Open Energy

Modernising Energy Data Access
Icebreaker One — Phase 3 Report
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Contents

Executive Summary

Figure 1: Open Energy stack

Open Energy set out to make it easy to find, access and share energy data, to deliver a beta programme (using a core use case to help navigate priorities) with direct stakeholder engagement and a route to live services. It has delivered operational services for Energy Search and Access Control that are now online and market-facing.

It has delivered its main objectives and key results. These include substantial and material industry and stakeholder engagement and understanding of direct user needs. Throughout the programme we engaged with over six hundred people through Advisory Groups, the Review Track for seeking industry feedback, one-to-one conversations and webinars. Individuals in our Advisory Groups represented over 50 organisations. These included government, regulators, regulated entities, enterprise businesses, SMEs, startups and universities.

Future development must consider the following principles:

1. A compulsion to participate

Data increases in value the more it is connected. Incentives must exist to mandate participation by the sector in open standards that enable interoperability and drive behaviours towards an open marketplace for data.

2. Design for search

All solutions must be considered from a perspective of maximising cohesion and interoperability. Specifically addressing the needs for machine-integration for

application developers, as well as direct service users. Machine-definitions of data licensing must be developed as in-scope for this work.

3. Continuous, iterative development

All digital services are iterative in nature. The outputs from this work will be considered as a continuous and evolving process.

4. Engagement with users and industry

Collaboration is critical to the development of this work from both a technical perspective (solutions must meet user needs) and from a cultural perspective (solutions must be co-designed, adopted, used and iterated upon with market participants).

Our model in the development of Open Energy has been to embrace these four principles. The business model for future development has been defined to address the long-term neutrality and operational sustainability of the services described herein.

Throughout the project we have worked in the open, with cross-sector industry advisory groups, public webinars, blogs, public documentation and continuous outreach. We also engaged with the BEIS-funded Energy Data Visibility Project to ensure cohesion across the two workstreams and enabled MEDApps winners to join our Beta Testing.

We reflect that, while 'technical', data should not be considered a 'technology issue'. Further analysis will be required to understand the economic impacts and benefits of Open Energy as a whole, as well as the cultural and organisational barriers.

This work should be considered as contributory towards the National Data Strategy: design patterns established in energy will affect other sectors. Government and industry must work together to maximise market openness, including ensuring that appropriate governance is in place to help prioritise where, when and how regulatory intervention may be required.

The potential of Open Energy is not limited to the boundaries of the energy domain as there is significant scope to develop this work for export to other sectors.

Achievements and deliverables

Through tightly controlled programme management and risk-control processes, we successfully achieved engagement with target stakeholders and delivered against the planned Phase 3 development roadmap, including private and limited public beta testing. The services are now live. On completion of Phase 3, we will engage with industry on a 'pilot' basis building on learnings from this phase.

We have created market-facing operational services including Energy Search and Access Control. These services enable the discovery, access and usage of both Open Data and Shared Data.

Working with industry, we have developed the business model and a delivery plan for live service launch.

We have completed and delivered substantial documentation/guides that will lay the foundations for a long-term Code of Practice for the sector, including:

- **Operational Guidelines - <u>Version 1.0</u>**
  - Contents**:** Introduction, Considerations before you start; Core policies; Guidance for Data Providers; Guidance for Data Consumers; Common security requirements; Metadata; Access control and capability grant language; Glossary.

- **Membership documentation:**
  - <u>Membership proposition and fee structure</u>
  - Definition of active membership

- **Beta testing and technical documentation:**
  - <u>Open Energy Beta Testing Round 2 Onboarding Pack</u>
  - <u>Open Energy Infrastructure Support Libraries</u>
  - <u>Beta Round 2 Introduction</u>
  - <u>Registering with the Open Energy Directory</u>
  - <u>Open Energy Beta testing round 2 slides</u>
  - <u>Example metadata files</u>

Together, these form the basis of a potential 'Open Energy Standard' upon which long-term industry engagement can be anchored (through both voluntary and regulated engagement).

Approach — working collaboratively, and in the open

Development work was documented and communicated openly throughout the programme. This included innovative direct stakeholder engagement as well as public webinars and written updates on our websites.

Open Energy Advisory Groups were formed to convene industry expertise to help understand how the UK may better modernise energy data access and to engage with a broad base of stakeholders. This allowed us to shape our work and ensure that Open Energy really was designed by the industry for the industry. Each advisory group was formed through open recruitment including experts from across the energy sector to ensure a wide range of subject matter experts representing a cross section of private and public players. The Advisory Groups were directed by a Steering Group, representing both government and industry stakeholders, who helped to reinforce the strategy and disseminate the work and ensure the delivery of our objectives. These groups were further supplemented by a document Review Track group and the publication of public consultations.

Roles and responsibilities

This project is for the sector and by the sector so it was essential to take an open, collaborative approach to ensure the delivery would meet expectations. This involved collaborating with development partners, working with individual experts, engaging with over 50 organisations via the Advisory Groups, Review Track and Steering Group, as well as inviting industry incumbents to act as "critical friends" to ensure that the project was delivered to the needs of the energy sector.

Core Team

A core project team of 20 people, including support by Icebreaker One operational staff, was set up to fulfil essential roles for the project delivery. This included a project manager, a delivery manager, a product owner, an engagement manager, researchers, developers and communications and project support specialists. More about the team can be found here: https://icebreakerone.org/team.[1]

Development partners

Raidiam

Raidiam provided the directory component to facilitate secure access for data sharing. Their technology was developed for Open Banking and this was adapted for the energy sector based on needs and requirements defined by Open Energy.

Passiv UK

Passiv UK brought deep sector expertise and helped deliver the core use case. They acted as trusted advisors and engaged with Council authorities to encourage their participation in beta testing.

Advisory Group Co-chairs

Membership Advisory Group

Sara Vaughan and Faith Reynolds acted as co-chairs for the Membership Advisory Group.

Sara Vaughan is an experienced Executive and Non-executive Director in the energy sector, with a deep understanding of customer, commercial, government and regulatory affairs, as well as of legal and governance matters.

Faith Reynolds is a subject matter expert and author on Open Banking, Open Finance and Smart Data as well as a strategic adviser to industry, government and regulators. She brought her knowledge of Open Energy from Phase 2, having co-led the work on regulatory and legal policy.

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[1] https://icebreakerone.org/team

Delivery Advisory Group

Aneysha Minocha and Cristobal Pollman acted as co-chairs for the Delivery Advisory Group.

Aneysha Minocha is the Founder and Director of Quantenergy, with the mission of delivering a quantum leap in how quickly commercial properties achieve net zero through quantitative data analysis for rapid deployment of cleantech solutions.

Cristobal Pollman is Co-Founder and Director of Sterling Capital and brings his experience of infrastructure projects, real estate private-public partnerships and transportation.

Steering Group co-chairs and representatives

The Steering Group was co-chaired by Gavin Starks and Miles Cheetham of Icebreaker One.

Gavin Starks is the Founder and CEO of Icebreaker One and has founded, funded and run over a dozen organisations including acting as CEO of the Open Data Institute, Co-Chair of the Open Banking Standard and CEO of global environmental intelligence company, AMEE.

Miles Cheetham leads on the Open Energy Membership proposition and use case development and previously worked on the Open Banking Implementation Entity, responsible for use cases, market requirements, propositions and customer experience.

In order to provide appropriate guidance for the direction of Open Energy, the Steering Group was made up of a cross-section of regulatory, governmental, consumer and commercial representatives. These were: Innovate UK, BEIS, Ofgem, Citizens Advice, the Energy Networks Association, Energy Systems Catapult, Office for Zero Emissions Vehicles, as well as Maxine Frerk, who acted as an independent representative, and the Advisory Group co-chairs. Members of the Icebreaker One delivery and operations team attended as observers and to update the Steering Group on progress.

Open Energy is, by its very nature, built on cross-sector collaboration and technology transfer. It started from the hypothesis of applying the principles and learnings of Open Banking to the energy sector to facilitate data sharing and has continued to draw on this wealth of knowledge, whilst going beyond this to adapt to the specific needs of the energy sector and develop innovative membership, data access and licensing models. The result has been that the outcomes have been described as "world-leading" by our Advisory Group members.

Approach and innovation

Open Energy's core innovation focused on culture change as much as innovative technical development. The importance of this work being carried out by an independent third party to convene all the relevant stakeholders and break through silos in order to overcome collective action challenges continues to be essential to the evolution of this work. As an independent, non-partisan, non-profit organisation, Icebreaker One was able to lead the development of Open Energy and allow stakeholders to come together without any singular vested industry interest dominating the overall goals. Creating spaces for and convening stakeholders across the energy sector throughout our engagement efforts (detailed below) allowed participants to understand and think through how sharing data in a way that removed friction and ensured secure and trusted access can be beneficial and drive net zero solutions.

As well as developing innovative membership and licensing frameworks through consultation and collaboration with the energy industry, Open Energy underpinned this by putting tried and tested technologies together in a way that hasn't been done before. These were then tested and iterated on with users through our beta testing programme. Open Energy adopted an innovative method of user testing with real industry users, gathering feedback structured over two rounds of beta testing where we ran daily drop-in sessions as well as rapid response support via the Slack messaging tool. Through the daily support sessions, users shared screens so that the technical team could see exactly what their journey was to help them take their next steps.

As a result of user research under the Energy Data Visualisation Project (EDVP), the user interface for Energy Search evolved and improved to reach its current state, which has been described by users as simple and easy to use.

The innovation in our approach, emphasising openness and consultation, also led to innovative outputs detailed in the results section. This approach displayed innovation in gaining strong industry legitimacy during the development process.
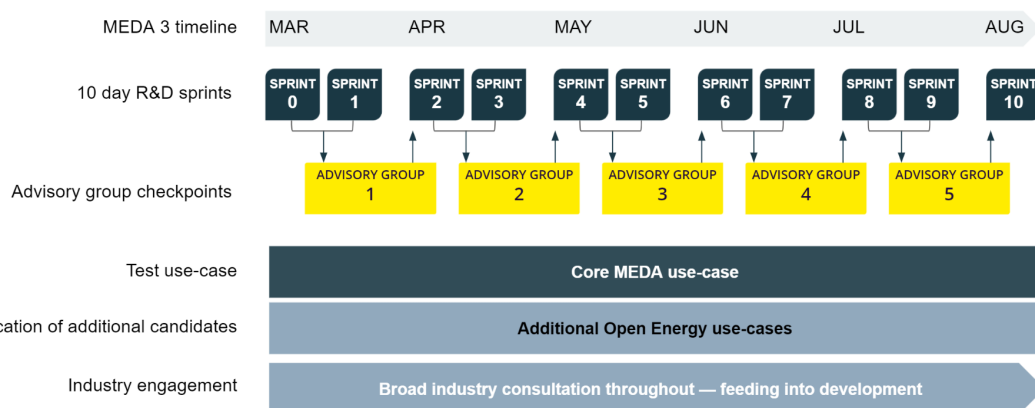

Figure 2: Open Energy Phase 3 Programme Structure

Fundamental to the success of Open Energy was that any solution developed should be created in collaboration with the sector, for the sector and by the sector. This approach underpinned all streams of work, as well as being its own stream: it fed into research, technical development and continuously sought feedback from the industry at large.

We ran two Advisory Groups (adding a third under EDVP as that started mid-way through the project) which were overseen by a Steering Group. We also organised a Review Track and Open Consultations, as well as an extensive webinar series. Our beta testing programme was designed to be as open and collaborative as possible, accessible to all those with the technical skills to join. We continuously learned from and rapidly iterated on our approach, underpinned by our Agile approach.

Open Engagement

Advisory and Steering Groups

As part of the stakeholder engagement work package, the Open Energy Advisory Groups were developed to convene and combine individual expertise to help understand how the UK may better modernise energy data access. There were two main Advisory Groups:

1. **Membership Advisory Group**: Consulted on the principles of Membership, key policies, including conditions to participate, roles, responsibilities and liabilities, licencing policy, funding model, Operational Guidelines, and discussed ongoing governance.

2. **Delivery Advisory Group**: Consulted on the drafting of operational guidelines and understanding data production and usage. Fed into the requirements for technical delivery of the Open Energy Governance Platform and the Energy Data Search to ensure they have met user needs. Alongside this, they examined the day-to-day operational aspects of Open Energy including security and systems.

In addition to these two Advisory Groups, our consortium of Icebreaker One, Digital Hippo and Arup won the Energy Data Visibility Project (EDVP) run by BEIS to build on the existing delivery and enhance the MEDA programme scope. This project added one more Advisory Group:

3. **Data Standards & Glossary Advisory Group** was created as part of EDVP, becoming our third advisory group. To maximise cohesion and interoperability across the sector and harmonise data governance, operations, policy, tech, and user needs, this Advisory Group consulted on the EDVP requirements on data standards and glossary, established an awareness on the Energy Data Search functions, and fed the outputs back to the MEDA Advisory Groups to ensure alignment.

Each advisory group was formed through open recruitment and included experts from across the energy sector to ensure a wide range of subject matter experts representing

a cross section of private and public players were represented. All participants agreed to a Terms of Reference to ensure an open and fair collaboration.

The Open Energy Steering Group was created for overarching governance of the Advisory Groups, to provide project guidance and sign-off on Advisory Group recommendations. An additional Review Track group was also established for participants who could not attend the advisory groups but who still wanted to engage and give their feedback. These groups are described in more detail in the Results section.

External Communications

Our external communications strategy aimed to:

- Support industry engagement in the development of Open Energy;
- Clearly communicate the value of Open Energy to prospective beta testers and potential members;
- Raise awareness of Open Energy and expand our audience of energy data users.

We developed a set of **messaging** to set out the purpose, features and benefits of Open Energy. We worked with the findings of earlier user research interviews and input from our Membership Advisory Group and Steering Group to develop messaging to set out the value for data providers and other categories of user.

We designed and delivered a series of **webinars** intended to keep our target audience engaged in the programme and to identify new entry points for people with little background knowledge.

We published regular **content** on our website and distributed it on social media to deliver transparent updates on the programme, consistently making sure we were working in the open.

We engaged with **journalists** in Open Energy, pitching news stories on developments in the programme, as well as offering background briefings to a range of national and energy trade sector journalists.

Research

The research activity was divided into two key themes: **Membership** and **Operational Guidelines**, as described in the next two sections.

Membership

The requirements for the Membership Proposition were developed through careful and detailed consultation with Advisory Groups, Steering Group and Review Track participants, as well as wider key stakeholders. Membership research started with an internal exercise to map the scope of the UK energy sector to segment actors into different categories and to quantify the number of actors per category. We also researched the different needs, types and sizes of potential members and their likely spread across the different Open Energy membership roles: Data Providers, Data Consumers, Service Providers and multi-role members.

Operational Guidelines

The Operational Guidelines and standalone components, such as common policies, were developed through a process of internal research and extensive sector consultation. Consultation took place via a combination of presentation and discussion with Membership and Delivery Advisory Groups, document review by the Advisory Groups, Review Track and Beta Testers and public consultation documents. All work was sent to the Steering Group for final review and sign-off. Open working practices were used throughout to ensure documents were reviewed at early stages of development, enabling flexibility and responsiveness to sector feedback. A summary of consultation feedback and Open Energy responses was also published in response to each phase of public consultation to ensure transparency regarding how policies were adapted post-consultation. These can all be found at https://energy.icebreakerone.org.[2]

Iterative Delivery

The aim of the MEDA competition was to "*allow the owners and users of digital energy information to collaborate and develop efficient solutions to achieve the UK's decarbonisation ambitions*". It particularly encouraged a focus on design and build which will facilitate a user to search and access relevant data by using state-of-the-art data science techniques. These techniques also had to support and enable ongoing initiatives across the energy sector, such as the Open Networks Project[3] and other activities being conducted by the Energy Networks Association (ENA). We held a number of meetings with ENA representatives and involved MEDApps winners in our beta testing programme in order to integrate with these initiatives as much as possible.

Key to the MEDA strategy was promoting interoperability of data whilst recognising the various standards and technologies in use across the energy industry, as well as ensuring interoperability with data from outside the energy sector.

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[2] https://energy.icebreakerone.org/
[3] http://www.energynetworks.org/electricity/futures/open-networks-project

To satisfy these goals, the delivery of the core components for Open Energy was largely based on proven, established technologies and open standards. Combining these in innovative ways to deliver the project, we added our own code or tools only where there was a gap. This included writing bespoke Python code to incorporate energy service metadata from data providers into our CKAN system discovered via the Access Control directory, and extending a vanilla CKAN network of Docker containers to having a secure HTTPS protocol by default. Throughout Phase 3 the team embraced Agile software development methods to ensure constant iterative development and delivery, allowing us to quickly incorporate feedback from our advisory groups and beta testing.

All custom software development necessary to the delivery was created in the open and [licensed](#)[4] in such a way as to promote uptake across and beyond the industry.

The proven open source tools we used included:

- CKAN (in turn built upon PostgreSQL, Solr, Redis and Datapusher)
- Docker (we relied on [OKFN's Docker](#)[5] approach)
- Git (for version control)
- Sphinx (for documentation)

To provide the Access Control directory, we used the Raidiam directory and its associated Financial-Grade API compliant authorisation server. Our use cases differ substantially from those of Open Banking; we are providing organisation-level services, rather than to individual consumers. We worked closely with Raidiam (the suppliers of the FAPI compliant security solution) to add features necessary for Open Energy.

We also used other commonly used tools and services:

- GitHub to manage software development
- GitHub Actions for deployment and other automated tasks
- Jira for project management
- Amazon Web Services
  - AWS Elastic Beanstalk for deploying CKAN as a network of Docker containers
  - EC2 instances for hosting CKAN
  - AWS RDS instances for hosting PostgreSQL databases
  - S3 buckets for storing harvester logs and versioned deployment copies
  - AWS ElastiCache for running a Redis cluster

We wrote a Python program to pass data between the different systems. We wrote an exemplar Python library to help anyone who can use or understand Python get started providing or consuming data (here are the links to the [source code](#)[6] and its [documentation](#)[7]).

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[4] https://github.com/icebreakerone/open-energy-python-infrastructure/blob/main/LICENSE
[5] https://github.com/okfn/docker-ckan
[6] https://github.com/icebreakerone/open-energy-python-infrastructure
[7] https://icebreakerone.github.io/open-energy-python-infrastructure/index.html

Working in the Open

We worked collaboratively, shared our work in progress and improved on it while we interacted with beta testers and collected their constant feedback.

Throughout Phase 3, the technical team published:

- A [detailed, step-by-step recipe](#)[8] for how to deploy a standalone data provider
- Technical architecture documentation
- [Metadata documentation](#)[9] including how we represent licensing and access conditions
- Example [metadata files](#)[10] to support data providers
- [Video showing an end-to-end process](#)[11] for how to access shared datasets programmatically

Beta Testing

In order to ensure that our work was meeting the needs of the industry, we spent much of the latter part of Phase 3 working with a growing number of organisations participating as our beta testers. Beta testing was critical to ensure that we had not only created core systems that delivered the technical functionality, but that what we created could be *understood by* and *made sense to* those people who would need to use it.

We held two rounds of beta testing which consisted of over 20 participants testing and providing feedback on the service. For a list of the beta testers who agreed to be named in our reporting, please see Table 2 in the Results section. For each round of beta testing we held a kick-off meeting, hosted daily 30 minute drop in sessions to provide support for the beta testers, and finally we held an end of round debrief and feedback session.

Some beta testers used our exemplar Python library within a freeware programming software, Jupyter Notebooks or Google Colaboratory to consume data with minimal custom code. We provisioned an [example data provider](#)[12] that uses our full authorisation framework, so that data consumer beta testers had something stable to interact with to test their work.

One beta testing organisation created a .NET equivalent to our Python library for use in Microsoft environments, which they intend to open-source. This is an example of innovation beyond the project scope that was enabled by the work we've open-sourced.

In order to select our beta testers, we promoted the sign up (a simple google form that anyone could complete) via webinars, our website, our social media channels, the

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[8] https://icebreakerone.github.io/open-energy-python-infrastructure/ec2.html
[9] https://docs.openenergy.org.uk/main/metadata.html
[10] https://github.com/icebreakerone/open-energy-metadata-demo
[11] https://www.youtube.com/watch?v=CMI2UVdlxFw&ab_channel=TomOinn
[12] https://icebreakerone.github.io/open-energy-python-infrastructure/data_provider.html#example-data-provider

Advisory Groups and Review Track and via direct targeting of particular user groups (e.g. the DNOs).

Round 1 testers were selected on the understanding that encouraging large organisations to join early would give them the most time to engage with the testing programme, whilst navigating the internal approval processes that they may encounter. To achieve a representative spread, we also invited three SMEs (although one did not respond). We chose a smaller cohort in Round 1 in order to not overwhelm the internal Icebreaker One team so that they could provide the best levels of support. We describe the cultural challenges of working with incumbents in the Results and Lessons Learned sections.

Round 2 testers were focused around MEDApps and SMEs: this produced a much faster pace of engagement and quicker results, although we had tested and iterated on our engagement processes by this point. All applicants who had shown an interest in participating were invited to join Round 2.

We invited city councils to join in the Beta Testing who responded that they did not have the in-house technical resources or time to be able to participate, but would like to engage with Service Providers in future. This validated a core hypothesis in our use case that the majority of Local Authorities will work with Service Providers in order to supplement the need for technical skills.

In addition to email, we used the Slack messaging tool to support the beta testers and to give them a place to discuss problems and ideas between themselves. We also held daily drop-in meetings on Google Meet where we encouraged beta testers to share their screens as they worked through a problem. These sessions proved invaluable to us by letting us see the diversity, and sometimes unexpected complexity, of technical issues facing organisations as they published or consumed Shared Data via our services.

Results

Open Engagement

The Membership and Delivery Advisory Groups and the Steering Group were very successful and had good attendance. They met once a month for five months from March to July 2021. The Data Standards & Glossary Advisory Group met once a month for two months, from June to July 2021. The list of participants who agreed to be named can be found in Appendices A, B, and C. The next sections provide more detail on the scope of the meetings that took place.

Steering Group Meetings

The Open Energy Steering Group oversaw the work of the team and Advisory Groups, providing a focal point for reporting, a challenge function and ultimate sign-off for Advisory Group recommendations. The Steering Group included representation from Ofgem, BEIS (Energy and Smart Data), Energy Networks Association, Energy Systems

Catapult, Office for Zero Emission Vehicles and Advisory Groups. The five meetings were well attended.

At each meeting, the agenda included a progress summary, updates on Advisory Groups and specific policy and technical recommendations for agreement. These specific recommendations included fees and the [business model,](#)[13] membership proposition, data sensitivity classes, data access management, licensing, inclusion of the Energy Data Visibility Project (EDVP) and the acronyms/terminology used.

Advisory Group Meetings

Both the Membership and Delivery Advisory Groups were well attended by stakeholders from the industry. Across the two Advisory Groups, their objectives were to:

- Shape the Operational Guidelines
- Inform data production, flows and usage
- Review authorisation process and audit
- Consult on the Energy Data Search and Access Control
- Ensure Capabilities meet user and sector needs

The groups met on a monthly basis, totalling 5 times each in Phase 3 and completed the following actions:

- Agreed our Terms of Reference, conditions for participation, roles, responsibilities and liabilities for the Membership Advisory Group and its future roadmap
- Agreed standard definitions, acronyms and terminology to be used in Open Energy (to be incorporated in Operational Guidelines)
- Consulted on data sensitivity classes
- Identified and defined core roles and responsibilities within the Open Energy ecosystem – Data Providers / Data Consumers / Service providers / Dual roles
- Reviewed all sections of the Operational Guidelines
- Agreed high-level membership charging principles (not-for-profit, proportionate, inclusive) to form basis of detailed membership model work
- Provided detailed input into the membership and charging model, distillation of the business case and value of membership, including the importance of de-risking the commercial proposition
- Consulted on Data Access Conditions for Data Consumers
- Reviewed Licensing and Access Control conditions which included Authorisation Flows, Licensing Model and Access Rules
- Discussed the Metadata publication specification which details the content required from the Data Provider, the technical access specification (API) and data representation best practices.

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[13]https://docs.google.com/presentation/d/1WVPJo_Coj9kxYT6MLVSvfcnzxyr35VbHcVxMRSey4uk

- Provided feedback on gaining traction including developing further use cases, upstream and downstream in the energy value chain, to enable further engagement and to enhance the user base
- Identified additional use cases to add to development timeline

Additionally, the Delivery Advisory Group reviewed:

- Live demo of the Energy Search and Data Access to the Advisory Group
- Beta Testing lessons learnt

Data Standards and Glossary Advisory Group Meetings

Formed for EDVP, the Data Standards and Glossary Advisory Group met monthly in June and July and completed the following actions:

- Validated EDVP metadata design principles
- Defined the requirement level of proposed metadata
- Validated the approach to energy terms & glossary creation

Review Track Consultations

The Review Track was set up to enable engagement with individuals who were unable to attend the advisory group meeting. The 23 members were invited to 6 reviews as follows:

1. Review Track #1: Background Info and Early Drafts:
   - Briefing note: Open Energy Phase 3 (OE3) background reading for Advisory Groups
   - Introductory briefing (recording) and slides
   - Summary slide pack from Open Energy Phase 2
   - Working glossary sheet
   - Additional Use Case suggestions
   - Data Sensitivity Classes
   - Operational Guidelines Introduction and Guidance for Data Providers
   - Architecture Overview
2. Review Track #2:
   - Data Sensitivity Classes Consultation Responses and Finalised Policy
   - Consultation on the Proposed Membership Fee structure
3. Review Track #3:
   - Consultation: Open Energy Licensing Model
4. Review Track #4: Operational Guidelines sections:
   - Introduction
   - Glossary
   - Considerations before you start
   - Common policies

5. Review Track #5
   - Access Control
6. Review Track #6
   - Open Energy Membership Proposition Summary

External Communications

We developed a set of **messaging** to set out the purpose, features and benefits of Open Energy. The messaging clearly articulates the overall problem Open Energy aims to solve and positions it as a solution to help energy data stakeholders adapt to the pace of change required in digitalisation, data-sharing, and climate-readiness by explaining the features and benefits of Open Energy in plain language.

We designed and delivered a series of **webinars** intended to keep our target audience engaged in the programme and identify new entry points for people with little background knowledge. Our webinar topics responded to live feedback that we were hearing from our target audience: for example, potential users saying that they were unsure what technical readiness they would need to achieve to integrate with Open Energy. We designed a webinar that, in 30 minutes, had experts answer the question and presented a success story of integration from one of our beta testers. Please see Appendix C for links to our Presentations.

We published regular **content** on our website and distributed it on social media to deliver transparent updates on the programme, consistently making sure we were working in the open. We initiated a blog series, Icebreaker Stories, to profile other voices in support of Open Energy. We published videos of all webinars openly online and promoted our consultations across social media. Please see Appendix B for links to our Publications and Appendix D for other related meetings, events, or dissemination activities.

We engaged with **journalists** and secured coverage highlighting the range of beta testers using the services.

Research

Membership

We produced a [membership proposition](#)[14] that is categorised by aggregate turnover or non-profit status. Within the non-profit group, the needs of different types of organisations such as trade bodies, local authorities, universities, community energy and charities were also noted.

Messaging was identified as a critical component and a clear articulation of the Open Energy proposition was developed, together with an easily understood description of the features and benefits for the Energy Search and Access Control components. The

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[14]https://docs.google.com/presentation/d/1U6mfxSXmC5srgQqueNbiml3l5HW8UqRjr5IjPDP4PFU

benefits associated with these new capabilities were explored, developed and articulated for Data Providers, Data Consumers and Service Providers.

The full feature set for Members was agreed, including the core Data Search and Governance Services, representation (to the Advisory and Steering Groups), service desk, sandbox/testing facility and communications.

In particular, the specific requirements of the DNO community and the range of benefits afforded to this group were considered in depth. These Members will be Strategic Partners, essential as Data Providers, providing the foundation for growth of Data Consumers and Service Providers and fuelling the engine of innovation in a digitalised energy sector. This research extended to understanding the future digital business model for these organisations, which encompasses both cost reduction (meeting regulatory compliance for data sharing), as well as significant incremental service and revenue opportunities provided to existing and new energy data customers.

Membership Fees are a critical component and were subject to a two-week public consultation alongside discussions at both Advisory and Steering Group meetings. We agreed to implement an interim fee structure based initially on turnover, which will run until March 2023. This will provide certainty on funding and further development, while providing time to consider the requirements for a long-term fee structure. This approach is structured to keep fees low for SME, micro-business and non-profit organisations in order to minimise barriers to entry to what we believe will be a highly innovative ecosystem.

Likewise, longer term Governance for Open Energy Membership was discussed and, alongside further consultation on the long term fee structure, a timeline for this was agreed.

Technical definition of active membership

To understand the processes required for sales, onboarding, membership administration and the technical requirements needed to support members sharing data, the Open Energy team drafted a technical specification of active membership. This includes the necessary conditions for active membership and capabilities granted by active membership. This was shared with the Membership Advisory Group for initial feedback with further work expected to finalise this definition prior to Go to Live.

The membership contract

In preparation for Go to Live we briefed a specialist technology and contract solicitor to draft a membership contract. To minimise contract amendments, the membership contract is designed to outline the core relationship between the member organisation and Icebreaker One as an entity. It then references all the other policies, practices and guidelines, such as access control and licensing. This contract will be reviewed by the Advisory Groups later on in 2021 for further feedback.

Operational Guidelines

The next sections outline the resulting guidelines that were developed.

Roles, responsibilities and functions within the Open Energy ecosystem

One of the initial core pieces of research in Phase 3 constituted a review of the roles, responsibilities and functions within the Open Energy ecosystem. This exercise sought to ensure all participants were able to use common language and definitions. Consultation took place via the Advisory Groups and results are documented in the Glossary[15] and Introduction[16] of the Operational Guidelines. Terms were reviewed iteratively as Phase 3 developed, with language and definitions tightened to reflect a deepening understanding of roles and changes recorded in relevant documentation.

Glossary

Another core piece of research was to develop a glossary of terms and acronyms relevant to the Open Energy ecosystem. This exercise helped to standardise language where multiple terms existed and prompted a review of where acronyms could be overused and thus confusing. The glossary was consulted on by the Advisory Groups and Review Track. We adopted a policy of writing in plain English and minimising use of acronyms for future documentation. Sphinx documentation software was identified as a tool for managing publishing to the web, linking and version control for the glossary, and other documentation. The glossary can be found in our [Operational Guidelines](#).[17]

Data sensitivity classes

Open Energy can facilitate sharing of a wide variety of data types with varied levels of sensitivity. In order to handle this complexity and to ensure data is appropriately protected, Open Energy developed a system of data sensitivity classification. This policy details five Open Energy data sensitivity classes, graded across three dimensions of sensitivity: personal, commercial, and security. They are designed to complement [Ofgem's Data Best Practice guidance](#)[18] by adding nuance to how Data Providers can classify types of Shared Data.

This policy was consulted on by the Advisory Groups and Review Track, as well as opened to public comment. Consultation during policy development informed a range of changes including:

- Reducing the number of classes from 6 to 5
- Improving descriptions and example data types provided for each class
- Updating guidance regarding the classification of aggregated and anonymised personal data

Details of the data sensitivity classes public consultation feedback can be found in our [tracking document](#).[19] The updated policy is in our [Operational Guidelines](#).[20]

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[15] https://docs.openenergy.org.uk/main/glossary.html
[16] https://docs.openenergy.org.uk/main/ops_guidelines/introduction.html
[17] https://docs.openenergy.org.uk/main/glossary.html
[18] https://www.ofgem.gov.uk/publications/consultation-data-best-practice-guidance-and-digitalisation-strategy-and-action-plan-guidance
[19] https://docs.google.com/spreadsheets/d/1x7xKfnsUqwzDiZcRTrcwP9QuhuuDYYcEEAkxv8y3OPY
[20] https://docs.openenergy.org.uk/main/ops_guidelines/common_policies.html#data-sensitivity-classes

Data access condition types

Once Data Providers have allocated their datasets to appropriate sensitivity classes, they are then required to specify the access conditions for each dataset. To encourage the creation of access conditions that are fair and proportionate to the dataset's sensitivity profile, data sensitivity classes will be used as a guiding basis for considering access conditions, though not a complete determinant. As such, we define a standardised range of access condition types that Data Providers can associate with a particular dataset. This acknowledges the need for more nuance than would be captured under a 'one size fits all' approach for each sensitivity class, while still enabling standardisation of condition types. The policy focuses on access conditions for classes OE-SA and OE-SB only as personal data (OE-SP) are out of scope for Open Energy Phase 3.

This policy was consulted on by the Advisory Groups and Review Track, as well as opened to public comment. Consultation responses were broadly supportive of the proposal, however they promoted some tightening of how different access condition types were defined and placed in the proposal. Consultation informed a range of policy adaptations including:

- Dividing group-based access conditions into externally defined and self defined types
- Tightening the scope of use case-based access conditions to promote clarity and fairness
- Removing purpose-based access conditions to reflect coverage of these conditions elsewhere in ways that reduce implementation difficulties

Details of the data access condition types consultation feedback can be reviewed in [our tracking document](#).[21] The updated policy is in our [Operational Guidelines](#).[22]

Data licensing model

Licensing represents the final component that Data Providers must take in order to ready their datasets for sharing via Open Energy. Preparations consist of two parts:

1. Creating access rules
2. Associating the grant of a set of capabilities and obligations with each rule to form the license

This is an innovative licensing model that proposes a system whereby access and capability grants are determined, for each request to a Data Provider's API, on the basis of a set of rules defined and published by that Data Provider. This is different from the single licensing model that is commonly used in the sector, whereby one license is produced to cover all circumstances of the dataset's use. It also responds to industry feedback regarding problems with the length and complexity of single licenses, which

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[21] https://docs.google.com/spreadsheets/d/1aEScmtWxy9HR60nfqANES0ugeHLT1B1E4RuUp2GXMvk
[22] https://docs.openenergy.org.uk/main/ops_guidelines/common_policies.html#data-access-conditions

can increase cost, friction and risk associated with data use. By contrast, the Open Energy model permits reasonable multiple licensing within a set of transparent, standardised parameters that enable each license to be significantly simplified.

This policy was consulted on by the Advisory Groups and Review Track, as well as opened to public comment. No significant changes to the model were proposed in the consultation phase. However, consultation informed a range of minor changes including:

- Sharpening the descriptions of certain capabilities
- Confirming use of the 'data pyramid' to support the definition of different levels of onward sharing permissions
- Honing a set of clarifications provided with the policy to support understanding

Details of the data licensing model public consultation feedback can be found in [our tracking document](#).[23] The updated policy can be found in the [Operational Guidelines](#).[24]

Further feedback on the finalised policy through the Advisory Groups emphasised how innovative the proposed model is, supported by the policies on data sensitivity classes and access conditions, and highlighted opportunities for considering its implementation in cross-sector spaces relevant to broader BEIS Smart Data initiatives. In the next phase, further legal support will be required to draft the legal texts underpinning different capabilities and obligations underpinning the licensing model.

Iterative Delivery

We have produced two substantial pieces of documentation for the technical delivery and published both to publicly accessible locations:

1. The Open Energy Technical and Operational Documentation (https://docs.openenergy.org.uk/1.0.0/index.html) covers:

   - Introduction to Open Energy
   - 'Considerations before you start' for both Data Providers and Data Consumers
   - Details of core policies, including data sensitivity classification, access control, and licensing
   - Guidance for Data Consumers
   - Guidance for Data Providers
   - Common security requirements
   - Open Energy architecture
   - Technical specifications for the metadata file format
   - Technical specifications for the access rule and capability grant language
   - Open Energy glossary, divided into 15 sub-categories

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[23] https://docs.google.com/spreadsheets/u/0/d/1dbCSVSYC_ppihfTjkne5S2dyTS2LEBH25UeFfthITAg
[24] https://docs.openenergy.org.uk/main/ops_guidelines/common_policies.html#data-licensing

- Additional resources and links for supplementary reading

2. The Open Energy Python Support Documentation
   (https://icebreakerone.github.io/open-energy-python-infrastructure) covers:

   - Describes the details of our Python library
   - Includes exemplar data provider and data consumer implementations
   - Detailed walkthroughs for onboarding to the Directory, and deployment of Data Providers to cloud hosting systems

These documents are heavily cross-linked and the primary documentation (the Open Energy Technical Documentation) are also versioned, with both previous and development versions accessible alongside the current live release.

Metadata for datasets

We identified the need to define a simple metadata standard to allow data providers to describe their datasets so that we could index them appropriately and provide information of value to data consumers when choosing datasets.

Working via a public consultation process, we designed a metadata format that incorporated relevant portions of established metadata standards and formats, such as DCAT and OpenAPI. This approach leveraged these standards' familiarity to data scientists and allowed developers to use readily available parsers and generators. This approach also allowed us to incorporate these standards' inherent flexibility in supporting future requirements into the metadata standard.

We created an automated metadata harvesting process to poll registered Data Providers' data set definitions, leaving complete control over the data set definition in the hands of the data providers. The process provides automated feedback to data providers about any issues in parsing their metadata files.

Beta testing

Technical delivery doesn't occur when the software is deployed or services are enabled, it happens when real users adopt, use and see the benefit of that software and those services. Waiting until a service is feature-complete and polished, squanders the opportunity to get impactful feedback that can materially improve the design or technical direction of a project.

As such, being able to get early, sometimes somewhat raw, versions of our services into the hands of potential data providers and data consumers has been critical to our delivery. It gives us direct feedback about what works and what doesn't, what makes sense and what is confusing. The feedback is sometimes unexpected but always welcome, because it represents at least some of the reality of the industry.

In order to get consistent feedback and to keep testers focussed on the key functionality, we asked them to attempt a number of specific test scenarios, and tracked their progress.

We found that with minimal additional guidance, the beta testers, particularly Data Consumers, were able to follow the scenarios and develop working software. We encountered a few recurring problems with interpretation of the documented guidelines in the context of Directory UI, which we will address by improving the documentation and user experience around creating certificates. Additionally, this exercise showed that we need to emphasise to Data Providers the need for them to build a FAPI-compliant API and we should make this process as clear and straightforward as possible. We will continue to improve our already extensive documentation on this subject.

Beta Testing Round 2 Scenarios

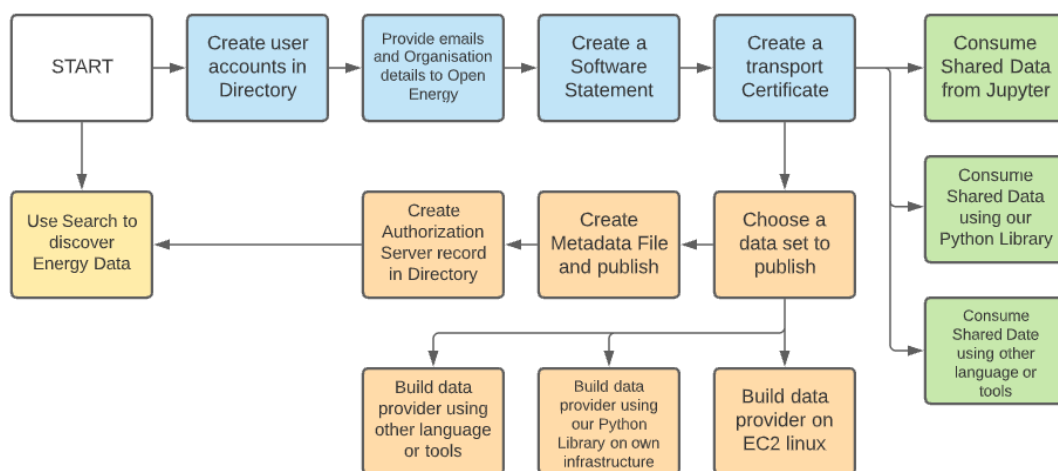Scenarios 1-14 are depicted in Figure 3 below and referenced in Table 1 below.

Figure 3: Beta Testing Round 2 Scenarios

Nb.	Scenario	Participant role
1	Create user accounts in directory	All participants
2	Provide emails and Organisation details to Open Energy	All participants
3	Create a Software Statement	All participants
4	Create a transport Certificate	All participants
5	Choose a data set to publish	Data provider
6	Create a metadata file and publish	Data provider
7	Create Authorisation Server Record in the Directory	Data provider
8	Build data provider on EC2 linux (level 1)	Data provider
9	Build data provider using our Python Library on own infrastructure (level 2)	Data provider
10	Build data provider using other language or tools (level 3)	Data provider
11	Consume Shared Data from Jupyter (level 1)	Data consumer
12	Consumer Shared Data using out Python Library (level 2)	Data consumer
13	Consume Shared Data from using other language or tools (level 3)	Data consumer
14	Use Search to discover energy data	All participants

Table 1: Beta Testing Round 2 Scenarios

How our Beta Testers Progressed in Round 1 and 2

Key:

Level	Colour
Not Applicable	
Eligible	
Complete	

Beta Testers	Scenarios Completed													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Beta Tester 1														
Arup														
Brits Energy														
Data Catalyst														
DNV														
DT Squared														
Energy Systems Catapult														
Farad.ai														
Beta Tester 3														
IMBY Ltd														
National Grid Electricity														
Ordnance Survey														
Passiv UK														
Beta Tester 4														
Project LEO														
Scottish & Southern Electricity														
Quantenergy														
University of Birmingham EIG														
UrbanTide Limited														
Wattify Limited														
Youtility Ltd														
Zuhlke Engineering Ltd														

Table 2: Tracking how our Beta Testers Progressed in Round 1 and 2. Note: We have only named the testers who have agreed to be named in our reporting.

Watching the testers' successes and their struggles gave us a lot of insight in how to improve our code, our processes and our documentation — insight that no amount of isolated, internal discussions would have achieved.

Perhaps most importantly, the beta testing has enabled us to clarify the stories we tell about Open Energy to different stakeholders across the industry with specific roles and

concerns, from development and infrastructure to security and operations. These stories will make it possible for individuals to have meaningful conversations internally about what we're doing and how it benefits them.

Energy Search and Access Control

System architecture
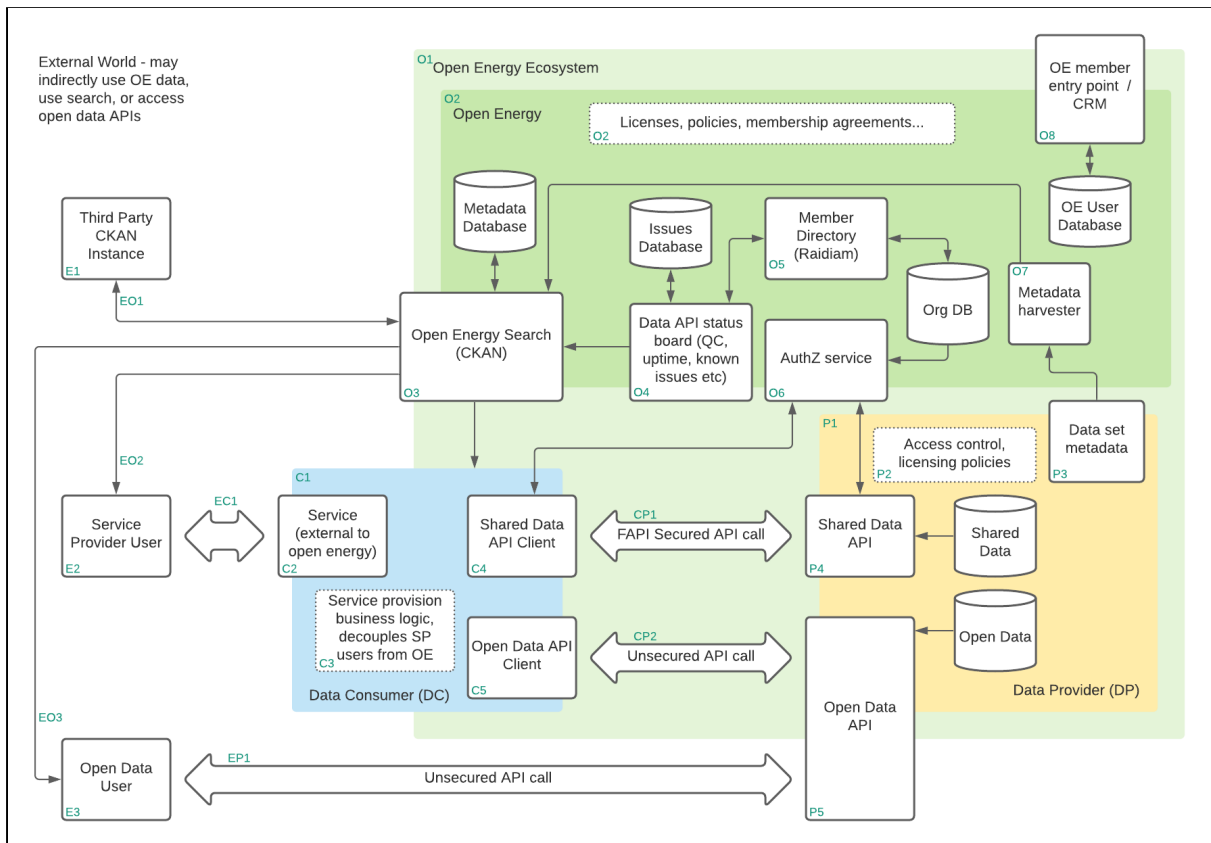
Figure 4: System Architecture Diagram

The diagram above shows the functional units in the Open Energy ecosystem in terms of software components and data repositories. The pale green area shows interactions and systems within the Open Energy ecosystem itself — these entities are only visible to Open Energy members. The darker green section shows systems managed directly by Open Energy as part of its service offering, while those in blue and yellow are representative of components created and maintained by Data Consumers and Data Providers respectively.

As part of Phase 3 we have created all components within the dark green area with the exception of the status board, this has been deferred to future work prior to the deployment of a live service.

Open Energy Search is further described below and forms the basis for discovery of datasets, surfacing metadata created according to our specification by Data Providers, and gathered through our custom Metadata Harvester component.

Data access is mediated by the Authorisation Service and Member Directory components which underpin our trust framework, providing mutual authentication and delivering sufficient information for Data Providers to make per-request authorisation and licensing decisions as defined in our licencing and access control model.

In addition to the components we maintain directly, we have provided extensive documentation[25] and reference implementations for the Shared Data API Client (on the Data Consumer side) and the Shared Data API (for the Data Provider).

User Experience

Metadata files contain useful attributes that help describe and understand datasets across a diversity of providers and consumers. Figure 5 below shows how these attributes are visualised within the UI.
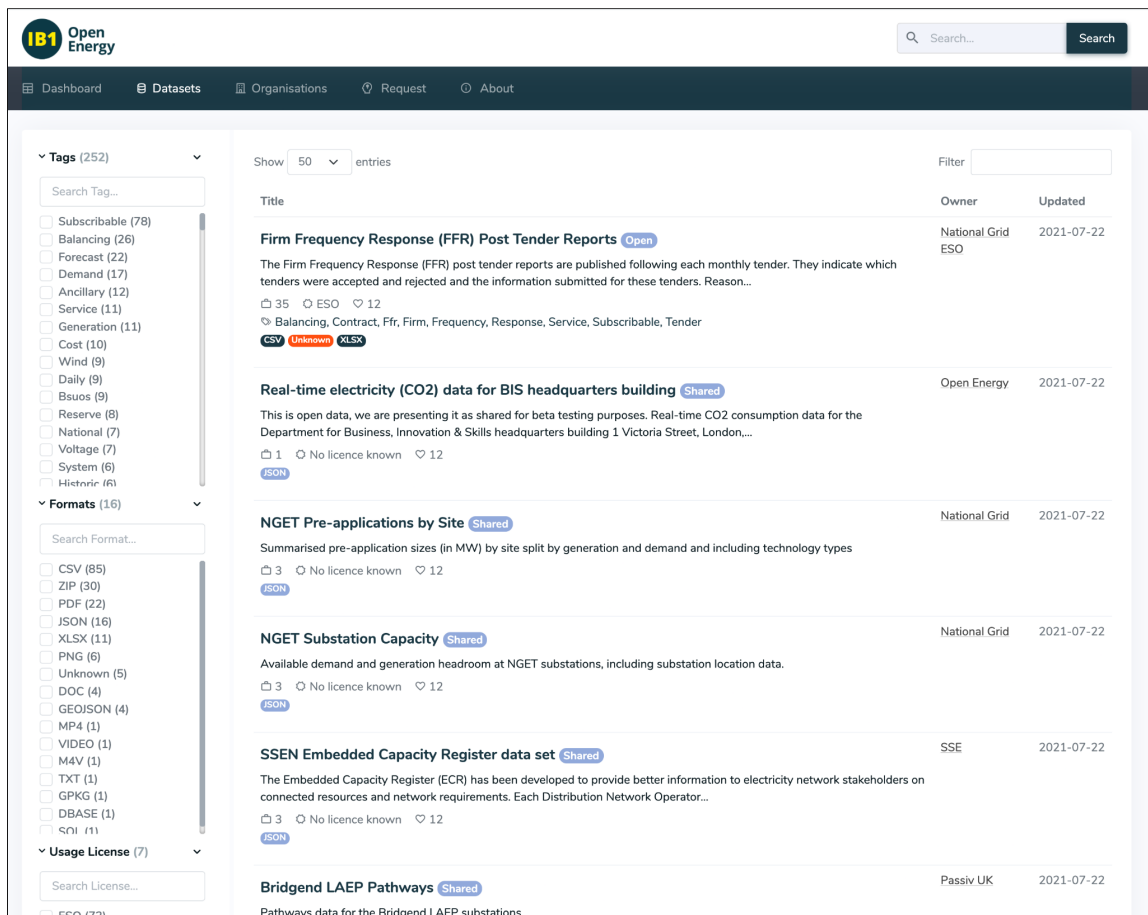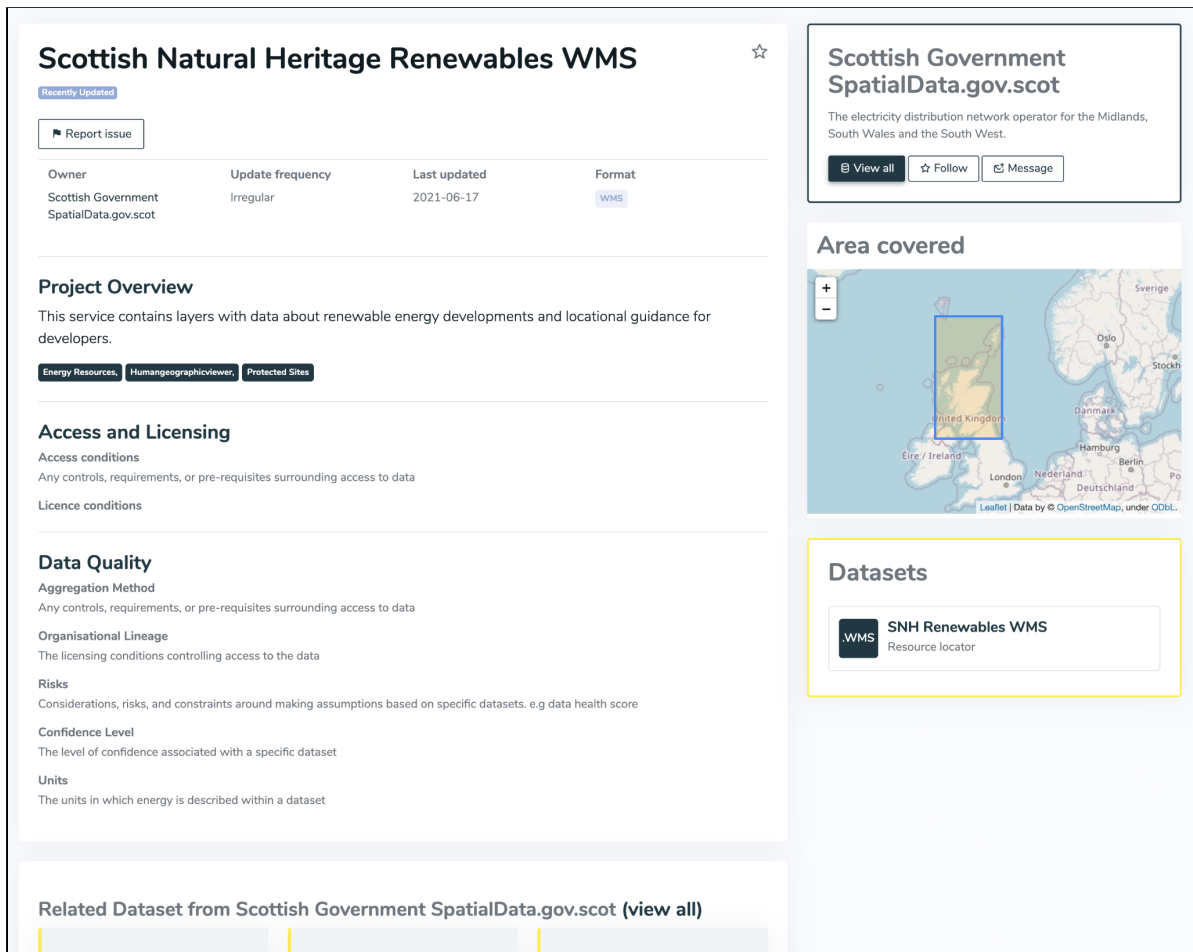
Figure 5: Data can be easily searched and filtered to quickly find the right result, or simply to discover what's available for use.

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[25] https://icebreakerone.github.io/open-energy-python-infrastructure

To help users, we have sought to show as much information about the dataset as clearly as possible. This includes rendering maps from spatial data, clearly displaying licence information and linking data through tags and related search results.

Users can also follow or contact a data provider, or see all data they have provided. It is also easy to report an issue with a dataset so there is public feedback for continual improvement.

Figure 6 below illustrates these detailed views.

Figure 6: Open dataset detail-view based on its metadata

Figure 7 illustrates documentation describing a relevant Data Provider API's endpoint and expected API response upon a successful request.

Figure 7: Documentation guiding Data Consumers on accessing shared datasets programmatically
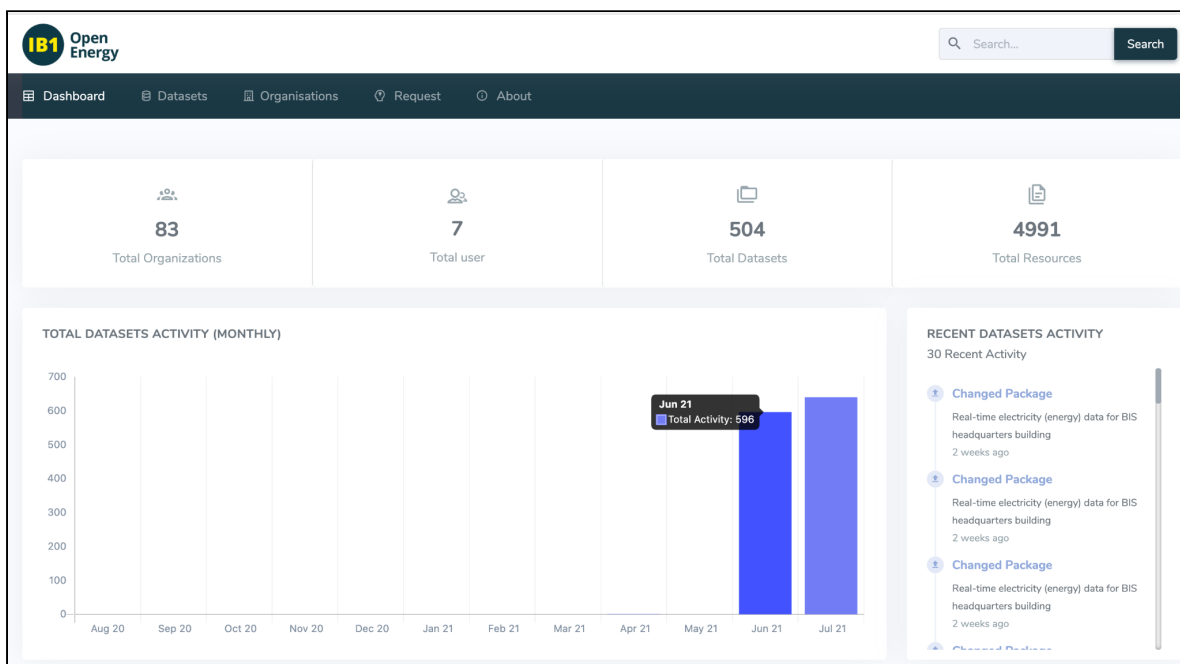
Figure 8: Open Energy Dashboard describes key metrics on member organisations and datasets available on Energy Search

Figure 9 below illustrates the Analytics Dashboards showing trends around page visits, audience and user actions. It provides leading indicators on industry movement by logging search terms used.
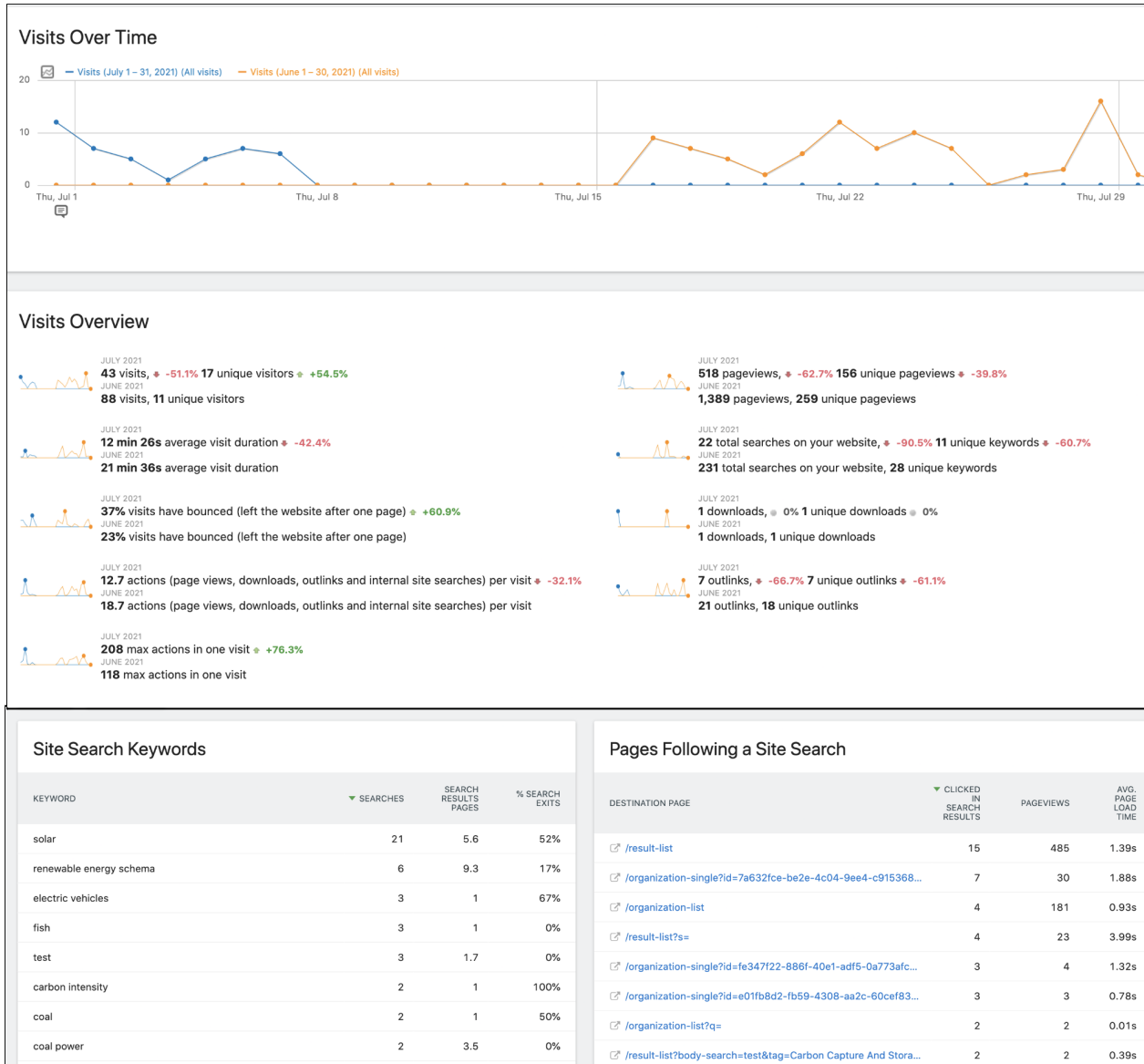
Figure 9: Analytics Dashboards

Planning for the future

The process of Go to Live planning identified a number of functions and research areas required for development beyond Phase 3. Inputs from the Advisory Groups across the project phase have helped to shape this planning e.g. flagging the need for consultation on developing a dispute-resolution mechanism. A summary of the Go to Live plan[26] was presented to Advisory Groups and the Steering Group in July.

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[26] https://docs.google.com/spreadsheets/d/1DCAjg5eXoStCHItccuxw3HCINI_bk92zVTHg1ThV-jM/edit#gid=0
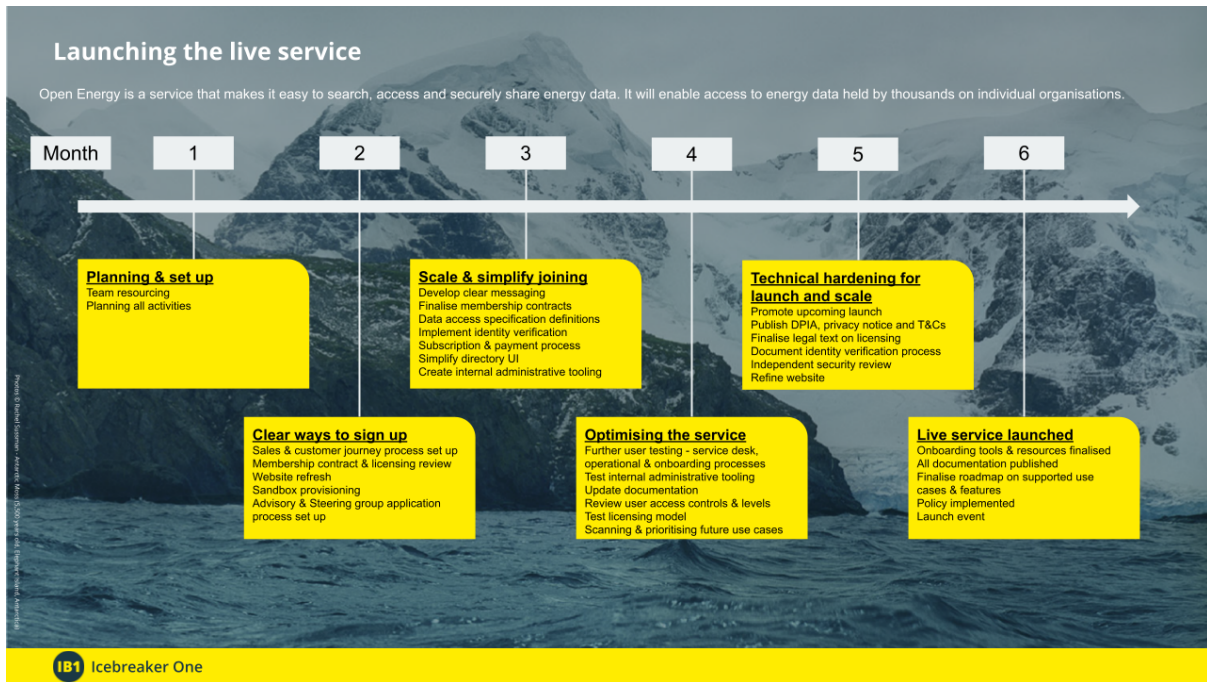
Figure 10: Summary of the Go to Live plan

Lessons learned

Open Engagement

As evidenced throughout this report, Open Engagement was core to our approach, underpinned by our Agile approach to delivery. Integrating suppliers directly into fortnightly planning, daily scrum meetings and fortnightly show & tells meant that delays could be avoided, and a sense of collaboration and open communication was maintained throughout. The regular monthly webinars and Advisory Groups, as well as the consultations, allowed us to constantly seek feedback from the industry and test our hypotheses, amending rapidly where needed.

In Phase 3, a key lesson learned and hypothesis validated through delivery of the core use case revolved around the difficulty of culture change in the energy industry. The pace of change within large organisations (due to internal processes, a lack of resources and legacy infrastructure) versus the rapid pace of development in Phase 3 meant that some organisations were unable to act quickly enough. This was evidenced through difficulty in attempts to involve Local Authorities in our beta testing programme, as well as feedback received from DNOs and large organisations informing us that the speed of their internal processes prevented them from participating more deeply in beta testing. We mitigated this risk by providing additional tools, daily drop in sessions and extra support for those interested, but, as shown elsewhere, Local Authorities in particular fed back that they lacked the technical skills to join at this stage.

This experience confirms the initial view formed in Open Energy Phase 2 when developing the Local Authority use case, that there is a clear need for well positioned

service providers that can take on the data analysis and scenario planning role for Local Authorities. We expect to see the same situation for future use cases, given that in many organisations there are limited IT resources and typically many competing priorities. This shows that there is a significant opportunity for specialist service providers, providing solutions to problems such as those identified in the Local Authority community retrofit use case. Going forward, we will be developing onboarding processes that take into account the size of an organisation, understanding that different, more customised approaches will be required for larger organisations.

Research

Lessons learned from research and policy development include three notable successes and two main challenges. Firstly, the approach of working in the open and collaborating on policy development was highly successful and should be continued. This was facilitated through sustained engagement with the Advisory Groups, Review Track and public consultation documents, ensuring that all policy development included at least one opportunity for feedback. For public consultations, all feedback and Icebreaker One responses were published transparently, summarised in a blog[27] describing the outcomes from the consultations and associated documentation. Stemming from this approach, our second success lies in the creation of an innovative approach to data licensing[28] which highlights how important it is to be responsive to industry feedback and needs. Continued industry engagement will be sought next, accompanying the creation of legal text and technical implementation. Thirdly, we have produced Operational Guidelines written in plain English with minimal use of acronyms and specialist language. This approach makes the information much more accessible to all and will be adopted in other documentation (e.g. user guidance) due for production in future development.

The two major challenges we faced were differential terminology use and misunderstanding of the aims and scope of Open Energy. Terminology difficulties were tackled by developing the glossary first and seeking feedback from the Advisory Groups in the early stages of Phase 3. Challenges related to misunderstandings around project scope were addressed through the iterative development of our communications strategy and resources throughout Phase 3. This included developing our messaging, tailoring communications to particular groups of participants with distinctive needs (e.g. DNOs, public sector), updating our website FAQs and conducting a significant programme of industry engagement through webinars. In future development, we will proactively address this issue by developing a communications strategy to deliver a recap of core aims and objectives and to continue to gather insight into needs and common misunderstandings present in different parts of the sector.

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[27] https://energy.icebreakerone.org/2021/07/15/outcomes-of-open-energy-phase-3-policy-consultations
[28] https://docs.openenergy.org.uk/1.0.0/ops_guidelines/common_policies.html#data-licensing

Technical Delivery

Our two beta testing rounds enabled us to gain valuable feedback from watching our participants encounter our work 'from scratch'. In particular, the diversity of deployment environments (operating systems, programming languages) and internal organisational structures highlighted issues we had not anticipated. We were able to use this to drive development of technical and non-technical material to better assist newcomers onboarding to Open Energy and partly as a result of this work, the second round of beta testing progressed more smoothly and quickly. In particular, we found:

1. Command line tools for key generation and similar tasks which are widely available on Linux-like systems, tended to work differently, or in some cases not at all, on Windows platforms (even when the appropriate libraries and tools were installed, the syntax variations between platforms caused problems). We mitigated this by providing our own Python-based implementation of a critical key generation tool.
2. There was a significant conceptual leap required for data providers - many of our beta participants quite reasonably assumed they could put static files up behind a secure web address (of some kind) and that this would be sufficient. To communicate exactly what the technical requirements for a data provider were, we:
   - documented the technical details[29]
   - produced a sample data provider populated with test data
   - produced exemplar code for this data provider, along with instructions on the steps we used to deploy the example data provider[30] to Amazon EC2 in the cloud
3. The internal structures of organisations posed challenges in ensuring the right people were involved at the right points in the process, particularly in the case of data providers where a mix of technical, operational, legal, and commercial decisions had to be taken. This was particularly true for larger organisations such as the DNOs. To aid these organisations in particular, we produced an overview Considerations Before you Start[31] document outlining the different kinds of expertise and authority needed for each kind of member.
4. Tooling will be critical for the usability of Open Energy. Our beta testers were confronted with many novel specifications, information formats and API requirements. Over the course of the two beta rounds, we evolved our tooling to help check metadata file formats and catch problems as early as possible and it is clear that the more support we can provide in this and other similar areas (access rules, validating data provider APIs and so on), the smoother the process will be, particularly for new members.

Engagement via the daily drop-in sessions dramatically accelerated the evolution of both the tooling and the documentation around it and even led to other discussions for collaborations between the participants.

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[29] https://docs.openenergy.org.uk/1.0.0/ops_guidelines/technical_common.html
[30] https://icebreakerone.github.io/open-energy-python-infrastructure/ec2.html
[31] https://docs.openenergy.org.uk/1.0.0/ops_guidelines/before_starting.html

IPR, dissemination and publications

IPR
As a non-profit dedicated to open licensing, IB1 has an open by default policy (MIT, CC-BY) which has been applied to relevant outputs. Its subcontracting policies carry through this mandate where commercially relevant and legally possible (in instances where, for example, third-party software is commissioned). In instances where open licensing is not possible, to minimise operational risks, our process ensures that (a) there are equivalent market solutions available or, (b) organisations can be asked to hold service-related assets in escrow for redeployment by an alternative provider should that become necessary (e.g. in cases of supplier bankruptcy), or (c) commissioning of alternative functionality is not overly burdensome.

Dissemination and Publications
During Phase 3 of the project we:

- Published 8 reports, summaries and policies (see Appendix B)
- Held nineteen webinars with over 489 attendees (see Appendix C)
- Published 32 interviews, blogs, consultations, speaker engagements, podcasts raising awareness and building the profile of Open Energy (see Appendix D)

Interest and contacts from potential end users
We had significant interest from potential end users.

In cooperation with Catapult Energy Systems, we organised a workshop on 2nd June for energy tech companies and MEDApps winners which had a large attendance including:

Advanced Infrastructure	Farad.ai	Brits Energy
GL Industrial Services	Mind Foundry	Powermyev
UrbanTide	City Science	Zuhlke

Table 3: MEDApp Winners Engaged with on 2nd June, 2021

Furthermore, we had individual engagements with key stakeholders including across government, publicly-funded bodies, large enterprises and local authorities.

We engaged directly with local authorities to validate our use case further and understand their needs and technical capabilities. They participated in Advisory Groups, attended webinars and had numerous 1-1 conversations with the Icebreaker One team. Feedback towards Open Energy was very positive, as they emphasised that costs incurred and time for responses currently could delay a project by months so they saw value in reducing the time required to search for and access Shared Data in particular to help make decisions. As described in the Lessons Learned section, we validated our Open Energy Phase 2 hypothesis that most Local Authorities will rely on working with Service Providers who will utilise Open Energy on their behalf. They stated that due to

budgetary constraints, they are more likely to formulate the questions and strategies first and then work with a Service Provider in order to analyse the necessary data to make decisions regarding retrofitting Low Carbon Technologies.

An additional council worked with partners such as Passiv UK to develop a Local Energy Market Model which will enable the increased deployment of Low Carbon Technologies. Passiv UK has developed a Target Operating Model which will leverage the Open Energy architecture to support secure data access by the Council. Passiv UK engaged with the Chief Executive of the Council and the IT lead to discuss the opportunities afforded by participation in the Open Energy Public Beta testing phase. There was support for active participation and indeed adoption of the Open Energy model across the Council. However there were limited IT resources available during the Public Beta testing phase and it was not possible for the Council to participate. Passiv UK will be working with the Council to support the utilisation of the Open Energy architecture as part of the Local Energy Market Demonstrators planned for 2022.

Additionally, we organised monthly webinars during which we gave presentations about the Open Energy Service and how to join. These webinars were attended by interested Data Consumers and Data Providers, with 489 attendees over the course of the 6 months.

We discussed the [features and benefits](https://docs.google.com/presentation/d/1U6mfxSXmC5srgQqueNbiml3l5HW8UqRjr5IjPDP4PFU)[32] of the Open energy service with all the contacts we had developed, as well as our draft approach to membership conditions. Many of the contacted companies also joined our beta testing programme (described in the Beta Testing Approach and Results sections).

The interest from users is very diverse, as they have developed their unique business models and use cases. The overlapping interest for all users is the desire to be able to search and use energy data of any type.

Finally, we have engaged with organisations that are in first instance a data provider, but over time are expected to develop their own user business models. For example, we have given presentations to the DNO and Gas Distribution Network (GDN) communities on two occasions, on 30 April and on 28 June, with 9 major organisations in attendance.

Route to market and exploitation

The total market size potentially interested in Open Energy Services has been estimated at 8,000 organisations, varying in size from micro-companies to multinational and publicly listed companies.

As already outlined with our membership proposition research, we have segmented these 8,000 organisations into twelve main categories. The table below lists those categories and provides an estimation of the number of larger players within each. Within the below figures, we estimate that there is capacity for 14 organisations to become Strategic Partners, based on the upcoming regulatory mandate for energy

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[32] https://docs.google.com/presentation/d/1U6mfxSXmC5srgQqueNbiml3l5HW8UqRjr5IjPDP4PFU

networks to open up their data.

Market size for providers and users of energy related data

Category	Number of large orgs in category (est.)	Notes
Energy suppliers	84	>1% market share: 14
Electricity DNOs	6	Several distribution areas are covered by the same company
Energy consultants	12	
Solar power generators	± 150	
Gas DNOs	4	Several distribution areas are covered by the same company
Water (and sewage)	26	
Energy Tech / Built	15	
(re-) Insurance	15	
Academia / think tanks / research institutions	150	We estimate only a small proportion will become member
Transmission Operators	3	
Energy Data Service Providers	9	
Financial Services (ranging from banks, Fintechs, comparison sites, to asset managers, etc.)	many	

Table 4: Market size for providers and users of energy data

In addition to the types of organisation listed above, discussions with bodies such as Office for Zero Emission Vehicles (OZEV) reveal that the energy sector has an increasingly close overlap with the transport and automotive sectors. These provide adjacent markets into which Open Energy can expand. We have already begun to experience sector pull, as evidenced by propositions under development by MEDApps participants (e.g. using Electric Vehicle and Charge Point Operator data). Furthermore, the Open Energy model is replicable across a broader range of industries, as well as in international markets. These all provide possible routes for future market expansion once the Open Energy model is live.

As the project has developed, and our understanding of the unmet needs and opportunities has developed, we have raised our expectations for the potential of this technology and approach. It holds huge potential for energy, and we now also believe that it can be adapted and used across many other sectors as the basis for a national data sharing infrastructure, supporting National Data Strategy and the Smart Data Initiative.

Market Needs

User needs for data sharing in the energy sector tend to differ by type of organisation. Our analysis identified common user needs across our five membership categories:

- Strategic partners - regulated entities with an obligation to share data
- Enterprises - companies with aggregate annual turnover of at least £36m
- SMEs - companies with aggregate annual turnovers between £1.7m - £36m
- Micro-businesses - companies with aggregate annual turnovers under £1.7m
- Non-profits - including trade bodies, public sector, universities, charities, community energy etc. where specific rules and features apply

Common user needs within each membership category are outlined in this *Figure 11: Common User Needs for Membership Categories*

What are the needs of typical Open Energy members in each tier?

Our approach is to understand end user and sector needs

01	Strategic Partners	Energy networks have new regulatory obligations to share data and comply with the MED Data Best Practice Guidance. They also need to make good use of their rich data assets to support net-zero obligations. To do this, they need infrastructure, guidance and tools to help their large and complex organisations meet these obligations quickly and cost-effectively. As the energy data economy grows it will be increasingly important for networks to be able to service large volumes of data requests.
02	Enterprise	Enterprises need infrastructure to govern, share and access data safely and reliably. This can help them make the most of emerging commercial opportunities and new markets associated with energy system digitalisation and decarbonisation. These need to both access and share large volumes and diverse types of data. Service reliability is important to them and internal efficiency is a motivating factor.
03	Small/Medium Enterprise	SMEs currently report data discoverability and access as some of the biggest barriers to business growth. Due to their smaller size, lowering costs associated with data access and sharing is also important. SMEs need ways to save time and money - e.g. by reducing legal costs or staff time - that can help their businesses develop. They also need access to reliable data streams on which to build data-driven products and services, that won't fail technically or be subject to frequent license changes.
04	Micro Business	As the smallest commercial members who are more likely to operate on intermittent funding, micro-businesses need affordable ways to access and share data that can also support internal cost-savings. As microbusinesses are more likely to be building products or services hinged on reliable access to a smaller number of data streams, reliability of access is a priority to ensure their business can develop sustainably.
05	Non-profit	Policy and public sector organisations need easily discoverable data that they can access quickly for use in data-driven decision making. Often working on short project timelines, quick and affordable access to varied data sources is a priority. In universities and research institutes, short projects give rise to similar needs for fast data access. Licensing clarity is another priority for researchers in particular, who need transparency and stability regarding permitted data uses in order to assess research feasibility and any ethical implications.

Photos © Rachel Sussman - Antarctic Moss (5,500 years old, Elephant Island, Antarctica)

IB1 Icebreaker One

Market Share

In evaluating the expected market share we draw on the nearest comparable proxy, Open Banking. Like Open Energy, it was created by convening teams to develop common principles and practice for sector-wide data sharing. This was also developed and implemented by an independent non-profit (in that case, funded by the banks) to develop and take the standard to market, including a directory (a Governance Service) consisting of accredited organisations using it that now numbers in the hundreds.

The experience and insight gained from work undertaken indicates that the architectural approach and infrastructure can be adapted to meet energy needs and are sufficiently flexible to be repurposed for data sharing across other sectors. It is the policy, regulatory, legal and operating requirements that must be contextualised for different sectors, such as transport.

From our experience in Open Energy and Open Banking, there are a number of principles that will contribute to widespread adoption and market share:

- **Regulatory imperative**: We can learn from Open Banking, mandated by the CMA as a remedy following the financial crisis of 2008/2009, and which applies to the nine largest UK retail banks. Because it was adopted by these major banks, the rest of the UK market followed suit. Therefore, we believe a mandate from Ofgem will have the same effect: once the key Data Providers (the DNOs and GDNs in particular) adopt Open Energy, the rest of the market will follow suit. The balance between regulatory intervention and a market-led approach must be carefully weighed. For example, experience from Open Banking was that standards, although agreed, may be implemented slowly or ineffectively. This means that regulatory deadlines may be required.

- **Dedicated Open Energy Implementation Entity:** A non-profit, sector specific organisation with responsibility for implementation provides a strong convening and coordinating body for development of both the Energy Search and Access Control.

- **Appropriate funding:** Open Energy must be appropriately funded by the sector, through a not-for-profit Membership model that ensures stability and independence, with no requirement for long-term state support in order to deliver on its mission.

- **Led by sector and end user needs:** Open Energy must be shaped by the market, based on a deep understanding of end user (energy sector, industrial and consumer) needs, which must take precedence over technically-led development. Where legacy infrastructure exists, Data Providers in particular may be biased to build what they can support, or commit to solutions that have the least impact or cost. This may result in a technical capability, but might not be implemented in a way that the market can easily use.

- **Collaborative and consultative approach:** Developing a successful sector-led approach requires a collaborative culture. This can be viewed as time consuming and complex, and often requires careful navigation between the vested interests of the various parties involved. However, once this has been achieved, the

ongoing development, maintenance and scalability will more than offset the initial investment.

- **Maximisation of the benefits from a decentralised architecture:** Open Energy architecture is designed with only the minimum required centralised components, de-risking and allowing rapid and low-cost system evolution.

- **Ecosystem development:** Support for Data Providers, Data Consumers and Service Providers must be provided from the start, with ongoing outreach to the market to understand and respond to needs as Open Energy develops.

Following these principles will lay a firm foundation for Open Energy, which will prove attractive to the sector as the de facto Standard. This, like Open Banking, will aim to ultimately achieve 100% adoption of the key Data Providers with a regulatory data-sharing mandate (i.e. DNOs, GDNs, Energy System Operator), and therefore deliver widespread adoption and market share for Data Consumers and Service Providers.

Future Financing

The Membership funding model is currently based on turnover. From the pilot phase through to the end of year 4 (i.e. a 5-year horizon) we expect the following growth. Adoption is modest in year 1, but will grow substantially and with rapidly increasing volumes of data sharing. This growth will be mainly driven by SMEs and micro-businesses providing innovative new services that support decentralisation and decarbonisation. As we have seen in Fintech, a highly dynamic and creative ecosystem will drive growth and diversity of use cases as EnergyTech accelerates. In a ten-year timeframe this will deliver strong growth with associated economic and environmental benefits.

The table below shows the number of Members in each tier over a five year timeframe, from Pilot to end of year four.

Member tier	Pilot	Year 1	Year 2	Year 3	Year 4
Strategic Partners	1	4	8	10	15
Enterprise	2	10	15	20	40
SME	5	25	100	200	300
Micro business	5	25	100	200	600
Non-profit	2	12	22	32	42
Totals	**15**	**76**	**245**	**462**	**997**

Table 5: 5 year horizon for each member type

We have developed a financial plan against this forecast that enables Open Energy to become sustainable through a sector Membership model, without any need for

public-sector support. This is initially implemented through an interim funding model which will run to the end of March 2023, providing the time required to better understand sector requirements and therefore develop a long-term funding model.

Route to market and exploitation

Given the wide variety and diverse nature of the market, we aim to approach different market segments in sequence — starting with the segment or category that is of the highest value and most closely related to our use case: the DNOs and the GDNs. Our route to market for this category is threefold:

1. Creating awareness and education with promotion via webinars, social media, trade press
2. One-to-one engagements listing the benefits and opportunities of the Open Energy Service
3. Engaging on a policy-regulatory level with Ofgem and BEIS to support business development

We will expand outwards following a similar route-to-market process and tailoring our narratives and use case propositions. We will widen our focus from the key domain players depicted closest to the Open Energy circle on the left in Figure 12 below, out towards the broader sector and eventually to other sectors.
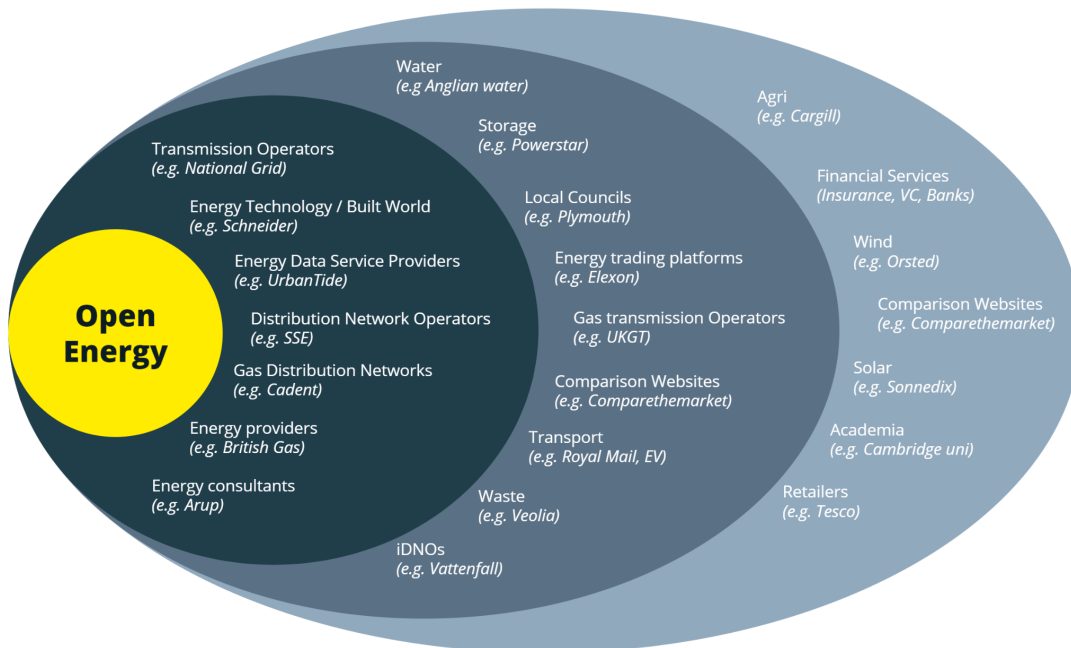
Open Energy Membership Map

Figure 12: Open Energy Membership Map

Conclusions and next steps

Phase 3 of Open Energy has been delivered in full, meeting all of its objectives and milestones. This includes substantial and material industry and stakeholder engagement and understanding the direct user needs. Future development must continue with the same principals, engaging with the sector and working with open, collaborative and iterative processes in order to adapt to changing needs.

Open Energy set out to make it easy to find, access and share energy data, to deliver a Beta Testing Programme (using a core use case to help navigate priorities) with direct stakeholder engagement and a route to live. It has delivered operational services for Energy Search and Access Control that are now online and market-facing.

Further development will be focused on the following principles:

1. A compulsion to participate
2. Design for search
3. Continuous, iterative development
4. Engagement with users and industry

In the autumn, we will be moving to a 'pilot' phase, where we will continue to encourage industry collaboration. We will be running a forum to develop Codes of Practice, shaped by Advisory and Steering Groups. They will focus on identifying and prioritising new use cases and developing the policy, legal, technical and operational standards, to address market needs at a sector-scale.

The Go to Live Plan is a detailed 6-month plan that will take Open Energy from the Pilot Phase to market engagement and adoption throughout the sector. We will proactively engage and convene stakeholders through the forum to understand their needs, iterate developments to meet those needs and deliver an operational, supported service. There will be substantial focus on market engagement and adoption at this stage.

This work should be considered as contributory towards the National Data Strategy: design patterns established in energy will affect other sectors. Government and industry must work together to maximise market openness, including ensuring that appropriate governance is in place to help prioritise where, when and how regulatory intervention may be required.

The potential of Open Energy is not limited to the boundaries of the energy domain as its innovative research and technical developments lay the foundations for more profound and complex initiatives. There is significant scope to harness this work and apply it across other sectors achieving far reaching impacts that could revolutionise the way we are sharing data.

Appendices

Appendix A: Steering Group Members

Below is the list of those who agreed to be named as Steering Group Members:

Co-chairs:
Gavin Starks, CEO, Icebreaker One
Miles Cheetham, Data Infrastructure
Lead, Icebreaker One

Members:
Aneysha Minocha, Co-chair for Delivery
Advisory Group, Founder and CEO,
Quantenergy
Claudia Gibbard, BEIS
Cristobal Pollman, Co-chair for Delivery
Advisory Group, Director, Sterling
Capital
Danae Marshall, BEIS
Dhara Vyas, Citizens Advice
Faith Reynolds, Co-chair Membership
Advisory Group, Subject matter expert

and author on Open Banking, Open
Finance and Smart Data
Harriet Egdell-Page, BEIS
Jonathan Berry, Western Power
Matt Hastings, Innovate UK
Maxine Ferk
Sara Vaughan, Co-chair Membership
Advisory Group, Non-executive Director
at Elexon Limited
Simon Pearson, Energy Systems
Catapult
Sophie Adams, Office for Low Emission
Vehicles
Steven Steer, Zuhlke, (represented as
Head of Data, Ofgem until June 2021)
Heather Swan, Ofgem
Helen Crooks, Ofgem

Appendix B: Publications

Below is a list of publications created during the project.

Title	Date
Summary: The UK energy data ecosystem	2021-03-04
Summary: Data Spectrum for Energy	2021-03-04
Report: Data protection and smart meter data	2021-04-12
Report: Enabling secure and scalable non-financial reporting and data flows	2021-04-28
Policy: Dataset Sensitivity Classes in the Open Energy Ecosystem	2021-07-05
Policy: Data Access Conditions in the Open Energy Ecosystem	2021-07-06
Summary: Updated FAQ	2021-07-07
Policy: Open Energy Data Licensing Model	2021-07-14

Appendix C: Presentations

Below is a list of presentations delivered during the project.

Webinar title	Date
Webinar: Data for Open Energy, organised by BCS, The Chartered Institute for IT	2021-02-09
Webinar: MEDA 3 Summary 16 February	2021-02-16
Webinar: Transforming energy data sharing to achieve net-zero	2021-02-16
Webinar: Update on progress towards a net-zero UK energy sector	2021-03-15
Webinar: Introduction to Open Energy	2021-03-15
Webinar: Introductory Briefing for Open Energy (MEDA Phase 3)	2021-03-16
Webinar: Open Energy DDSP presentation 2021-03-31 slides	2021-03-31
Webinar: Unlocking energy data – an early look at the Open Energy product	2021-04-19
Webinar: Open Energy DDSG — ENA Data and Digitalisation Steering Group 2021-04-30 webinar slides	2021-04-30
Webinar: Open Energy – enabling frictionless energy data sharing for data providers	2021-05-17
Webinar: Energy Digitalisation Taskforce Launch	2021-05-17
Webinar: IEA Wind Task 43 Digitalization in Wind Energy	2021-05-19
Webinar: Hear from our beta users – First reviews of the Open Energy service	2021-06-17
Webinar: Modernising access to energy data to achieve Net Zero – an introduction to the Energy Data Visibility Project	2021-06-23
Webinar: Open Energy presentation to ENA and DNOs [not recorded]	2021-06-28
Webinar: Using Open Energy data to drive the UK's energy infrastructure to Net Zero	2021-06-30
Webinar: Getting on board with Open Energy	2021-07-26
Webinar: A Showcase of the UK's exciting energy data visualisations	2021-07-29
Presentation: Open Energy Membership Proposition 2021-2022 [published after report submission]	2021-07-30

Appendix D: Other related meetings, events or dissemination activities

Below is a list of blogs, interviews, consultations and podcasts disseminated during the project.

Title	Date
Blog: Open Energy gets UK Government backing	2021-02-03
Interview: How can data sharing help deliver net-zero? - Finextra TV	2021-02-10
Blog: Icebreaker One joins Oxford-led green finance group	2021-02-23
Blog: ESG Data for a Green and Sustainable Future	2021-03-16
Blog: An update from the first Open Energy Advisory Groups	2021-04-12
Consultation: Share your Feedback: Open Energy Data Classes	2021-04-13
Blog: Executive Summary: Enabling secure and scalable non-financial reporting and data flows - report	2021-04-28
Blog: How can the structure of our energy markets support the transition to net zero?	2021-04-29
Blog: An update from the April Open Energy Advisory Group Meetings	2021-05-10
Blog: Open Energy in 5 minutes	2021-05-12
Blog: How do the data and climate agendas align?	2021-05-13
Blog: Help shape the future of Open Energy as a beta tester	2021-05-14
Consultation: Share your Feedback: Open Energy Data Access Conditions	2021-05-17
Blog: EDVP Research Sign-up	2021-05-17
Blog: An update from the May Open Energy Advisory Group Meetings	2021-05-28
Blog: Call to enter the 2021 EDVP Showcase for Energy Data Visualisations	2021-06-01
Podcast: Local Zero - Smarts, data and digitalisation	2021-06-02
Blog: Three Energy Data innovation calls — act now	2021-06-03
Consultation: Share your Feedback: Open Energy Data Licensing Model	2021-06-10
Blog: Mapping the Energy Data landscape	2021-06-15
Blog: Notes from the first Data Standards Advisory Group	2021-06-16
Speaker engagement: Turing's Environment & Sustainability Interest Group	2021-06-21

[event](#)	
Blog: [Six things to know about Ofgem's plans to help the energy sector use data better](#)	2021-06-24
Blog: [An update from the June Open Energy Advisory Groups & Steering Group Meetings](#)	2021-06-30
Blog: [For the sector, by the sector: a summary of the March-June Open Energy Advisory Group meetings](#)	2021-06-30
Media coverage: [Energy data-sharing beta test aims to help the UK move to net zero - Smart Cities World](#)	2021-07-06
Blog: [Notes from the second EDVP Advisory Group meeting](#)	2021-07-07
Blog: [Outcomes of Open Energy Phase 3 Policy Consultations](#)	2021-07-15
Speaker engagement: [KTN - Smart local energy systems: unlocking net zero](#)	2021-07-19
Blog: Open Energy Operational Guidelines [published after report submission]	2021-07-29
Blog: July AG/SG update and summary [published after report submission]	2021-07-29
Blog: Open Energy for DNOs [published after report submission]	2021-07-30