Scottish & Southern Electricity Networks

RIIO-ED2 Investment Decision Pack

DSO Management (Optimiser)

Investment Reference No: 29/SSEPD/IT-DSO/DSO_MANAGEMENT

CONTENTS

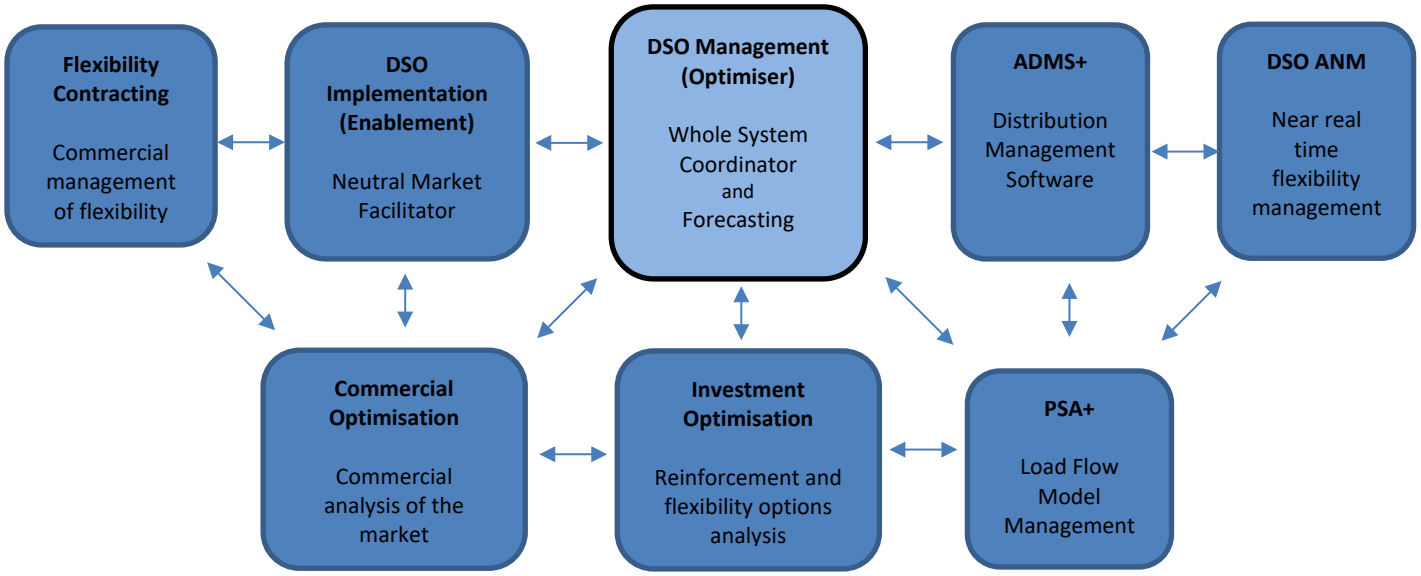
Definitions and Abbreviations	
ADMS	Advanced Distribution Management System
ANM	Automated Network Management
BPDT	Business Plan Data Table
CAPEX	Capital Expenditure
CEG	Community Energy Group
CI	Customer Interruptions
CIM	Common Information Modelling
CML	Customer Minutes Lost
CMZ	Constraint Managed Zone
DER	Distributed Energy Resources
DG	Distributed Generation
DNO	Distribution Network Operator
DSO	Distribution System Operator
EJP	Engineering Justification Paper
EV	Electric Vehicle
FTE	Full Time Equivalent
IDP	Investment Decision Pack
LA	Local Authority
LCT	Low Carbon Technology
MDM	Master Data Management
NIC	Network Innovation Competition
NPV	Net Present Value
OMS	Outage Management System
OPEX	Operational Expenditure
OT	Operational Technology
PSA	Power System Analysis
SCR	Significant Code Review
WSC	Whole System Coordinator

1. Executive Summary

Flexibility Services and Flexibility Markets are key tools in delivering Net Zero, as they will help to maximise the use of Low Carbon Technology whilst minimising upgrades to the electricity networks. A prime requirement of Flexibility services and Markets will be a system to forecast and coordinate between the network needs identified from DNO systems, other involved Parties such as the ESO and the marketplace. This project delivers the coordination and forecasting facilities.

The DSO Management (Optimiser) investment looks to install a system evolved from the Whole System Coordinator and Forecasting systems trialled in the current SSEN Transition Project.

The diagram below shows the interactions between the key systems outlined in our IDPs related to DSO. It should be noted that these systems and will be integrated with our ED1 investments in our Asset Management Database and Geographic Information System.

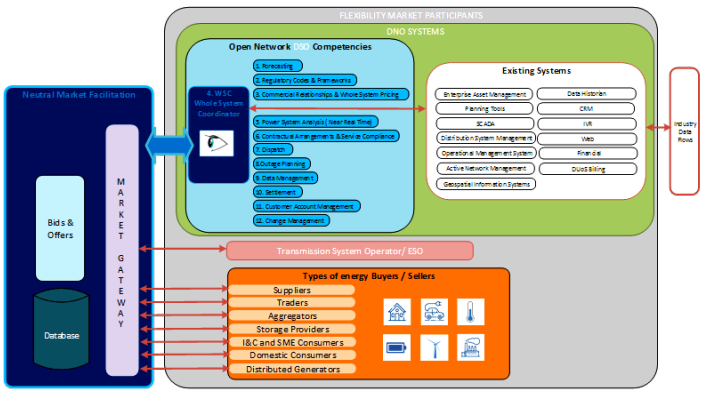


2. Investment Summary Table

Summary Table			
Name of Scheme / Programme	DSO Management (Optimiser)		
Primary Investment Driver	Progress to Net Zero		
Scheme Reference / Mechanism or Category	29/SSEPD/IT-DSO/DSO_MANAGEMENT		
Output References / Type			
Cost (CAPEX)	[redacted]		
Delivery Year	RIIO ED2		
Reporting Table	C4		
Outputs Included in RIIO ED1 Business Plan			
Spend Apportionment	**ED1**	**ED2** [redacted]	**ED3**

3. Introduction and Background Information

RIIO-ED2 will mark a significant change in the Electricity Distribution sector. To deliver our Net Zero aspirations will require a total change in the way we use our energy systems. There will be a move from petrol and diesel cars to Electric Vehicles (EVs), a change from traditional heating to Heat Pumps (and possibly hydrogen) and Distributed Energy Resources (e.g. battery storage and microgeneration) across the network at all voltages. To manage this change would either require significant reinforcement to the electricity networks, or real time management of the network along with some targeted upgrades focused on the most economic mix of these solutions.



Throughout RIIO-ED1 we and other Distribution Network Operators (DNOs) have been engaged in many Innovation projects to determine optimum strategies, processes, commercial arrangements and other changes that will be required. To deliver Flexibility several significant IT and OT system changes will be required. The diagram opposite is the latest iteration of what has been called the 'Eye' diagram and is taken from our Network Innovation Competition (NIC) TRANSITION project that is trialling key IT systems for the changes and articulates the key functions and interactions the project is trialling. The systems trailed in Transition will act as a blueprint for our development for delivering Flexibility. This 'Optimiser' project is concerned with the Whole System Coordinator function (item 4) and how it interfaces with the other elements in the light blue box, as well as our core internal systems, and of course the external market and Stakeholders. It will also include the Forecasting aspects as well as close ties to the Commercial systems that will be required to service the market.

The core function of this system is to define the requirements for the distribution system and validate them. Even under a DSO separation this capability would be important for the DNO to assess the distribution system and asset impact to determine the best lifecycle option to deliver maximum customer value.

4. Business Plan Fit

This project can be mapped to following strategic themes:

Progress to Net Zero	Safe, resilient and responsive networks	A trusted and valued service to customers and communities	Positive Impact on Society
✓	✓	✓	✓

5. Optioneering

This project will need to deliver the functionality described in both the Whole System Coordinator and Forecasting elements of the TRANSITION project, as well as supporting the contracts and settlements area, and the interfaces/links to other DSO and IT/OT systems. An overview of the system design that is currently envisaged to manage the DSO functions is set out on the TRANSITION website (https://ssen-transition.com/wp-content/uploads/2019/11/High-Level-Solution-Design-Summary-v1.pdf). The actual system(s) delivered in RIIO-ED2 will be based on learnings from TRANSITION, and well as other NIC projects including LEO (https://ssen-transition.com/dso/leo/), MERLIN (https://project-merlin.co.uk/) and EFFS/FUSION (https://ssen-transition.com/dso/tef/).

Some of the key elements the tool(s) will deliver are:

- Whole system coordinator functionality, including:
  - User profiles and security levels.
  - Inbound message processing for DSO Enablement, ADMS, Power System Analysis (PSA), Forecasting and Scheduling.
  - Outbound messaging, such as Optimise Constraint Analysis, Hierarchical Constraint Check and Dispatch Negation Check.
  - Viewing of NMF Dispatches and Contracts.
  - Managing WSC Constraints and activating Constraint solutions.
  - Standing data and reporting.
  - Receiving and utilising data from other systems, in particular the current connectivity model, connected loads and forecasts.

  - Near real time details of Peer to Peer trading, and Bi-lateral Contracts.
  - Interactions with the Advanced Distribution Management System.
  - Interactions with the Automated Network Management system.
  - Determining the optimum set of actions to manage potential constraints including evaluating the suitability of flexibility services.
- Forecasting functionality, including:
  - Weather adjusted forecasts for load and generation at different time frames and adjusting these for planned flexibility service despatch to determine the nature, duration and frequency of expected constraints.

    - Creation of load and generation load sets for Power System Analysis to accurately determine the impact of markets load, generation and flexibility providers.
- Ready access to all contract and commercial information.
- Provide output for Investment decision support.
- Be able to use smart meter data (down to premise where we have permission) and LV monitoring for LV Feeder, to aid load and load transfers.
- Allow for analysis, forecasting and cyclic loadings.
- Interfacing with Power System Analysis tools for short-term and near real time analysis
- View existing data, forecasts for varying scenarios, managing risks based on forecasts, 'normal' bands and variances from them.
- Provide income forecasts and weather risk impact scenarios.
- Provide a record of flexibility decisions from investment, to tendering to dispatch.
- Support Open Data, enabling details the contracted capacity deployed to be published.
- Support activation of last resort provisions in market failure, ideally predicting in advance.
- Service access management and selection.
- Be a Market Supervisory System and monitor the health of market participants assets where feasible.
- Use scalable and secure interfaces utilising IEC CIM 62325, 61968 and 61970 for all pertinent interfaces.
- Interact with Power System Analysis tools.
- Support and align with Load Disaggregation Models.

This set of tools represents the largest group of IT and OT changes that we will deliver in RIIO-ED2. Most of the effort and cost will be in the integration with all the other systems, as shown in the 'Eye' diagram, and with security. We need to provide flexible connections and affordable services for encouraging small scale customers with distributed energy resources (DER's) to participate in local flexibility markets. It is also important to ensure that while providing these services system resilience and security is not compromised. Security will be a major consideration, as the tool(s) will need to interface on one side with our Operational Technology (OT) systems, which are in a cyber secure zone, and on the other side with external systems (e.g. the internet) to allow the market to participate. Security is also an important given the potential impacts of the Access SCR 'minded to position' where both an increase of temporary flexibility could be expected as well as the need to closely monitor, forecast and manage levels of curtailment will likely be required across a greater range of connected assets.

With the trials underway in the TRANSITION project, this will provide robust tests to ensure integrity of our designs. However, whilst at some stage in the future the tool(s) may allow limited autonomy of control (through ANM or similar), for RIIO-ED2 we currently anticipate that the tool(s) will be advisory only in terms of our OT systems. We also do not anticipate any direct control of market participant assets during the period, other than in very specific arrangements agreed between us, the market participant, and other key bodies, notably the ESO.

5.1.1 Alternative Options

As the driver for this project is forecasting and coordinating the increasing Flexibility Market in near real time, doing nothing is not an option.

Due the number, complexity and speed of the decisions that will be needed to manage the Flexibility Market, a non-IT based solution (i.e. an increase in staff) would not be viable. This has been borne out by many international deployments of such systems, and in the on-going UK Innovation projects and trials. The manual alternative set out would therefore only be a partial alternative, as the reduced speed of response would mean that Flexibility could not be optimised.

The proposed solution has been based on the best value IT solution that is currently available. However, given the pace of IT development, the market will be re-examined at project commencement to ensure the best value solution at that time is chosen for delivery.

6. Stakeholder Evidence

Much of our stakeholder engagement for DSO has been through Open Networks as this is where we have been putting forward the industry position to gain stakeholder feedback in a consistent and efficient way for the industry. There has been strong support for initiatives relating to DSO Management such as the 'Common Contract' pointing towards have a consistent and easily understood interface to engage with flexibility is important.

There is a wide acceptance throughout the industry that the efficient use of flexibility is critical to enable the path to net zero in a cost effective way, moreover a desire from several stakeholder groups access the benefits of effective flexibility markets. In our ***Digital Investment Plan (Annex 5.2)*** we run through our stakeholder evidence and triangulation in detail.

More details of overall stakeholder engagement are set out in the ***Digital Investment Plan (Annex 5.2)***

7. Analysis and Cost

Costs have been built up using a bottom up approach and have been based on the best currently available solution. The IT options in this area are rapidly changing, so the market will be re-examined prior to delivery, and the best value option to meet the requirements set out above will be chosen. The project has been assessed over a 5-year lifecycle, with Opex requirements and Benefits equated for that operational period, as IT solutions often need updating after 5 years. NPVs of both 5 and 45 years have therefore been quoted below.

7.1 Cost Profile

This project has the following cost profile and will be delivered as a series of sub-projects, some waterfall, other's iterations. The CBA assumes that the benefits set out in section 7.2.1 become a cost in alternative option, as set out in CBA guidance: this is undoubtedly a conservative approach. The full build-up of costs is contained in the ED2 IT Investment Plan (Non-Op Capex) Cost Estimate spreadsheet.

	Total £'M	2023/24 £'M	2024/25 £'M	2025/26 £'M	2026/27 £'M	2027/28 £'M
CAPEX	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]
ED2 OPEX	[redacted]					[redacted]
ED2 Benefits	[redacted]					[redacted]
5 Year OPEX	[redacted]					
5 Year Benefits	[redacted]					
NPV 5 Year (Recommended Option)	[redacted]					
NPV 45 Year (Recommended Option)	[redacted]					
NPV 5 Year (Partial Alternative Option)	[redacted]					

NPV 45 Year (Partial Alternative Option)	[redacted]					

7.2 Benefits

7.2.1 Financial Benefits

Benefits are shown for the first 5 years after the project is implemented.

	Total	Year 1	Year 2	Year 3	Year 4	Year 5
Better understanding of system requirements to limit over-investment and unnecessary procurement activities. The cost of contracts in ED2 are estimated at £22.5m. The efficient management of the network using the Optimiser tool is expected to reduce the contracted value by 20%, giving a total ED2 saving of £4.5m.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Avoid 16 additional staff by the end of ED2 needed to optimise flexibility for 90,000 transactions over the period (building over time). SS08 rate used.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
25% of the benefits achieved using PSA+, as that system cannot operate without the Management tools. The cumulative CMZs in ED2 is estimated at 500, staring at 140, then 200, 280, 380 and finally 500. Each CMZ takes an estimated 6 weeks to manually set up in a Power System Analysis (PSA) tools, and 9 weeks a year to maintain, especially changes to switching, etc. This would mean that a lot of additional specialist FTE would be required (initially 33, then 47, 65, 88 and finally 114). Using the SS08 staff rate this gives a total avoided cost of £27.83m. PSA cannot operate without the Optimiser tools, therefore 25% of the related	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

avoided cost has also been attributed to this project.						

This project is fundamental to the Flexibility market. It will negate the need for system reinforcement, that without the Flexibility Market would add over [redacted] during the period. We estimate that that there will be 1500 flexibility contracts through the ED2 period, and these will defer a range of reinforcement projects, but often the more expensive options on our Primary system or even our undersea cables. The projects range from [redacted], with an average of circa [redacted]. This project will be a fundamental support for the Flexibility Market and will both limit over-procurement and support optimal investment.

DSO Management also gives significantly better insight to the specific requirements we have on our network more generally. It helps reduces any short-term system overloading risks and assists the quick and decisive options to be presented to control engineers when a circuit trip occurs. This in turn helps to serve our customers better and will lead to improvements in Customer Minutes Lost performance. The Carbon Trust and Imperial College London has identified between £17-40bn of benefits for the wider economy form a "smart more flexible energy future" which referenced in Ofgem's and BEIS's report on Upgrading Our Energy System. Having a functioning marketplace platform is fundamental to enabling local flexibility and this customer benefit.

Flexibility gives the opportunities for other benefits; for example, CO_2 can be saved through reduced use of mobile and embedded diesel generation. Our Resilience as a Service NIC project is specifically investigating the implementation of this.

Using flexibility reduces our OPEX and limits amount of CAPEX that needs investing. This enables us to financially optimise our solutions to support our resilience in storms enabling more customers to be returned to supply sooner, reducing Customer Minutes Lost. We can then focus on efficient running of our network outside a storm situation.

As discussed in our main DSO IDP, the overarching benefits of DSO in addition to TOTEX savings are:

- Increase in network resilience.
- Optionality value.
- Reduced losses.
- Reduced time to connect.
- Increase in renewables.

The capabilities and tools provided by DSO Management will enable SSEN to operate smarter. Without them Distribution System Operation is not possible, as articulated above the broader benefits are significant. Even if SSEN is not undertaking Distribution System Operation itself, much of this investment is necessary to share the information required to optimise the benefits which a low carbon system will bring.

7.2.2 Non-Financial Benefits

The main non-financial benefit is the value for customers this development will bring by facilitating effective user-friendly market flexibility and the related opportunities for all parties. A development of this nature will time trouble and costs experienced by customers and help mitigate other impacts, e.g. reduction in the related environmental footprint.

7.2.2.1 Foundation to other Projects/Initiatives

These tool(s) will be the foundation for DSO working. Without the ability to analyse the forecasts and the device the required services we will be unable to realise the benefits from flexibility services. This capability will underpin the Flexibility Market.

Our suite of DSO projects all rely on each other to create an optimised and holistic approach to DSO. If any one of these are not delivered our DSO capability will be impeded as will our ability to deliver maximum customer value.

7.3 Key Assumptions

The current programme and costings assume that all planned RIIO-ED1 system changes, in particular the upgrade to PowerOn Advantage and our Connectivity+ project, will be complete before the start of RIIO-ED2. If some of the current planned application changes are not completed, this will increase the complexity, and hence cost and timescale, of this project.

We are also assuming that all the learnings from the various NIC projects listed above will be available by the start of the RIIO-ED2 period. Later delivery of those projects would delay the implementation of these tools.

7.4 High Level Dependencies

This project will rely on the Connectivity++ project to ensure all customer connectivity is accurate.

The project will also be part of a major process and culture change within our organisation, so appropriate provision has been made in the costings for this work.

The project is reliant on several innovation projects, notably TRANSITION, to inform the requirement specifications.

7.5 Deliverability & Risk

Our ***Ensuring Deliverability and a Resilient Workforce (Chapter 16)*** describes our approach to evidencing the deliverability of our overall plan as a package, and its individual components. Testing of our EJPs has prioritised assessment of efficiency and capacity, and this has ensured that we can demonstrate a credible plan to move from SSEN's ED1 performance to our target ED2 efficiency. We have also demonstrated that SSEN's in house and contractor options can, or will through investment or managed change, provide the capacity and skills at the right time, in the right locations. This assessment has been part of the regular assessment of our EJPs, IDPs and BPDTs. Our ***Deliverability Strategy (Annex 16.1)*** and ***Supply Chain Strategy (Annex 16.2)*** are included in the Business plan Submission

Our deliverability testing has identified a major strategic opportunity which is relevant to all EJPs.

- In ED2 SSEN will change the way Capital Expenditure is delivered, maximising synergies within the network to minimise disruptions for our customers. This is particularly relevant for a Price Control period where volumes of work are increasing across all work types.

- The principle is to develop and deliver Programmes of work, manage risk and complexity at Programme level and to develop strategic relationships with our Suppliers and Partners to enable efficiency realisation.

8. Conclusion

The project will deliver the critical Whole System Coordinator and Forecasting functions, without which the development of a Flexibility Market (wherever it is hosted) will be impeded. Manual alternatives would not deliver the speed or control necessary for such rapid market interactions and would prove to be expensive over time due to the extra manual resources needed to meet customer expectations. SSEN is keen to introduce these developments and help facilitate the sector changes needed to accommodate our low carbon future and provide greater value for customers.