MERLIN

Modelling the Economic Reactions Linking Individual Networks

Annex B

MERLIN Project Scale-up Activities and Plans

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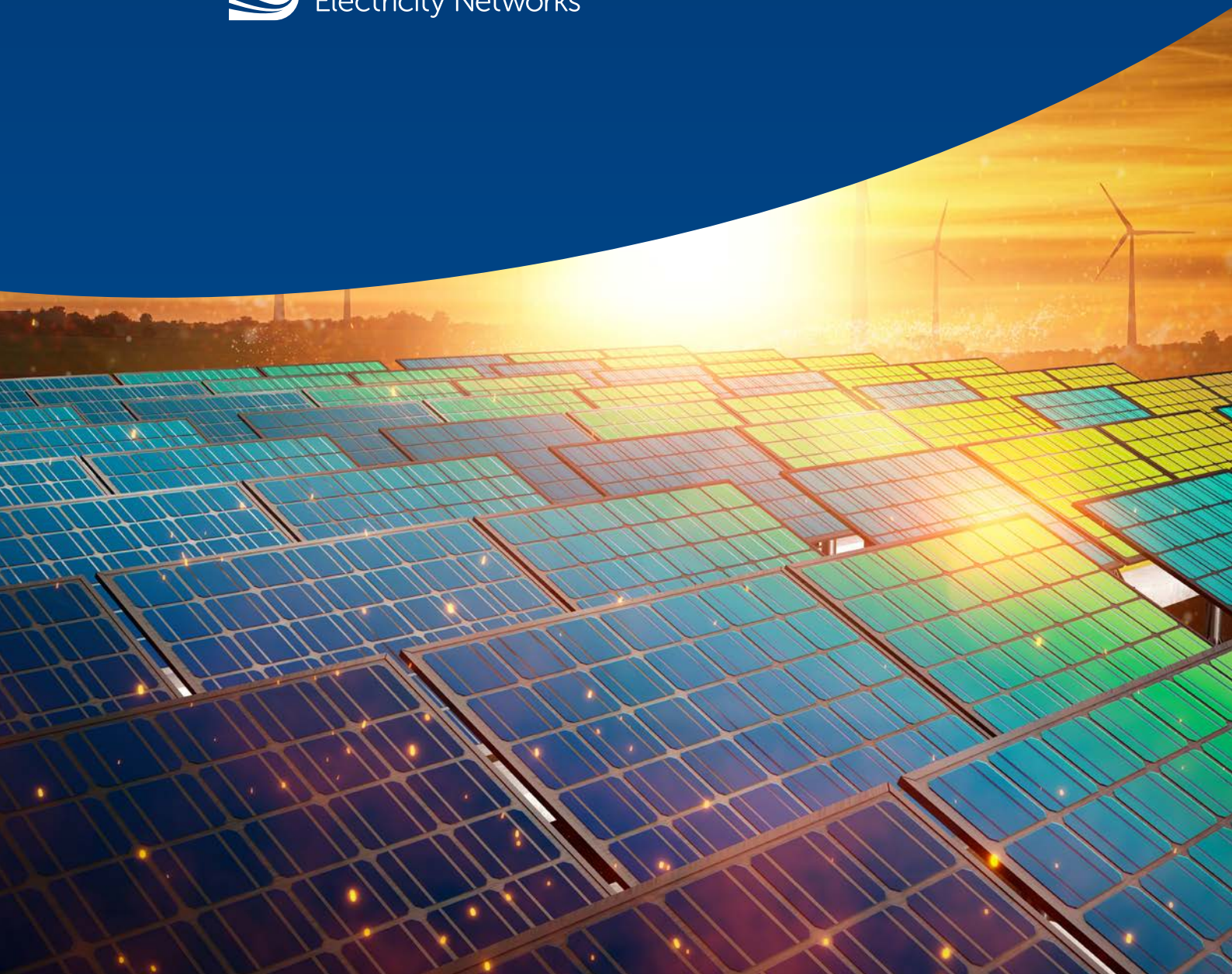

This report provides an overview of the scale up activities and future plans of the three tools developed within the MERLIN project.

1. Overview of the Team's Scale-up Activities and Plans

GridOS Integrated Distribution Planning (IDP)

MERLIN developed the IDP tool so that it could be used on UK networks, and with the additional economic functionality added it can now also perform techno-economic analyses. The tool is now moving from running simulation based analyses in MERLIN to conducting operational based analyses as part of the **TRANSITION** project. It is being utilised to provide a close to real time network model that will be utilised by our Control Room / Operational staff to track the impact of flexible services on the network. To become operational-ready the IDP tool needs to ingest significantly more data close to real-time. This requires development to process additional data sources and API's to both receive the data and send completed models onto other systems. Some of this development will occur during the TRANSITION project, but we expect additional development will still be necessary as this field evolves.

GridOS Transactive Energy (TE)

MERLIN developed the TE tool so that it could be used in the UK and to align with the flexible services recognised by the Energy Networks Association (ENA). This tool has moved from simulation and testing within MERLIN to operational use as part of the TRANSITION and **LEO** projects. To become operational-ready the tool needs to connect with other tools, both internal SSEN tools and external third-party tools. GridOS TE will also be trialled using flexible service providers, where it will be able to determine changes in power-flow caused by the provision of services.

Cimphony

MERLIN developed this tool so that it could import a variety of network data types and combine them into common information model (CIM) format utilising machine learning algorithms in order to build complete network models. We utilised point-in-time data i.e. data that was available at point of download date/time build these models. The next steps for Cimphony is to utilise APIs to obtain data near real-time and provide this as 'open-data' for third parties to make use of, which is taking place within the **NeRDA** project. NeRDA is only making power data available, which means there is still a need to make the additional data available. This additional piece of work is planned for RIIO-ED2 as part of our **Digital Strategy**.

2. Team's Scale-up Activities and Plans

2.1 Partnership(s)

GridOS IDP

Core technology partner:
Opus One Solutions

Potential adopters:
SSEN and other Distribution Network Operators (DNOs) within the UK and globally.

Future partnerships:
Future partnerships: SSEN has adopted the GridOS IDP tool within the TRANSITION project. It is being used to provide network modelling and flexibility simulation within the TRANSITION project to support the decision to trial flexibility markets in the same area. The tool is also being utilised by several distribution network customers in North America to support similar decision-making.

GridOS TE

Core technology partner:
Opus One Solutions

Potential adopters:
SSEN and other Distribution Network Operators (DNOs) within the UK and globally.

Future partnerships:
SSEN has adopted the GridOS TE tool within project TRANSITION. It is being used to provide the core functionality that enables flexibility market operation within the Oxfordshire area. The GridOS TE tool supports several Distribution System Operator (DSO) functions, including neutral market facilitation and whole system coordination.

Cimphony

Core technology partner:
Open Grid Systems (OGS)

Potential adopters:
SSEN, other Distribution Network Operators (DNOs) within the UK and globally and energy industry application developers.

Future partnerships:
SSEN has adopted the Cimphony tool within the NeRDA project. It is being used to manage as-built network and real-time data for public consumption as part of the Open Energy Data initiative. SSEN has also expressed interest in using the tool as part of its Digital Strategy to manage planning network data for internal and external stakeholders. The tool is also being utilised by Norwegian Water Resources and Energy Directorate (NVE), the Norwegian Regulator, to manage network data from the transmission system operator and from the 120+ DNOs in Norway. The software is also an integral part of the industry leading Active Network Management software deployed at multiple utilities.

2.1.2 New partnerships

GridOS IDP: No further partnerships are required by the core technology partner to develop or commercialise the solution as GridOS IDP was licensed to SSEN for the purposes of Project MERLIN, not developed as a result of the project.

GridOS TE: No further partnerships are required by the core technology partner to develop or commercialise the solution as GridOS TE was licensed to SSEN for the purposes of Project MERLIN, not developed as a result of the project.

Cimphony: None required, the technology is now developed and ready to implement.

2.2 Scale-Up Solution and Value Proposition

2.2.1 Intellectual Property (IP) Strategy

GridOS IDP: GridOS IDP is a proprietary technology developed by Opus One Solutions and licensed to SSEN to facilitate specific learnings and outcomes in Project MERLIN. Opus One have licensed the application of GridOS IDP in the MERLIN project region following the completion of the Project for a period of two years. The project learnings and dissemination that relate to using GridOS IDP and applying it to SSEN's network investment planning have been shared both within the SSEN team and more widely across the industry. SSEN and Opus One have a partnership to expand on the learnings of Project MERLIN through Project TRANSITION, which will continue to use the GridOS IDP Product.

GridOS TE: GridOS TE is a proprietary technology developed by Opus One Solutions and licensed to SSEN to facilitate specific learnings and outcomes in Project MERLIN. SSEN and Opus One have a partnership to expand on the learnings of Project MERLIN through Project TRANSITION, which will continue to use the GridOS TE Product.

Cimphony: The software is a commercial, closed-source platform developed by and owned by Open Grid Systems. In common with most modern software systems, open source libraries are used within the software and all are used under their standard, open source licenses. None of the source code or IP for the Cimphony platform owned by Open Grid Systems is made available to third parties under an open source license.

Some modules, such as the geographical visualisation, make use of third-party services, notably Mapbox, to provide background data (geographical data and satellite/aerial imagery). These services are used under a commercial license.

Open Grid Systems strategy moving forward is to maintain the software as a closed-source, commercial offering, with customers offered licenses to operate the software themselves, or to procure the software as a service from Open Grid Systems.

2.2.2 Forward-Looking Impacts of the Solution

GridOS IDP: In wider industry discussions, the ENA Open Networks Project identified there was an evidence gap where DNOs could assess the economics of flexibility services. GridOS IDP was used to provide techno-economic analyses in support of grid planning that includes options to use flexibility. This allowed SSEN to simulate multiple scenarios (i.e. worst case, best case, base case, etc.).

At scale, this capability enables all DNOs to have a complete understanding of where flexibility options may provide an economic alternative to grid reinforcement. It also allows DNOs to undertake a risk assessment by evaluating flexibility under a wide range of scenarios. This benefits the DNOs through whole system efficiency in long-term decision-making and can also provide transparency to how reinforcement decisions are made. For example, the ENA's recent Common Evaluation Methodology tool can benefit from the outputs of GridOS IDP. This allows the industry to better understand the available market size for flexibility in different regions, which can serve as an investment signal.

GridOS TE: In Project MERLIN, GridOS TE was used to simulate market participation methods as well as to assess both the economic value of a flexibility market as an alternative to network reinforcement and the potential reduction in carbon emissions through use of a flexibility market. Simulating a market in this manner allows SSEN to understand both the associated cost, as well as the reliability of participants when running such a market. The results from the simulation will also be used to empower prosumers to better understand the economic viability of electrification of assets such as vehicles and heating systems, and in turn generate new business models around those resources amidst changing regulations. Similar to GridOS IDP, the outputs from GridOS TE can provide price signals to flexibility service providers regarding the relative investment case for developing future services.

Cimphony: Cimphony is a scalable, model-driven data management, analysis and editing platform. Open Grid Systems has already demonstrated the flexibility of the system which has been used as:

- Data management and integration module in real-time control systems as part of the Active Network Management system from ZIV Automation.
- Customer outage reporting and notification for SSEN's PowerTrack mobile Apps and Website.
- Network data management for multiple network operators and utilities to support the management of planning and operational models in a standard form.
- Real-time situational awareness including network generation/demand-response visualisation for ANM and real-time lightning strike monitoring.

Looking forward, utilities are moving towards procuring Software as a Service (SaaS), so Open Grid Systems can offer more cloud-based services over traditional software licensing. Open Grid Systems has already provided BAU SaaS solutions to some clients, and the expectation is that there will be more demand for this as companies embrace cloud systems and SaaS.

This requires investment in expertise on solution and cloud architecture, and security to ensure managed, public-facing services can scale and are secure. This differs from the solution for MERLIN that was hosted on a combination of internal, private cloud systems, and public cloud systems.

The push for open data and standardisation within the UK electrical utilities will provide many benefits to end users, and Cimphony is intended to support this by providing the utilities a platform to convert, integrate and expose planning and real-time data to end users. This requires working with external stakeholders, the regulator, and utilities to understand data requirements and restrictions as well as the technical interface and data requirements of third-party users.

2.3 Business Model(s) and Commercialization Readiness

2.3.1 Business Model(s)

GridOS IDP: The target market for GridOS IDP are distribution network utilities and local authorities, specifically planning departments. GridOS IDP can support both target market segments in long-term planning, providing the tools necessary to shape outcomes such as community and distribution level future energy scenarios, which are a regulatory requirement from DNOs in GB.

The long-term business model for GridOS IDP is to provide technology licensing (or Software-as-a-Service) to both target customer groups. Given many of our customers are early in their journey towards Distribution System Operator (DSO) functions or Smart Local Energy System functions, we also support customers through upfront implementation services. These services including data conversion, project management support, energy market design, custom development, training and third-party stakeholder engagement. Our revenue streams include an implementation cost at the start of an agreement, with an annual licence fee following full implementation. The licence fee is dependent on the number of users of GridOS IDP within the organisation. As smart energy systems mature, we expect the industry to converge on standards that will allow us to offer direct SaaS services in the medium term. This implies that our revenue structure will change as the proportion of revenue from licence fees will eventually overtake implementation fees.

Our solution supports long term investment planning in regulated energy markets, which includes North American distribution utilities and local municipalities, UK/EU distribution network operators, local authorities and other regulated markets such as Japan, Australia, Singapore and New Zealand. In these geographies, our current competitors are utilities' own planning departments, which often commission one-off network investment reviews timed according to regulatory reviews. These departments are often assisted by energy market advisory firms. Our competitive advantage through the provision of a software service is for more regular investment planning. This is also driven by customer need; as the grid becomes more dynamic and volatile due to the changing nature of DERs, investment planning can no longer be considered a static function that occurs every few years. GridOS IDP also supports a number of other functions, including supporting transactive energy or flexibility markets (see GridOS TE section below).

Costs include implementation costs, which are associated with the upfront implementation services. This includes additional project management and development resources associated with providing customers support in initial pilot and implementation. We expect to operate a cost recovery model on these costs. For technology service costs, this includes the ongoing support and maintenance costs (personnel costs), as well as Opus One's own software licensing and hosting costs for cloud services. We anticipate that as the industry is beginning to explore smart energy system operations, implementation may be undertaken on an investment basis, with cost recovery beginning in year 2-3 after the deployment of the GridOS IDP license.

Implementation costs are subject to industry changes, such as changing regulation, data standards, and distribution network reporting requirements. These may impact the magnitude of customisation and implementation support upfront. As a mitigation measure, we would seek to continue to price our services on a cost recovery basis. Our licence revenue is subject to the risk of a lower cost or more competitive entrant; our product strategy remains to continue to innovate and demonstrate customer value through evolving and expanding the feature set to meet changing needs.

GridOS TE: GridOS TE targets the same customer group and general revenue and cost structure as GridOS IDP (distribution network utilities and local authorities, specifically planning departments). GridOS TE facilitates flexibility market simulation and operation; competitors include other flexibility procurement platforms, such as Piclo or Nodes in the UK, with the distinction being that GridOS TE operates a market to schedule resources as well as procure contracts from those resources. To procure flexibility contracts as well as schedule those contracts in operations, GridOS TE gives the user the option to either:

- Perform security constrained economic cost minimization analyses that select contracts and dispatch those contracts based on power system constraints and load and generation forecasts to minimise costs to both contract for services and provide services in operations.
- Perform economic cost minimization analyses that select a user or system-determined quantity of flexibility from contracts, and then dispatch those contracts based on the same analysis in operations.

Project MERLIN makes use of the first set of functionality but omits the dispatch element.

In real-time operations (e.g. under 5 minutes), distribution networks may also seek direct device control solutions through DERMS, which would be considered an indirect competitor to GridOS TE, or a complementary technology. In some live deployments, GridOS TE generates dispatch set points that are communicated to end devices through a DERMS platform. Both the market operation and contract procurement functions in GridOS TE may be used with or without power flow analyses.

Revenue and cost structures for GridOS TE are similar to those of GridOS IDP (licence fees, implementation costs, maintenance costs). The revenue risk of customisation for GridOS TE are slightly higher, as many distribution network operators are trialling a wider range of flexibility service designs. We will continue to mitigate these risks in the same manner as GridOS IDP (price services on a cost recovery basis).

Cimphony: This project has reinforced Open Grid Systems' assessment that there is a requirement for network data conversion, integration, and management within distribution utilities. The project highlighted the disparate data sources, the benefits that could be brought by integrating them, and the challenges in automating this process.

The learnings from this project has allowed Open Grid Systems to refine its roadmap to support the current and longer-term challenges that are being faced by utilities in the UK and across the world. The target market encompasses any company dealing with network data, from large utilities at transmission and distribution, down to small-scale operators, generators, consultants, regulators, coordination authorities, etc. This project has reinforced the need to use standards, support large data volumes, and be capable of performing the role of integrator as well as manager of data.

The primary competitors are other vendors of power system data management software, including large multi-national vendors such as Siemens, General Electric (GE), and DigSilent, as well as Geographical Information System (GIS) vendors such as Esri and GE. The integration of real-time and as-built in a single platform with standardised interfaces and data models provides a differentiator, as the existing solutions are either planning models, or as-built models for operational and historical data stores. The integration of all three offers a unique solution.

The costs cover the ongoing development costs of the software. Timelines are influenced by project and customer requirements. Upgrades are generally driven by customer requests, as well as in-house Research & Development (R&D) and tracking of industry trends. The Return On Investment (ROI) is measured by the company's overall profitability each year as the primary revenue source is software licence sales, services delivered using the same software, then consultancy services to support the integration and conversion of data.

When providing SaaS, the preferred approach is to use established cloud service providers such as Amazon Web Services (AWS) and Azure. This places risks that the costs of the infrastructure will increase faster than the SaaS costs, however, as there are multiple providers and computing costs have historically fallen over time, this is considered a manageable risk.

2.3.2 Commercialization Plans

GridOS IDP: The use of GridOS IDP in Project MERLIN will support a more rapid commercialisation in the UK, where the product is in initial adoption phases. The project provided significant learnings for how to import SSEN's specific network configuration datasets. Many of these learnings mean that future expansion of the service across SSEN's territory will be able to bypass the initial data cleaning process (or can manage this more efficiently). The project also provides a precedent for all GB DNOs on the cusp of RIIO ED2 discussions, where investments in network data transparency and standardisation will be a priority. The project learnings provide an opportunity for industry convergence around data formats that will improve speed of adoption in the future. Opus One and SSEN are in discussions about the role of GridOS IDP as part of RIIO ED2 investment plans. We expect commercialisation will be a feature of RIIO ED2 as all other networks standardise and open up data, beginning in 2023. Project TRANSITION and LEO will form the basis for SSEN's longer term DSO strategy and Opus One continue to engage with SSEN to develop a Business as Usual (BaU) adoption of DSO principles through the GridOS TE implementation of TRANSITION's Neutral Market Facilitator (NMF) and Whole System Co-Ordinator (WSC).

GridOS TE: GridOS TE was used to simulate flexibility market operation in Project MERLIN. The conclusions from the project directly led to a further collaboration with SSEN in Project TRANSITION, which will extend the GridOS TE capabilities to trial operation of real flexibility markets. The simulation will be extended in this follow-on work through real participation from flexibility service providers. Project TRANSITION and LEO will form the basis for SSEN's longer term DSO strategy and Opus One continue to engage with SSEN to develop a Business as Usual (BaU) adoption of DSO principles through the GridOS TE implementation of TRANSITION's Neutral Market Facilitator (NMF) and Whole System Co-Ordinator (WSC).

Project TRANSITION is a flagship project of the Energy Network Association's Open Networks Project and will inform the DSO strategy for all GB DNOs. Therefore, the use of GridOS TE in Project MERLIN has provided the foundation for wider industry adoption of flexibility markets as BaU.

Cimphony: The project provided an insight into the data landscape of SSEN that would have been difficult to achieve without the scope of the project and collaboration with SSEN engineers. SSEN is typical of many utilities in the UK and abroad so this understanding has been invaluable for ensuring the system will meet the commercial, business-as-usual requirements.

The software is already licensed commercially, however the work on the project has focussed on enhancing the conversion, integration, and analysis of data. The current development sprint is focussed on making the conversion processes configurable, automated, and exposed to customers to allow them to feed into existing batch processes. This sprint is part of an expansion of the Cimphony product to support multi-system data integration and open data access. This began in July 2021 as part of an ongoing project with the aim to deliver this functionality by the end of 2021. This will then allow utility customers to leverage the work undertaken to support their own internal data, and external open data initiatives.

Through the MERLIN project work, new contracts have been secured to leverage the system within an innovation project for exposing near real-time data to third parties. The project has proven to be a valuable reference for the system and is used during presentations to other DNOs in UK and Europe. From this, interest has been expressed in how Cimphony can be deployed to support their own similar efforts.

2.3.3 Scale-Up Team

GridOS IDP: The success of Project MERLIN has meant Opus One is committed to delivering GridOS applications to DNOs as RIIO ED2 approaches. We have expanded our UK footprint to include:

- One Solution Specialist based in the UK to support our Professional Services team in providing ongoing technical support as the UK market expands.
- One Business Development Lead based in the UK to support our Strategy Growth and Marketing team's horizon scanning and engagement with UK DNO opportunities.
- By Q4 2021, we intend to hire a dedicated UK-based Product Manager and Project Manager (2 roles) to support delivery of future projects and ensure user requirements are met. We have engaged local recruitment firms to assist in the search and hiring process.
- By Q1 2022 we intend to onboard a dedicated EU-based Head of Sales to provide market expansion support based off the applications developed in Project MERLIN within Europe. We have engaged local recruitment firms to assist in the search and hiring process.

Based on the work we have done with SSEN in MERLIN and TRANSITION, our intention is to continue to review requirements and continue to expand our UK and EU based footprint into 2022 and beyond.

A number of software engineering and product roles were also recruited in North America to support the rollout of GridOS applications in the UK and EU.

GridOS TE: GridOS TE has the same scale up plan as GridOS IDP.

Cimphony: The team is expanding to include solution architects to support the deployment of Software as a Service offerings, and management of hosted systems. The company is looking to expand now that the pandemic restrictions are being lifted, with a focus on software development and project management. Existing partnerships are continuing, with new partnerships in the US being explored to support the deployment of the software overseas.

2.3.4 Barriers to Commercialization

GridOS IDP: Barriers to the commercialisation of GridOS IDP include the following:

- Non-standardisation of network asset data – recent reviews by ENA suggest that the transition towards standard formats for network data (CIM which is used to ingest data in GridOS IDP) is not yet BAU for most DNOs. The underlying cause of this may be a lack of awareness or training with DNO teams to adopt common data standards. If DNOs require significant implementation effort to import specialised or non-standard network data into GridOS IDP, this may raise the barriers to adoption. Mitigation to this risk would include a convergence towards network data standards (including CIM). Currently the ENA is discussing the adoption of CIM as a standard. Opus One plans to use Project MERLIN to demonstrate the role of standards in removing barriers to GridOS adoption. Opus One also intends to communicate the long-term value of data standardisation through forums such as the ENA.
- Lack of network visibility of DERs – Regulatory requirements are already in place for all GB DNOs to share publicly all DERs connected to their network with a capacity above 1MW (Embedded Capacity Register). This is a significant initiative towards better understanding the available assets on a system and supports more accurate assessments of power flow on the grid. However, DERs under 1MW are not easily obtainable and will be essential for modelling flexibility on lower voltages. As this data is not readily available at the present moment, it acts as a barrier to adoption due to poor network visibility for modelling tools such as GridOS. Opus One intends to socialise the benefits of having accurate grid visibility through forums such as the ENA, using Project MERLIN as a demonstration.

GridOS TE: Barriers to the commercialisation of GridOS TE include the following:

- Regulatory uncertainty around flex markets – Many GB DNOs are trialling different procurement approaches to flexibility, ranging from long-term contract procurement to intra-day trading. A lack of standardisation of services may reduce market liquidity and present a barrier to adoption for market participants, who would need to invest additional integration cost with meeting multiple market requirements. However, there is recent progress around the standardisation of flexibility services, including the ENA's defined service types (Sustain, Secure, Dynamic, and Restore) as well as standardisation of contracting. Other markets may emerge to challenge these service types, in particular if network capacity is to be a traded commodity as an outcome of Ofgem's current access charging review. Opus One's mitigation strategy is to remain engaged in the discussions around flexibility products,

demonstrate integration with existing defined service types, and provide the technical foundation upon which future products (such as potential network capacity trading) can be developed.

- Regulatory uncertainty over the coordination between ESO and DSO – a range of coordination pilots between ESO and DSO dispatch of DERs has been trialled, but no clear standardised precedent has been set. This presents a stranding risk that current GridOS TE functionality will need to be modified to accommodate a new format for market coordination in the future. We expect regulatory direction to be set on ESO/DSO coordination of DER markets in the future, including through Ofgem's current review of Future Systems Operations. Our mitigation strategy is to engage with Ofgem and industry bodies by setting the precedent for coordination through Project MERLIN and related Project TRANSITION.
- Unclear relationships between flexibility markets and alternative control systems – Many GB DNOs have preferred to roll out flexible connection agreements to connecting DERs as a tool for reducing the need for future network reinforcement. These tools may include inter-trip arrangements, Active Network Management, etc. These tools often share a direct asset control feature and there is a risk that future integration of direct control with market solutions may require upfront investment cost and IT asset stranding. This may present a barrier to adoption. While networks may benefit from many of these flexible connection arrangements, third parties in the industry including market participants may see their business cases impacted under current flexible connection arrangements, and there are signs that regulatory discussions are considering how better to integrate active controls as an enabler of flexibility market services in the future.

Cimphony: The major barriers to supply into utilities is around the maturity of the company, certifications (e.g. ISO 9001, 27001), and if there are any requirements on services being provided/hosted locally. Open Grid Systems has worked to obtain its ISO certifications and ensure it can meet the strict requirements placed on suppliers by UK DNOs.

The move towards standardised data is dependent on the utilities continuing their drive for open data and their continued adoption of IEC standards. Any move by the regulator to force utilities to use an alternative format/standard could cause problems as the Cimphony platform is focussed on the IEC standards.

Mitigations for this include engagement with the regulator and network operators to promote the use of IEC standards, and ensuring the platform is flexible enough to support alternative data models and formats.

2.3.5 Research, Development, Demonstration, and Deployment Needs

GridOS IDP: The GB network operators are actively defining requirements to meet their future DSO functions. These discussions include:

- Various ENA Open Networks Project workstreams relating to flexibility products, network planning and data sharing (the Common Evaluation Methodology), whole system planning and data exchange.
- Ofgem's planned review of DSO Governance in 2022, as well as the current review of the role of a Future System Operator (which may include some DSO functions).
- The Access Charging Review related to how DNOs can recover costs of network reinforcement. These discussions are live and will likely impact the future direction of travel of GridOS IDP. Opus will continue to engage with the industry regarding lessons learnt from both Project MERLIN (and follow on work with SSEN) to understand how to advance and adapt features to meet changing requirements.

Opus One also has an additional area of interest with integration with the control room of SSEN and other DNOs. We understand that all DNOs are actively reconsidering their operational systems needs as they transition to include DSO functionality as part of ED2 Business Plans. The operational timeframe presents different challenges for analytics and network decisions. These are considered in the secure and dynamic services in Project TRANSITION. These near real time processes will present the next challenge for business as usual system integration for flexibility markets and studies.

Working on the SSEN's TRANSITION and LEO projects is taking the IDP tool closer to commercialisation as we are able to demonstrate its functionality under live operational conditions. This additional innovation funding has allowed us to further develop the tool to meet these operational requirements. On completion of this project we expect that we will be in a position to meet the needs of DNOs in this field, but are also aware that this area is evolving rapidly so future development will likely be necessary.

GridOS TE: GridOS TE will follow the same requirements as GridOS IDP, shown above.

Cimphony: Undertaking similar projects with other DNOs will help to validate the outcomes from this project and allow Open Grid Systems to validate or reassess its approach based on the data landscape and processes within other DNOs. The system is designed to support both internal and external, public-facing open data sharing.

The work from MERLIN has directly led to an additional contract with SSEN to support the exposure of real-time data as part of the open data initiative. This innovation project will demonstrate the feasibility of providing high volume, low latency data, and identify the challenges and opportunities. Extending these learnings to other DNOs will be key to ensure that any solution developed works across companies within the UK and abroad.

Having demonstration implementations in other countries would be key for highlighting the benefits of a system built on international standards, but for heavily regulated countries would require a delivery partner. Open Grid Systems has undertaken projects in the US and Canada, and licensed software worldwide, but enterprise-level solutions in real-time requires the software to conform with local regulations, constraints on geographical locality of data, and access to sensitive data.

2.4 Next-Stage Financing and Funding

GridOS IDP: Opus One has secured follow-on commercial revenue through the extension of Project MERLIN into related Project TRANSITION, which provides a further demonstration of GridOS functionality. Our wider plan for next-stage funding includes a combination of:

- Further innovation-related rollouts including pilot projects with other GB DNOs – targeting government funding and innovation funding. This is targeted at recovering initial implementation and development costs, as well as establishing a business case for GridOS with new customers.
- Commercial implementations funded directly by DNOs – following the success of Project MERLIN , TRANSITION and in related projects with other DNOs, we are in discussions about large-scale BaU adoption of GridOS. This is targeted at recovering the ongoing customer support and maintenance costs.
- Capital raising through venture capital and strategic investors – building on the existing market traction through pilot projects in the UK as well as abroad, we are capital raising to invest in building out additional GridOS functionality that can support longer-term commercial implementations of GridOS at scale. This is targeted at proactively developing the product roadmap to meet customers' future requirements.

GridOS TE: Our financing and funding strategy for GridOS TE matches our approach for IDP.

Cimphony: Open Grid Systems plans to continue its development of the software using internal development funds. The company does not operate at a loss and uses income from software licensing and services to fund development of products. Since its inception the company has not sought private investment funding, and any government funding has come via project support funding and grants to support new staff from Scottish Enterprise, travel support from Scottish Development International to attend conferences, or the BEIS funding from MERLIN. This project developed the tool's algorithms and our own expertise on working with network data. It has also helped to demonstrate the scalability and maturity of the software and has been invaluable for demonstrating its usefulness to prospective customers.

2.5 Stakeholder Engagement

GridOS IDP: MERLIN has developed Opus One's Power Systems Analysis tool, so it can be used by UK Distribution Network Operators (DNOs). Opus One developed the tool to include cost benefit analysis (CBA) functionality that follows Energy Networks Association (ENA) guidelines.

Throughout Project MERLIN's timeframe, Opus One engaged SSEN and its advisors to benchmark this tool against available alternatives. Furthermore, Opus One solicited their feedback as they used the tool to continuously improve the user journey that enables distribution network operators to engage in flexibility planning in a future state. This feedback loop involves regularly scheduled check-ins around new releases of the tool as well as training on new features. Opus One intends to continue this engagement moving forward.

Opus One included additional functionality proposed by the University of Cambridge, that values the societal costs of utilising flexible services and assists with investment decision making. This integration allows Network Planners to compare both the physics and economic impact of traditional reinforcement and flexible service investment in a single tool.

Opus One utilised the Open Grid Systems Cimphony tool to bring together network data from various sources into the developed tool. By engaging OGS as an industry partner, this project has demonstrated that modelling tasks that take up to a week to complete can now be done at the click of a button. This is an extremely significant step forward, as models can be created and shared instantaneously both within SSEN and to outside organisations.

GridOS TE: Opus One has continued to engage with SSEN on Project TRANSITION, which has led to engaging with other stakeholders including other flexibility market platforms, industry actors, and other DNOs such as Electricity North West (ENW), Piclo, and flexibility providers in Oxfordshire. These stakeholders will engage with SSEN's market trial and their feedback and processes will be considered within the TRANSITION market flow.

Cimphony: We have demonstrated the system and its outcome to other network operators, regulators in the UK and Norway, and multiple end-user customers including consultancies, and system operators in the UK and abroad. This has included presentations at conferences, as well as one-on-one presentations with potential customers at their request. As pandemic restrictions ease, Open Grid Systems plans to demonstrate the software and the outcomes from MERLIN at industry trade events, conferences, workshops, and through industry committees/working groups that Open Grid Systems staff are members of. Open Grid Systems' Managing Director, Alan McMorran, is a visiting professor at Brunel University in London, and through this partnership will engage with academics to further disseminate the learning outcomes from MERLIN.

2.6 Use of the Final Prize

Option 1

Financial Management Tool (FMT) – During Milestone 2 of the MERLIN project a **Requirements Specification** document and a **Solution Architecture** document were created by CGI for the FMT. It is envisaged that an FMT will be required as part of the future DSO functionality architecture to keep track of costs paid to flexible services and provide visibility on optimal traditional reinforcement construction dates. These dates may move forward or backward depending on the rate and amount of costs paid for flexible services over time. Current practice is to manually perform this task on spreadsheets. This is not an issue at present as only a small number of flexible services exist on our network. However, in the future we anticipate much larger numbers of flexible services on our network, which will make current practice impractical and expensive as large numbers of people will need to be recruited to perform the role. Instead an FMT can be created to manage this task with minimal staffing costs.

Potential project partners: SSEN, Opus One, University of Cambridge, CGI, Baringa

Note: The above are examples of project partners but it is likely that a tender exercise would take place.

Option 2

Near Real-time Data Access (NeRDA)+ – The **NeRDA** project is providing near real time data via an open data portal. This data can be accessed by Energy Industry participants to help with additional projects, applications, etc. The NeRDA+ project would expand the data currently available and seek to provide it in additional formats. This builds on the work carried out by OGS in MERLIN and will also involve the **LEO** project participants for additional stakeholder feedback.

Potential project partners: SSEN, OGS, LEO Project

Note: The above are examples of project partners but it is likely that a tender exercise would take place.

Option 3

SSEN have a strong track record in innovation, where co-creating technologies with partners and stakeholders is an essential principle of our **Innovation strategy** and our **ED2 proposals**.

Example innovation projects looking at the smart flexible local energy systems to facilitate Net Zero include **LEO**, **TRANSITION**, **MERLIN** and **TraDER**.

If successful, rather than start a new project with the prize money, we could use it to leverage our existing funding to deliver more work on smart flexible local energy systems. This will save significantly on costs and accelerate the transition to Net Zero. This is a similar approach to the MERLIN, TRANSITION & LEO projects i.e. the learnings and technology development from these projects fed into one another to reduce costs and improve project efficiencies vs stand-alone projects.

Examples of leveraging funds to provide increased value include:

- Additional development of the Opus One tools used in TRANSITION, LEO and Hydro Ottawa projects to provide enhanced functionality that was not envisioned at the start of the project, but has now become necessary as the projects have evolved.
- Additional development of the OGS tool used in the NeRDA project to provide enhanced functionality and data access that will be required based on user/stakeholder feedback.
- Providing additional funds to the University of Cambridge to assist with policy research and economic analysis on the TRANSITION and LEO projects.

Potential project partners: SSEN, Hydro Ottawa, Opus One, OGS, University of Cambridge

Note: The above are examples of project partners but it is likely that a tender exercise would take place.

2.7 Other Relevant Information

All learnings have been made public for the benefit of all. To access MERLIN learnings visit https://project-merlin.co.uk

3. Concluding Remarks

Project MERLIN was an opportunity for Opus One and SSEN to collaboratively demonstrate the value of the GridOS IDP and TE tools in the GB energy context. The outcomes of Project MERLIN provided significant learnings on the foundational requirements of the DSO transition.

It cannot be overstated how important it is for DNOs to provide real-time grid visibility in order to effectively manage rising deployment of renewables and Low Carbon Technologies (LCTs). We are seeing strong consensus from the industry around the need for this to be managed through new market solutions such as GridOS as part of the next round of RIIO ED2 Business Plans.

Opus One and SSEN have already provided some extended learnings from Project MERLIN through Project TRANSITION, but there is still significant work to be done. We are currently developing a regional expansion plan based off the initial proposition developed in MERLIN, through both innovation and commercial BaU partnerships with GB DNOs. We are also undertaking capital raising to provide the scale-up resources necessary to deliver on DSO capabilities in line with ED2 timelines.

We expect there to be a number of regulatory challenges in the future, but we are prepared to address these. As highlighted in our response, the regulatory uncertainty and innovation trial nature of our engagement means we are prepared for the role of the DSO to be re-defined and clarified over the coming years. Our investment plans include consideration for these changes. Additionally, the regulatory changes, while unclear in the short term, all point to promising applications for GridOS and similar DSO-enabling technologies in the future. We therefore welcome the general direction of travel of regulation in supporting the DSO transition.

We have already demonstrated the follow-on value of GridOS TE and IDP as our partnership with SSEN continues through a parallel engagement (building off Project MERLIN) as part of Project TRANSITION. However, there is still significant learning and industry engagement required for us to fully scale up the tools developed through MERLIN, which includes other planning and market support functions. We look forward to continuing our partnership with SSEN outside of MERLIN.

The work done on MERLIN to develop OGS's Cimphony tool has led to an additional SSEN contract to provide a SaaS for the NeRDA project. MERLIN has also highlighted several key data challenges affecting GB utilities. Understanding these challenges has allowed Cimphony to develop and improve its modelling algorithms to provide improved services to SSEN and other GB DNOs. OGS have also been selected as a preferred supplier for SSEN's RIIO-ED2 Digital Strategy where Common Information Model CIM) expertise improved through MERLIN is expected to result in further contracts as the digital needs of DNOs evolve.

On a final note, it is important to realise that GB DNOs are fundamentally built on owning and operating electrical assets. The new requirements put on DNOs to continue to service customers while the grid becomes increasingly complex while it's electrical demand also rises means we need to find solutions now to be ready for the future. MERLIN has laid down the foundations by trialling the tools DNOs will need to be ready for this future and provided opportunities for the companies that can help meet these future demands.

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MERLIN
Modelling the Economic Reactions Linking Individual Networks

Scottish & Southern Electricity Networks