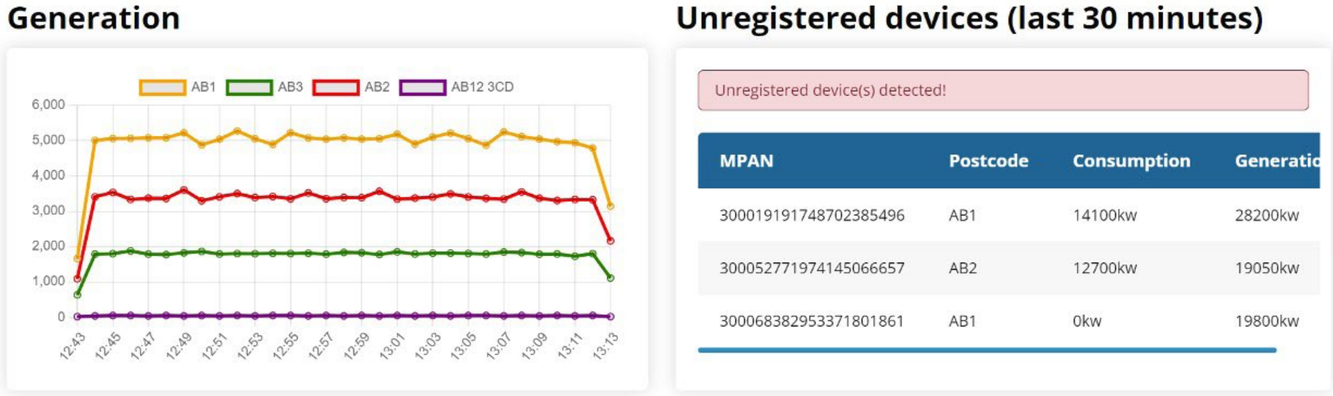
In addition, the future incorporation of further half hourly smart meter data from the “Smart Meter Data Repository” project when it becomes available would further improve the accuracy of LCT detection technology.

LCT DETECTION ROADMAP

LCT PROOF OF CONCEPT

During phase 1, dummy data was used to test our approach and idea for how LCT detection could work within the proposed solution. The screen shots from the proof-of-concept model shows how this could be utilised and developed with real data in phase 2. The proof of concept takes dummy real time consumption and generation data per MPAN (which could be accessed via the Smart Meter Energy Repository), compares this to expected household profiles and checks to see if an LCT asset is registered at the MPAN and address. It then flags those MPAN's that could have an unregistered LCT asset based on our profiles.





DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

This section is designed for readers who are seeking greater technical understanding.

To provide greater understanding of the high-level technical architecture this section provides a deep dive into each component, the different services within each component and how they are used to deliver the proposed solution and the identified use cases. Appendix 10 provides brief videos from the proof of concept tools that were developed in phase 1.

SECURITY

As previously stated, one of our core principles is to ensure the solution is secure by design. The security services will allow the system to be monitored and proactively detect threats and trigger the appropriate response. Services like AWS Config and AWS CloudTrail will log and monitor activity in the system and detect changes to the provisioned AWS services. Notifications and preconfigured response plans can be triggered based on defined metrics and alarms to ensure relevant individuals will be notified of any issues promptly.

All activity in the system is logged for compliance and audit purposes, with logs stored locally and replicated to central storage in the central logging account. Key information from the logs can be provided and shared with the user group, as required. Amazon S3 provides highly durable and available storage for these log files throughout their lifecycle to ensure they are not lost or accidentally deleted, thus providing the user group, BEIS and the industry confidence of the solutions security audit trail.

Services like Amazon GuardDuty and Amazon Inspector provide key monitoring capabilities, flagging unusual patterns of behaviour and vulnerabilities in the core compute services like AWS Lambda. AWS Key Management Service (KMS), AWS Secrets Manager and Amazon Certificate Manager (ACM) enable the secure generation, storage, use, rotation and eventual destruction of application secrets like encryption keys, application credentials like database connection passwords, SSL certificates and more. This delivers capabilities such as encryption at rest and in transit, secrets management and data privacy and protection to ensure the system only provides access to data and functionality for authorised users. The policy, as guided by the recommendations from the Data Privacy Impact Assessment (DPIA), is to rotate these keys every 180 days to balance minimising the operational overheads of continually rotating secrets with minimising the validity period of compromised material.

AWS Identity and Access Management (IAM) is a key service that provides the roles and permissions management of the services that make up the project FAIR platform. For example, when one service needs to call another, such as a Lambda function sending a query to Amazon Athena, AWS IAM evaluates the assigned policies to check it is allowed to perform that action. These policies can also be used to control support team access, so this service forms the core of the user and system access management approach to ensure data is protected and the principle of least privilege is maintained.

Therefore, by leveraging AWS services and our expertise we are able to deliver best practice security solution for project FAIR.

OPERATIONAL SUPPORT AND MANAGEMENT

Amazon CloudWatch is a fully AWS managed service that enables the gathering of application logs, configuring of metrics and alarms, and the visualisation of trends alongside the current state of the system through dashboards. Amazon CloudWatch also integrates with Amazon Simple Notification Service (SNS), Amazon Simple Queue Service (SQS) and Amazon EventBridge to provide a monitoring and notification system that will route notifications and system messages to the appropriate target user or system such as Jira Service Desk or OpsGenie. Additional logging for the APIs is supported by Amazon DynamoDB, a fast and responsive database with single-digit millisecond response times at massive scales to provide a real time view of the calls being made to the CAR and AAR.

DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

The overall logging and monitoring solution is shown in diagram 17 logging and monitoring, detailing how the AWS services write logs to a common set of locations, which are then used by monitoring, alerting and reporting services as part of operational support processes.

In addition, Amazon Athena can be used to query the backed-up log data for additional insights.

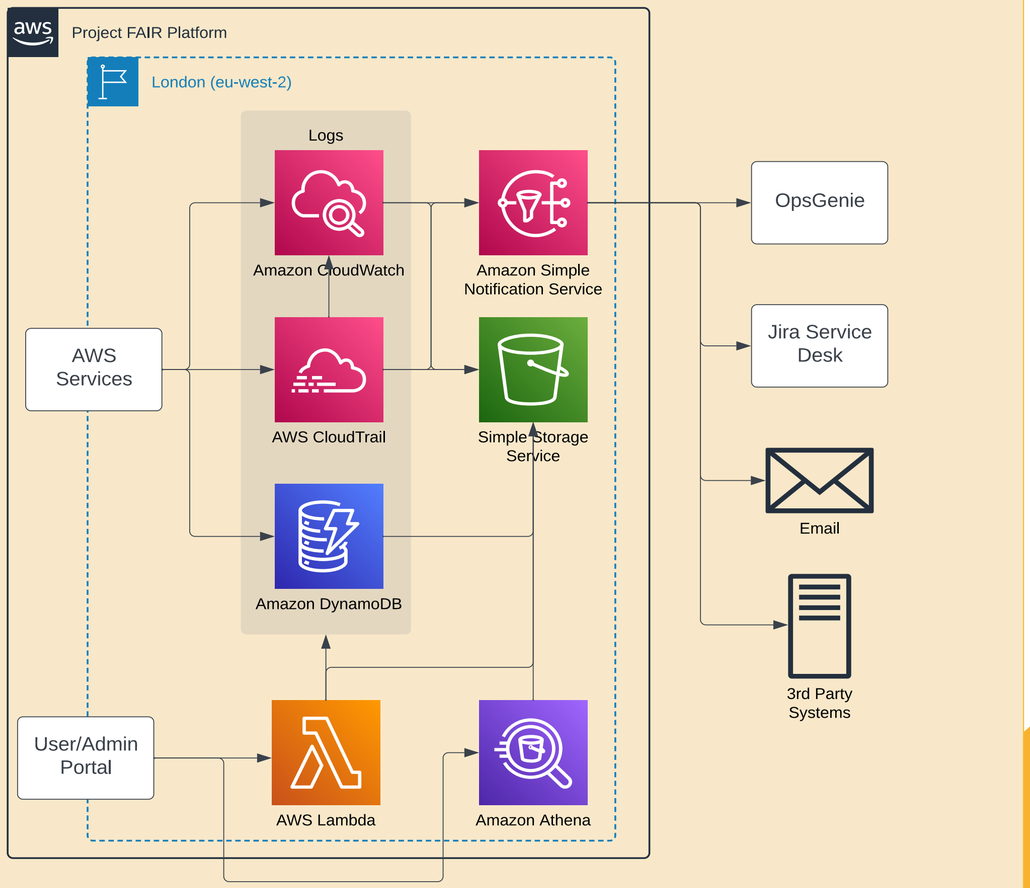
AWS PrivateLink ensures that services such as Amazon SageMaker and the AWS Transfer Family file interface endpoints can be securely accessed through well-monitored and controlled routes. It also provides a stable endpoint for client systems to connect to for SFTP file transfers to allow network-level restrictions that only allow clients on a configured allow list to connect.

Similar to compliance logs, operational logs are generated by the AWS services of the solution and are backed up and archived in Amazon S3, which is also used to store backups for the CAR Data Lake and other application data, files and source code (this detail in appendix 11 backups architecture diagram). Using S3 Replication, backups are replicated to the disaster recovery AWS Account in Ireland to provide geo-redundant storage of data. This, combined with the replication of the CAR, AAR, Dynamic Energy Data and User/Admin Portal components using Amazon CodeBuild (as described in appendix 12 Disaster Recovery diagram) would provide resilience and disaster recovery processes for the critical processes a solution such as this could eventually support, such as flexibility services and active grid management.

Visibility of ongoing service costs

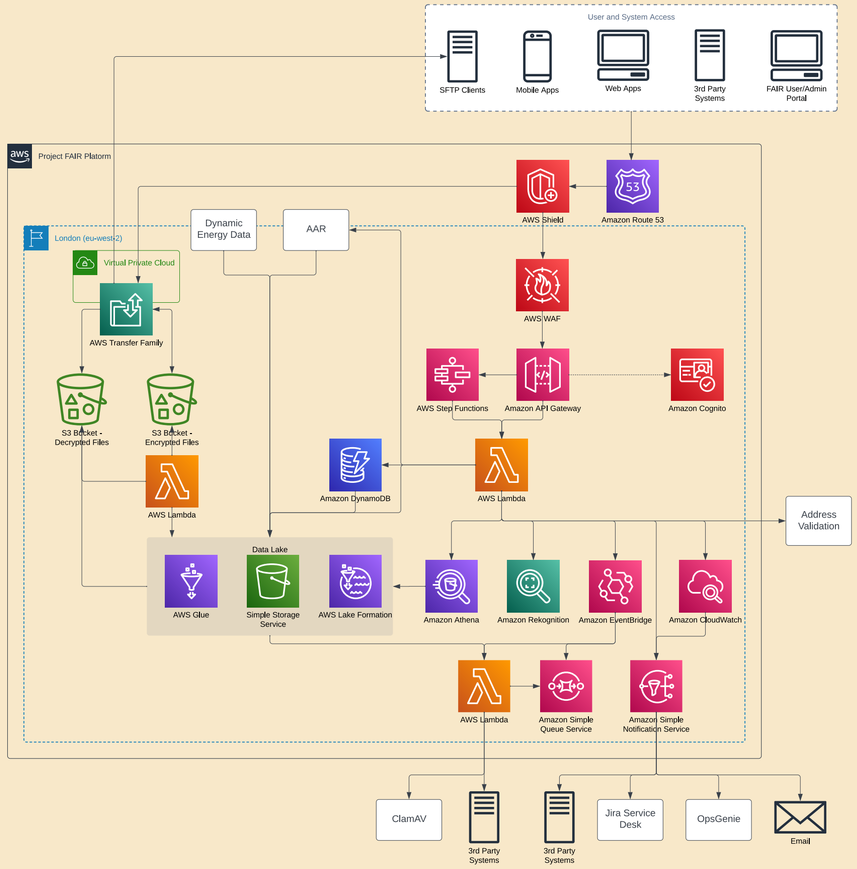
AWS Cost Explorer utilises the resource tags associated with each service instance to provide a detailed breakdown of the operational costs of running the solution. Reports and other extracts of the data can be prepared and re-used for regular updates and a consistent view of costs. This information would be shared with the user group and under the governance framework and operating model to ensure costs are accurate and can be recovered via key beneficiaries at first and later via commercialised products and services.

Diagram 17 - Logging and monitoring



DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

Diagram 18 - CAR



Central Asset Register

Diagram 18 CAR shows a detailed view of the CAR architecture including the proposed AWS services.

The CAR will provide a centralised Data Lake to store:

- LCT asset reference data (such as make/model, technical specifications, etc...)
- Device-specific information (like serial numbers or other unique identifiers)
- Installation data (including the address details where it was installed, date of installation, details about the installer, etc.)
- Customer consents
- Additional data sets such as Type Test Register approvals and half-hourly data to support the detection algorithm and more

The data will be stored in Amazon S3, with AWS Glue running transformation or other data management jobs (such as ongoing data quality checks) and AWS Lake Formation to create, manage and protect the data lake itself with fine-grained access controls. With these services, permissions are evaluated at the column level on a per-user basis to enable restrictions to be enforced on PII, other sensitive data and data for which consent for usage has been withdrawn. The same process can also be used to grant all users access to open data, improving the transparency and availability of data without compromising data protection and privacy, all in accordance with the governance framework.

A microservices layer of RESTful APIs and file-based Secure File Transport Protocol (SFTP) interfaces provide access to the data lake and other CAR capabilities, with DNS management and Distributed Denial of Service (DDoS) attack protection provided by Amazon Route53 and AWS Shield.

Secure File Transport Protocol (SFTP) interfaces +

DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

The API layer is provided by Amazon API Gateway, a serverless platform to design, develop, deploy and operate APIs as per the capabilities shown in the API Interfaces component. They will be built and documented according to OpenAPI 3.0 standards to provide consistency and familiarity for users and developers, minimising barriers for adoption to support the digitisation of multiple industry processes. Additional security is provided by the AWS Web Application Firewall (WAF) service which scans requests and applies rules to allow or deny traffic. Amazon Cognito provides the authentication for the APIs, with the associated IAM permission policies determining which APIs can be called, supporting the Zero Trust security model.

AWS Lambda services are used to fulfill the requests sent to the APIs, with dedicated Lambda functions for each microservice and AWS Step Functions used to orchestrate more complex services. These can scale to hundreds of thousands of requests per second to ensure consistently high-performance. Lambda functions will also be used to make calls to external services and systems, for example, directly calling target endpoints to retrieve data like updated virus/malware information for ClamAV, the file scanning software used on all uploads. It could also be used via Amazon EventBridge, Amazon Simple Queue Service (SQS) and Amazon Simple Notification Service (SNS) to provide event-driven processes for notifications and other asynchronous communication, such as sending alerts to DNO, if there is a safety notice issued on an asset.

These microservices will use the other AWS services shown in diagram 18 to deliver the required functions and capabilities which could include image recognition and text extraction for installation support through Amazon Rekognition. Amazon Athena provides the query engine for both user queries from the portal as well as any triggered by automated data processes such as quality checks or the LCT detection process. As well as storing API log data, the low-latency performance of Amazon DynamoDB can be leveraged to provide access to non-sensitive data that needs a quicker retrieval time than queried data, e.g. for APIs to access manufacturer and asset reference data for installation applications, a use case highlighted by our survey participants.

Not all processes or users can utilise API interfaces today, so, in the near term file transfers over SFTP using AWS Transfer Family can be enabled. This enables the inbound and outbound transfer of files securely using client certificate authentication for user access. It also has native support for decryption of inbound files using AWS KMS keys (outbound can be encrypted by Lambda functions). As with all files uploaded to the platform, whether by API or SFTP, they are virus scanned and only when confirmed as ‘clean’ are they tagged for ingestion by AWS Glue. It is expected this functionality would be phased out overtime, with estimations that it would no longer exist from 2025 onwards.

Additional security features +

DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

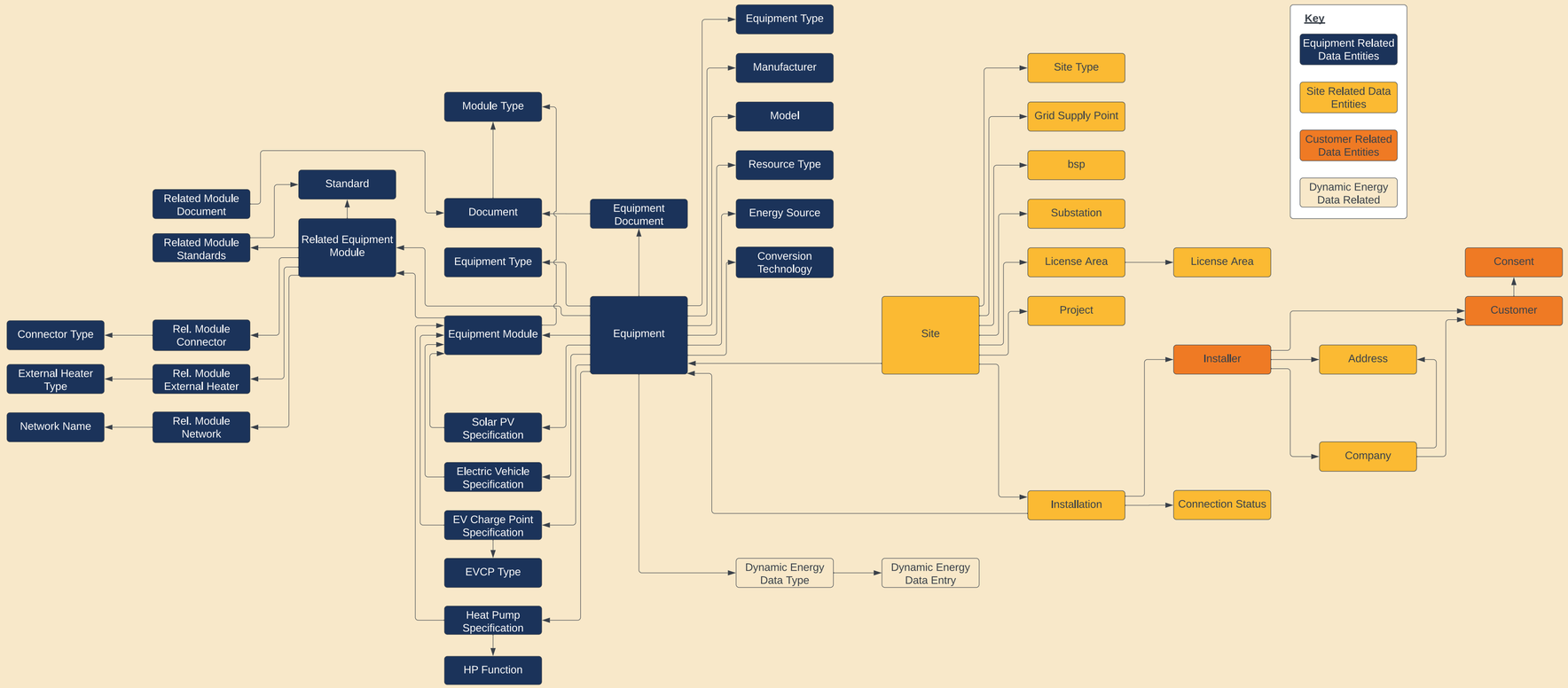
CAR SCHEMA

The schema for the LCT asset reference data and installation information will be standardised. A proposed version has been created as part of the technical deep dives during Phase 1 of this bid. CAR entity-level view is shown in diagram 19 CAR schema.

The schema is flexible and modular, able to accommodate existing device types while being seamlessly extendible so that new versions of existing devices – as well as entirely new types of asset not yet built - can be incorporated. Any changes to the schema will be reviewed and approved by the user group and the technical updates will be undertaken via the controlled change delivery process to ensure compliance and accuracy.

This will future proof the register against known and unknown changes as the renewable energy industry continues to evolve and grow.

Diagram 19 - CAR Schema



DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

AUTOMATIC ASSET REGISTRATION AND DYNAMIC ENERGY DATA

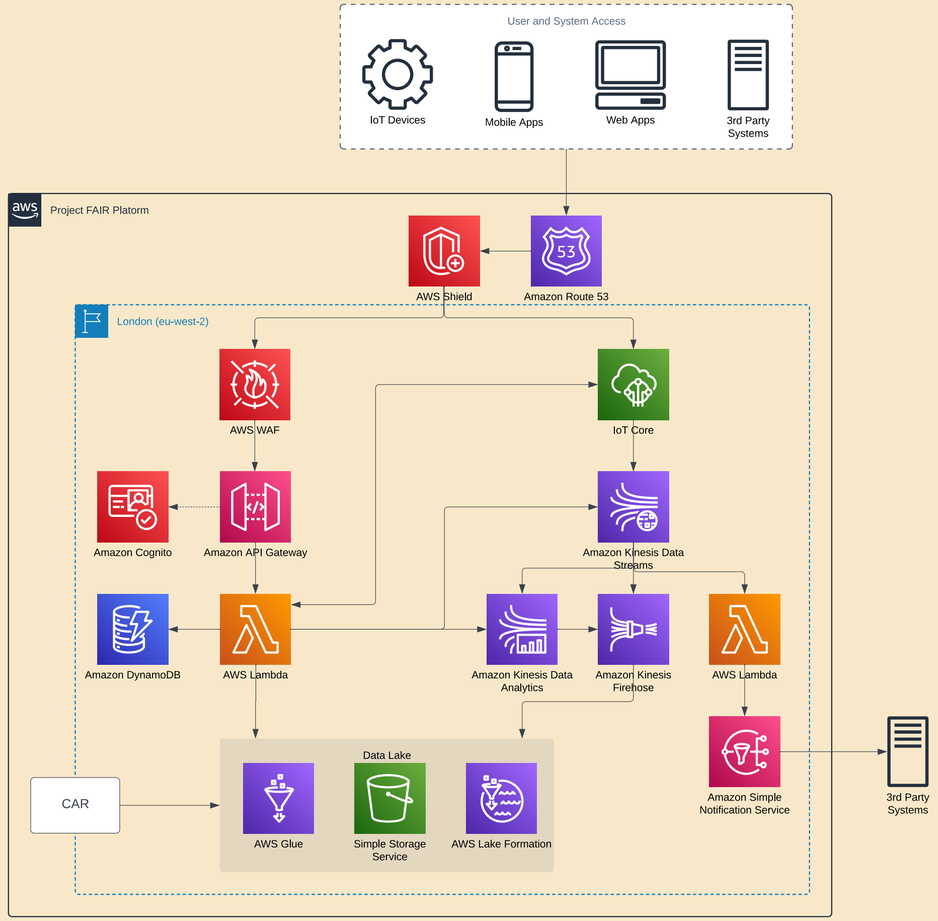
Diagram 20 AAR and Dynamic Energy Data shows a more detailed view of the combined AAR and Dynamic Energy Data components and describes how the functionality will develop and evolve over time as detailed in Project FAIR's roadmap section from notification drive to an IoT "plug and play" world.

To facilitate automatic registration of assets, the collection of dynamic energy data, and the use cases, the following four criteria need to be met:

1. The LCT asset must be able to communicate with the project FAIR platform using an agreed and standardised interface.
2. The project FAIR platform needs to be able to uniquely identify and authenticate each LCT asset.
3. Successful registration should automatically enable the transfer of dynamic energy data to commence.
4. The project FAIR platform needs to be able to send commands to the LCT asset to control its operation and manage relevant technical configuration throughout its lifetime (this capability will be implemented in the future but without the need to redesign or change the proposed solution architecture).

This approach supports the transition to IoT enabled processes, where LCT assets could be fitted with IoT chips to enable secure two-way communication between project FAIR, and APIs could be built for manufacturers to allow automatic sharing updated asset information. This will allow integration with existing CAR functionality like ingesting the Type Test Register data which can unlock further automation, e.g. blocking the device connectivity if it is yet to be approved.

Diagram 20 - AAR and Dynamic Energy Data



DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

The AAR functionality initially uses Amazon API Gateways, re-using the same pattern established in the CAR, where Amazon Route 53, AWS Shield, AWS WAF and Amazon Cognito handle the network routing and protection, request checks and authentication. The AWS Lambda-based APIs will be used to create new asset reference data and provide serial numbers as well as other information for manufactured devices that can be updated and used to receive the digital certificates to identify and authenticate the assets. New APIs or areas of the user portal would be built to enable the secure exchange of the platform's equivalent certificates for loading onto the assets.

When the LCT asset is installed at a premise and connected, the first time activation will initiate a connection to the Project FAIR platform AWS IoT Core service endpoint, which is also supported by Amazon Route53 and AWS Shield. A quadruple check of the device certificate, manufacturer ID, make/model ID and serial number will be used to uniquely identify the asset and trigger the relevant connection process, either 'Connect and Notify' or 'Apply to Connect'. Once that process has completed, the asset registration will be completed and it will begin to send dynamic energy data to the AWS IoT Core ingestion endpoint.

Amazon Kinesis Data Streams is a fully-managed, serverless data streaming service able to handle gigabytes of data per second with automatic scaling. It ingests and routes the dynamic energy data through the rest of the pipeline where three processes happen in parallel:

1. Amazon Kinesis Data Analytics performs real-time analytics on the data stream as it arrives, looking for trends and insights as well as checking for faults and issues.
2. Amazon Kinesis Firehose stores the raw data and analytics outputs in the CAR data lake, providing a backup and archive for the data.
3. AWS Lambda and Amazon SNS send the raw data to the relevant DNOs for them to use as part of their flexibility services.

The analytics rules and other configurations can be updated via new APIs using the same pattern for AAR, either from the User/Admin Portal or directly from 3rd parties such as the DNOs systems. APIs would also be created in future to allow the management of the devices in support of the flexibility and demand side management services that will be critical to achieving net zero and decarbonization aims for the industry. Existing CAR capabilities could also be re-used in combination with this new data, for example the detection algorithm would remain useful while old stocks of non-IoT enabled devices are cleared as it would be impractical to retrofit them.

DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

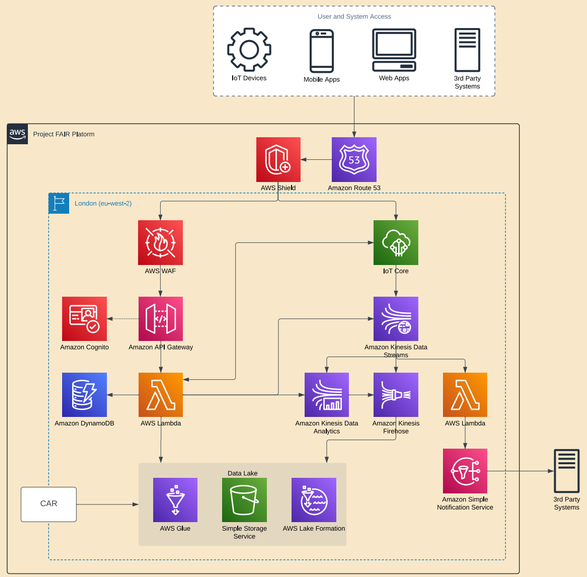
USER/ADMIN PORTAL

Diagram 21 user/admin portal shows user and admin portals. Both will be built using the same core technologies and AWS services, the only variation is in the specific APIs for each portal

Amazon CloudFront will provide low-latency and highly available access to the website files stored in Amazon S3. Similar to the CAR and AAR, Amazon Route 53, AWS Shield and AWS WAF will provide network and application security for the Amazon CloudFront endpoints. The portals will authenticate against Amazon Cognito where users will be prompted for a username/password and multi-factor authentication. The backend services that support the capabilities shown in Diagram 21 are accessed via the same API pattern used in the CAR and AAR, where the same authentication details used to login to the portals are used for the APIs to ensure user-specific access in accordance with the governance framework.

Support users can use the admin portal to implement the service requests that have been approved by governance and the user group, such as onboarding new organisations or users, updating platform documents and configuration, and accessing dashboards for system and process health reports. The user portal also provides end users with access to some administrative features like profile and organisation management sections and a secure area to exchange public key information for encryption purposes and certificate-based user access.

Diagram 21 - User/Admin Portal



The user portal will have the ability to query data using Amazon Athena and save the results in Amazon S3 as well as use the results in Amazon SageMaker to perform detailed analysis using machine learning, and visualise the results in Amazon QuickSight.

To ensure accessibility, a natural language data exploration capability will be developed that interprets sentences and phrases and converts them to queries, deskilling access to the data and insights and enabling greater openness and transparency.

Users will be able to configure notifications and alerts on certain events such as a dataset being refreshed or a specific event occurring. Application data such as user profile information, query history, notification configurations, etc. will be stored in the Serverless v2 version of Amazon Aurora, a scalable and fully-managed relational database service, while platform files like technical specifications and knowledge base artefacts will be stored in Amazon S3. The CAR, AAR and Dynamic Energy Data APIs can also be accessed from the Portals through web forms and other means to allow for the upload and download of data, registration of asset installations, etc. The Portals will provide a single point of entry for all relevant capabilities, reusing microservices where possible and taking a centralised approach to authentication and permission management.

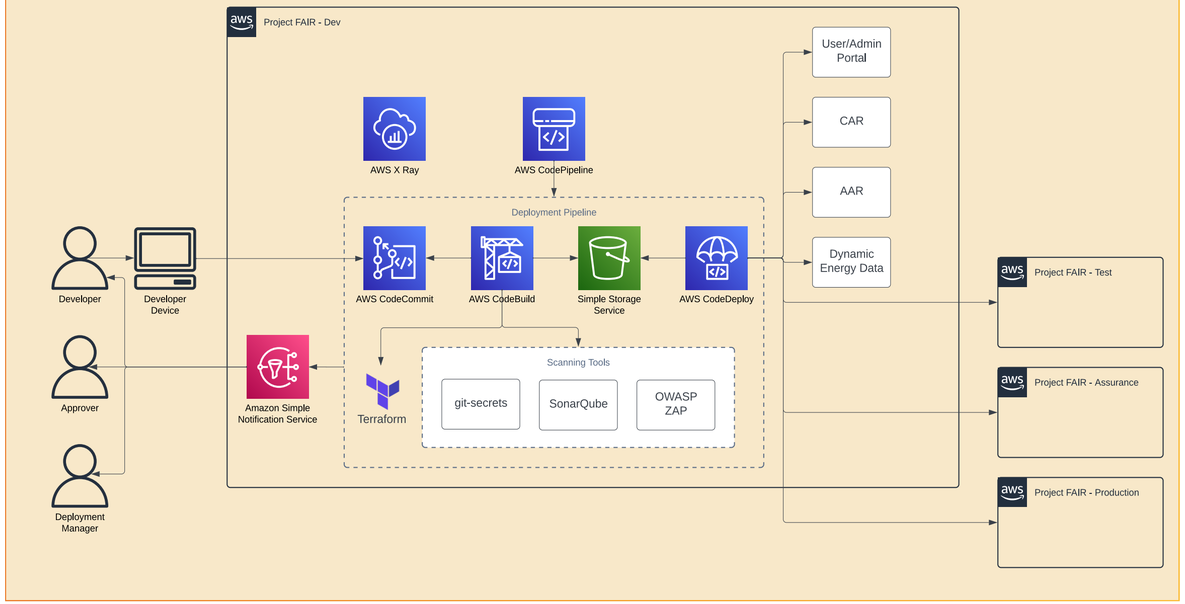
DEEPER DIVE INTO THE PROPOSED CAR AND AAR SOLUTION

CHANGE DEPLOYMENT

Diagram 22 Continuous Integration/ Continuous Delivery (CI/CD) shows the pipeline that will be implemented to enable the automated deployment of application changes to non-production environments and a controlled release to production. The governance and user group will approve all change requests before development begins and progress will be monitored with a constant feedback loop between all parties to ensure smooth running of the process. The automated delivery pipeline offers time and cost efficiencies and improves agility as well as responsiveness. For example, it is easy to trigger an automatic roll-back to a known safe version if issues are detected during deployment, or to provision new environments to support different testing scenarios such as testing for another industry project.

Developers will be able to write code on their local machines, collaborating on feature development and testing fixes. When a developer has finished, they will commit it to the source code management tool AWS CodeCommit which will prompt for review and approval by another developer, malicious code being committed and enhancing security to the solution. When triggered through a schedule, manual interaction or from an event, AWS CodeBuild will take the newly committed code and run various static and dynamic tests. This includes running automated test scripts to check functional behaviour and configuration as well as static code scans using tools like git-secrets to check for vulnerabilities or issues like hard-coded secrets. SonarQube will provide more detailed quality metrics and additional library/dependency scans. OWASP ZAP is another open source tool that can run static or dynamic scans on AWS Lambda services. When it has passed the required tests and any further approvals or prerequisites for deployment, the application build will be deployed to the relevant environment for the next stage of testing or release. AWS X-Ray provides is an AWS-managed service enabling developers to perform detailed tracing across serverless applications to help triage and understand issues. Additional open-source tools may be included to support the ones named here, e.g. Snyk for additional vulnerability scanning or sqlmap for SQL injection to databases.

Diagram 22 - Continuous Integration/Continuous Delivery (CI/CD)



The solution minimises the risk of the pipeline being compromised and malicious code being injected to ensure the solution is safe and secure by design. The extensive automated testing and scanning helps reduce the chance of issues being missed prior to production release.

BARRIERS, FURTHER CONSIDERATIONS AND RISKS

As with all major projects, there are barriers and risk that must be further considered, some within the projects control and others which are not. This section details the expected barriers, considerations and risks alongside proposing possible mitigations for the project and makes recommendations for factors beyond project FAIRs control.

In addition, appendix 2 includes a deeper dive into project risks that would be managed and mitigated during the subsequent phases of the project development, if successful. The table groups the barriers, considerations and risk into 4 common themes:

1. **DATA, CONSUMERS AND GOVERNANCE**
2. **STANDARDS AND TECHNICAL**
3. **OTHER RELATED PROJECTS AND DEPENDENCIES**
4. **FUNDING**

BARRIERS, FURTHER CONSIDERATIONS AND RISKS

1 DATA

Limited or no control | Elements of control or ability to influence | Within project FAIR's control

RAG Status	Barrier, consideration or risk	Proposed Mitigation or Recommendation
	There are several potential regulatory and legal barriers associated with accessing smart meter data which will be valuable to support key elements of our proposed solution. This includes the LCT detection aspects that aims to address the issues of assets that are not registered as well as restrictive usage and data privacy processes currently in place.	The permitted rules and access to smart meter data is not within this projects control. However by developing a clear understanding of why data is needed and how it will be used to define a permitted purpose with robust governance model as proposed, project FAIR should be able to access this data via the Smart Meter Energy Data repository or via the DCC or third party. ElectraLink see the importance and value of smart meter data and outside of project FAIR is seeking to unlock the data opportunity to help develop industry insights (subject to appropriate consent and governance arrangements).
	The benefits of increased transparency have been clearly stated in User type, cases and benefits section. However, consideration must be given to balancing privacy and developing insights. For example, if data is aggregated too much it can dilute the insight benefits, if not aggregated enough it can create privacy risks and finally the combining of different aggregated data sets can also create a privacy risk.	Our proposed governance model with clearly documented permitted purposes and controls will ensure that data is only made available to those who require it for a permitted purpose and aggregated data will only be published if the privacy risk has been fully mitigated. The user group will provide the necessary oversight to manage such risk and ensure robust governance controls, data standards and processes are upheld at all times.
	Consumer resistance to data sharing is a risk for many projects due to reports in the media of data breaches, misuse of data etc, this has created mistrust and a cultural resistance to data access.	These cultural barriers to data access are both within and outside of project FAIR's control. Learnings from ElectraLink's Project CLEVER has helped us understand what consumers know about the industry and what information they would be willing to share as well as how this maps to what DNOs and other data users would need to unlock the benefits associated with the data. Project FAIR has undertaken industry wide reviews and taken on best practice and advice, such as the citizens advice from their report, Clear and in control and Smart and Clear Customers attitudes to communicating rights, and choices on energy data privacy and access. This advice has been included in our proposed governance model and seeks to address consumers concerns about security and data privacy through the adoption of best practice data standards. Our approach is to ensure the solution is secure and safe by design to provide comfort and to reassure consumers. We will ensure that data rights, privacy, and controls are communicated in simple easy to understand language. It will also require better education for consumers. To achieve this project FAIR needs to work collaboratively with the industry (BEIS, Ofgem, other parties and projects) to help explain the complexities of the electricity industry, address consumer concerns and highlight the benefits of sharing data for permitted purposes.

BARRIERS, FURTHER CONSIDERATIONS AND RISKS

1 DATA

Limited or no control | Elements of control or ability to influence | Within project FAIR's control

RAG Status	Barrier, consideration or risk	Proposed Mitigation or Recommendation
	Elements of the data within the CAR and AAR may be personal data and/or commercially sensitive, therefore needing to be protected.	We have designed a solution that is safe and secure by design, this includes adopting best practice, industry standards and taking a zero trust approach to ensure security is at the forefront. As well as proposing a robust governance and operating model that ensures data is managed by a user group for permitted purposes only in accordance with the governance rules and processes.
	There is a risk that data providers refuse to grant access to the required data to support the CAR and AAR. Our extensive stakeholder engagement indicates that all participants we have spoken to in principle would provide the data subject to the data access agreement terms and the governance framework being proposed. However, there is no legal requirement for data providers to cooperate and provide data in the future. GB's energy market is unique, it has been unbundled, opened up to competition where possible and adopts a light touch approach to legislation i.e. less prescriptive and focuses on core principles and outcomes.	We have aimed to mitigate this risk by working collaboratively with our stakeholders and data providers. From the onset, we have taken onboard their requirements and feedback and incorporated that within our design – see proposed solution technical summary section for further details. We have proposed a robust governance model that builds upon our 25 years' experience of operating the DTS and working within the GB market. This does not guarantee that data providers will grant access but building trust makes this more likely to be achieved to avoid the need for new legislation and regulations.
	Until an IoT and "plug and play" world is fully implemented, project FAIR relies upon installers being aware of the processes and actively engaging with the registration process. There is a legal requirement on the asset owners to register their installed LCT assets but there are issues with the current process, as detailed in the setting the scene.	Elements of this risk can be addressed via project FAIR by educating installers regarding the registration process, digitising the process (via digitalisation of connections, or machine-readable APIs that connect to installer apps etc) and making that process quick, intuitive, and easy to use. Other options include applying learnings from project CLEVER and SKYLINE to help develop incentives for the asset owner and/or installers to complete the registration process. This does create funding and governance and monitoring challenges but if successful in securing phase 2 we will ensure we incorporate the project learnings and ideas within the development of the technical solution, governance regime and operating model. However, if this is not successful there may be a case for additional legislation, but as detailed above project FAIR is seeking to avoid this. This approach was taken in Southern Australia where regulations were introduced in 2020 which required all new solar and storage installations to be carried out by authorised parties only, for the assets to have the capability to be remotely disconnected and reconnected. The regulations also introduced standards for data capture and made it a mandatory requirement to provide this data with significant consequences for the asset owner if not complied with. However, the number of properties and LCTs in the region is significantly less than GB which would make policing similar legislation in the GB a greater challenge.

BARRIERS, FURTHER CONSIDERATIONS AND RISKS

2 STANDARDS

Limited or no control | Elements of control or ability to influence | Within project FAIR's control

RAG Status	Barrier, consideration or risk	Proposed Mitigation or Recommendation
	Within the CAR and AAR, we have developed a standardised approach, adopted open data principles a and developed cleansing, process and quality checks to ensure data quality. However, we have no legal authority over the industry to enforce data providers and users to adopt or comply with the standards developed.	This risk is partly within our control, by engaging with stakeholders, incorporating their feedback and developing a robust solution that provides benefits to data providers and users we are able to mitigate risk through buy-in to agreed standards. However, if this is not possible, new legislation or regulations may be required to create and mandate industry standards. (This was the approach in Southern Australia as discussed in the risk above.)
	With the proposed solution there is a size limit of 10MB per request for API ingress. Based on the information we have today we believe this is appropriate and not a risk. However, we recognise that larger files in the future (e.g., manufacturer technical specs) may require an alternative means to upload.	This is risk has been carefully considered in developing the proposed solution and two mitigations will be implemented. The first will be to include the need to batch requests to keep payload size under 10 MB in the documentation for the APIs. This batching or "pagination" of request/response data is a standard pattern for APIs and is straightforward to implement. For larger files or ones that are hard to batch (e.g. a PDF of a manufacturer tech spec), pre-signed S3 URLs will be used to provide temporary access to upload or download the relevant data with additional monitoring to manage conflicts. If this is deemed insufficient or issues are identified, then the file upload API can be delivered using provisioned infrastructure services (e.g. containers) rather than the serverless solution using Amazon API Gateway and AWS Lambda, at an additional cost. This would require additional operational process to support the EC2 instances (image scanning, patch/vulnerability management, etc.) but would remove the maximum file size limit.
	The move towards an IoT world without defined or agreed industry standards today could result in our solution, if implemented, being incompatible with the design chosen by some or many manufacturers in the future. This is an unknown facing the whole industry.	Our collaborative approach with stakeholder seeks to avoid such a risk, but if it is not possible to reach agreement or other factors influence the outcome, we have considered how our solution could be adapted to address this risk. An option would be to build a serverless integration layer using Amazon EventBridge, AWS SQS, AWS SNS and AWS Lambda that allows manufacturers and devices to send messages to the CAR, AAR and Dynamic Energy Data platform using web-based APIs. This will decouple them from the incompatible implementation details of our solution. The recognised limitation of this approach is that it would introduce time delays for the delivery of events to DNOs and push their commands back to the devices, thus reducing the real time benefits case.

BARRIERS, FURTHER CONSIDERATIONS AND RISKS

3 OTHER RELATED PROJECT AND DEPENDENCIES

Limited or no control | Elements of control or ability to influence | Within project FAIR's control

RAG Status	Barrier, consideration or risk	Proposed Mitigation or Recommendation
	Setting the scene section, details the current state of the energy industry and the interaction between all the live projects to support the digital transformation in the electricity industry. This includes projects such as the digitalisation of connections, the smart meter repository and digital spine. There are dependencies between project FAIR and these projects and any delays could impact on the development and implementation or reduce the ability to deliver all the benefits.	The progress and development of other projects is not within our control. However, we will work in collaboration and coordination with those projects to ensure project FAIR and other projects are not impacted and are able to achieve their full potential. In addition, regarding smart meter data, ElectraLink is considering other solutions and ideas which could provide an alternative, if the Smart Meter data Repository project is delayed.

BARRIERS, FURTHER CONSIDERATIONS AND RISKS

3 FUNDING

Limited or no control | Elements of control or ability to influence | Within project FAIR's control

RAG Status	Barrier, consideration or risk	Proposed Mitigation or Recommendation
	Our stakeholders indicated a possible barrier regarding funding for companies who are required for the development and implementation of the proposed solution and without access to funding it may impact the development of Project FAIR	For phase 2 we would continue to work collaboratively with stakeholders, ensure the solution development minimises impact on data providers and users. However, with such an industry wide project it is not possible to partner with everyone, therefore we would propose to monitor this risk and report regular to BEIS with status updates, impacts, mitigations and costs.
	Agreeing cost recovery funding with the key beneficiaries of the CAR and AAR.	For phase 2, we will continue to work closely with data providers, users and stakeholders to ensure we unlock the benefits detailed in this report. We will develop a detailed Cost-benefit analysis during phase 2, developing the governance and operating model including costs to discuss with our stakeholders and develop the detail to support the future funding mechanism. The objective is to agree the funding mechanism with key beneficiaries before the end of the innovation period and prior to any industry launch, if the project is to be implemented. This may also include an necessary proposals to BEIS / Ofgem to amend any impacted funding mechanisms for example: the digitalisation and possibility the DSO uncertainly mechanisms detailed with the RIIO - ED2 framework provisions. However, if it is not possible to reach an agreement with the key beneficiaries, we may require intervention by BEIS or Ofgem to secure the funding mechanism.

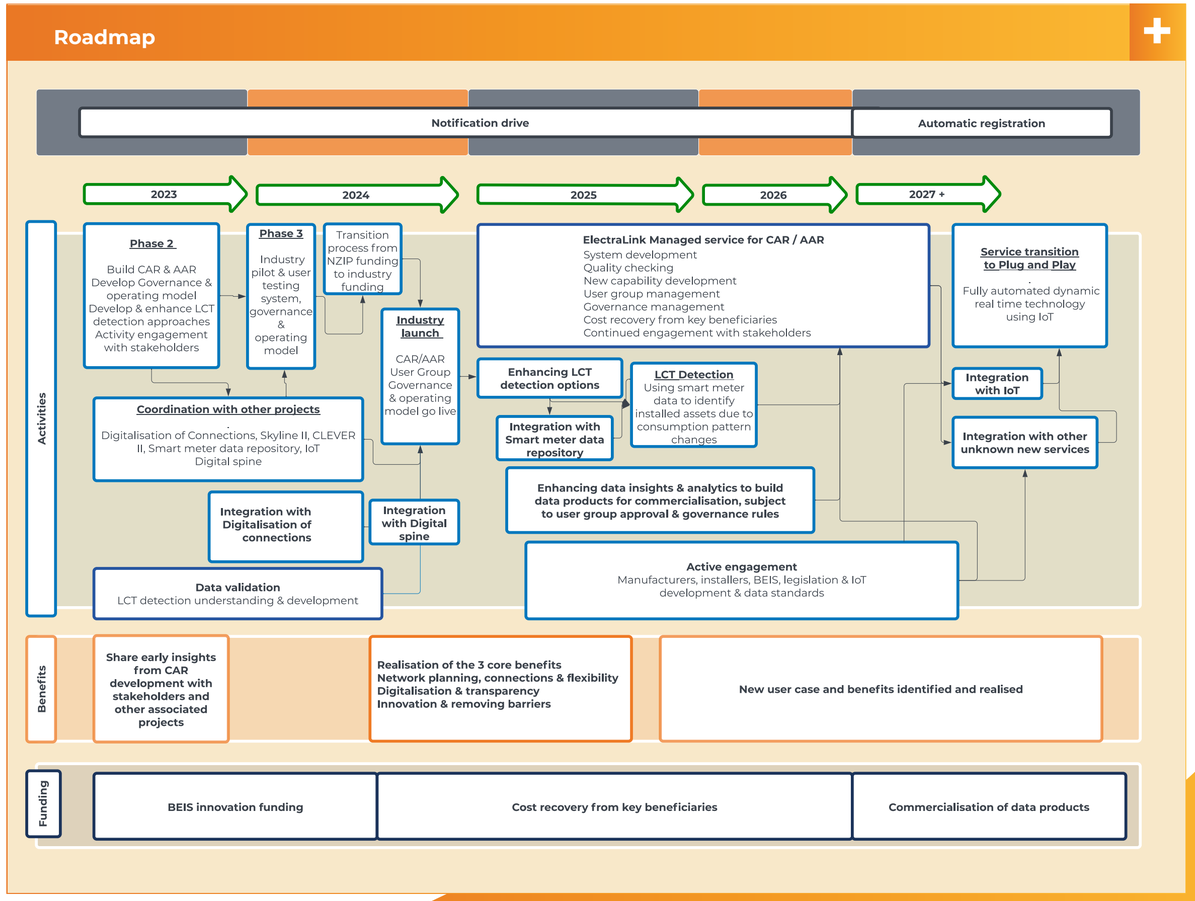
ROAD MAP FOR FAIR AND NET ZERO

Phase 1 of project FAIR has demonstrated that the shift to a fully automated LCT asset register needs to be approached in stages and that at each stage opportunities and benefits can be unlocked. The final stage of this evolution is a complete “plug and play” world where assets register themselves, share real time data, and identify performance issues and faults. To achieve this, there are a number of significant milestones outside the control of project FAIR that must be reached , such as manufacturers installing IoT chips into all devices and communication networks having the capacity to share vast qualities of data from millions of installed devices alongside smart meter data.

However, we can begin this journey with project FAIR and build a strong foundation with the CAR and AAR, a standardised approach with a robust governance and operating model alongside agreed data standards. The project delivers value today and can be enhanced and developed to drive future value. Diagram 23 shows project FAIRs roadmap describes the short, medium and long term evolution of project and links back to the benefits discussed in User types, cases and benefits section and makes reference to the mitigation highlighted in the barriers, further consideration and risk section.

Diagram 23 shows how the project will develop and transition into a fully automated solution. We anticipate that project FAIR will integrate with both the digitalisation of connections and the digital spine projects as soon as possible. We have estimated that will be around 2024 and would be managed alongside the industry launch for the project, if successful for phase 2 and 3.

As discussed in the Proposed governance, standards and operating model section, the proposed operating model is for ElectraLink to provide a managed service for the CAR and AAR, which includes revenue funding, management of the user group and governance, development, and enhancements. We also anticipate once the solution is operational that we would continue to work with stakeholders including BEIS, manufacturers, installers, DNOs anddata users to develop new user cases and benefits as well as integrate with other unknown projects today that support the digitalisation journey to a fully automated “plug and play” world.

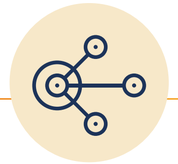


CONCLUSION

Project FAIR phase 1 has developed a solution that can be implemented and focuses on delivery 4 keys principles:



VALUE TODAY & FOR THE FUTURE



FLEXIBLE & SCALABLE SOLUTION



ROBUST GOVERNANCE & OPERATING MODEL



SAFE & SECURE BY DESIGN

By developing the CAR first, we are enabling value to be unlocked quickly for data users. It builds a strong foundation to manage the evolution from a fragmented LCT data state, to centralised digitalised process, through to the future world that is fully automated and support real time data exchange from the installed assets via IoT. Our solution is flexible and scalable to meet the expected growth of LCTs, and is supported by robust governance and operating models and data standards within a securely designed system.

Our collaborative approach to phase 1 would continue to be adopted in future phases and would constitute a key element for operations to ensure that the benefits detailed in this report are fully realised and that new user and benefit cases are developed to enhance the value of the solution for data provider and users, the industry, consumers and support the transition to net zero.

To recap the core benefits are focused around:

1. Network planning, connections and flexibility
2. Digitalisation and transparency
3. Innovation and removing barriers

The project FAIR roadmap section provides a high level plan out to 2027 and beyond. BEIS will determine the outcome for phase2 in early 2023.

In the meantime, if you haveany questions, queries, would like further information about project FAIR or any otherproject, or any data issues you are facing please contact us on: communications@electralink.co.uk