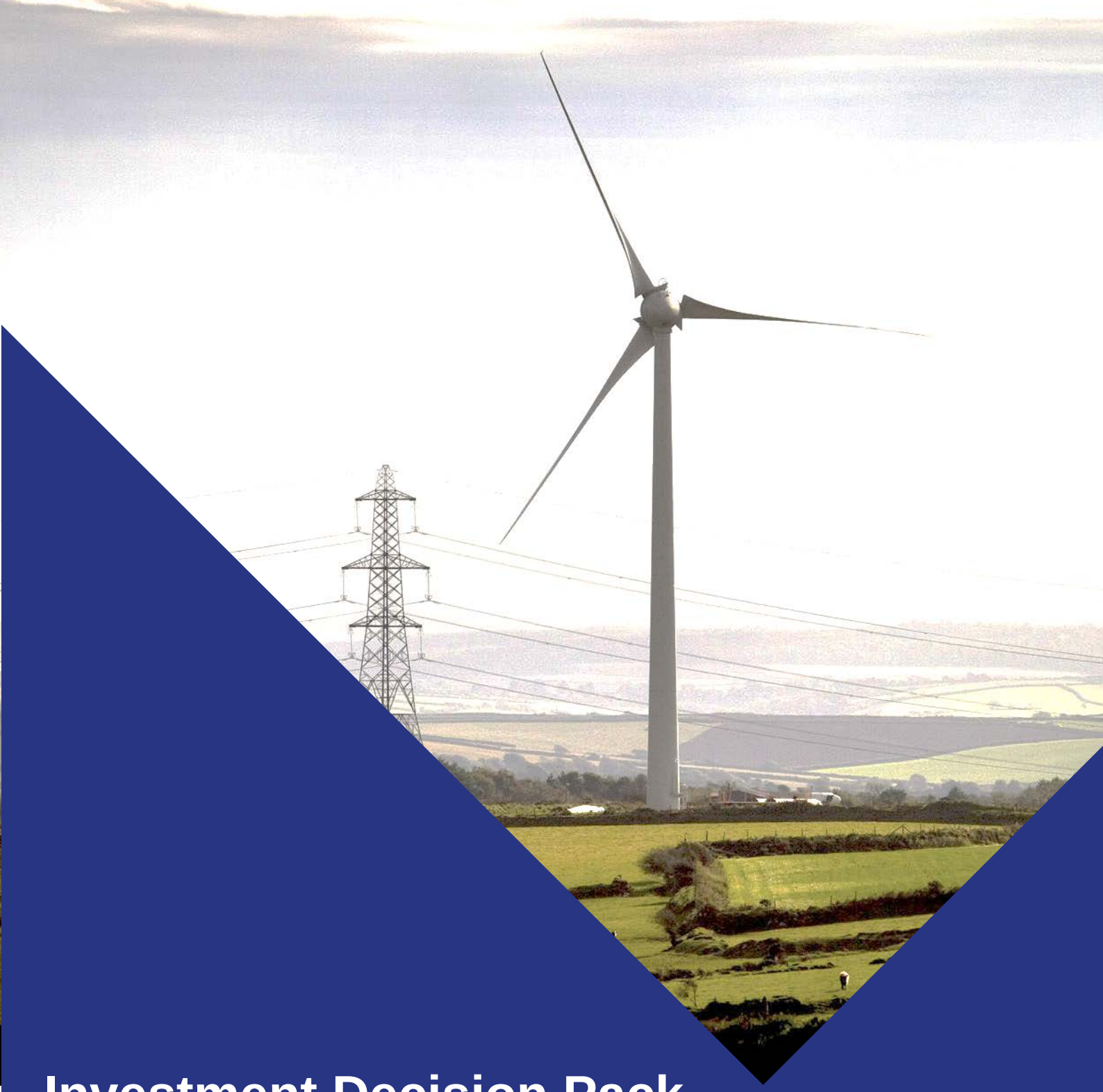


Investment Decision Pack
NGET A14.13 IT Transform
December 2019

As a part of the NGET Business Plan Submission

nationalgrid

Engineering Justification Paper IT Transform Investments			
Asset Family	*IT System*		
Primary Investment Driver	Collection of IT investments that explore the value of emerging technology in reducing costs for consumers and delivering a safe and reliable network		
Reference	A14.13		
Output Asset Types	*IT System*		
Cost	*£18.2m (ET share – some systems are shared with other functions)*		
Delivery Year(s)	*2021-2026*		
Reporting Table	D4.31		
Outputs included in RIIO T1 Business Plan	*NA*		
Spend Apportionment	**T1**	**T2**	**T3**
	NA	*£18.2m*	*NA*

Contents

Executive Summary

Our IT strategy has been created in response to the needs of our stakeholders, particularly on the need for a safe, reliable and resilient network. However, we must also think beyond traditional solutions to minimise costs through innovation and emerging IT technology. For example, in RIIO-T1, investments in our data and analytics capabilities underpinned our advanced asset condition monitoring techniques and the resulting safety, cost and reliability improvements.

This paper contains the collection of ET's IT 'Transform' investments proposed in the next regulatory period. The characteristics of these investments are:

- No existing capability or infrastructure
- Potential fluidity in timing, demand and technological maturity of investment

We identified and analysed options across 13 core IT capabilities. We did this against overall total cost of ownership, business strategic fit, the extent to which the option meets customer's needs, an overall risk perspective and National Grid's capacity to deliver. From this analysis, we have recommended a plan with investments totalling £18.2m that:

- Caters for the evolving needs and expectations of our customer and stakeholder groups
- Explores emerging technology or capabilities most relevant to the transmission business

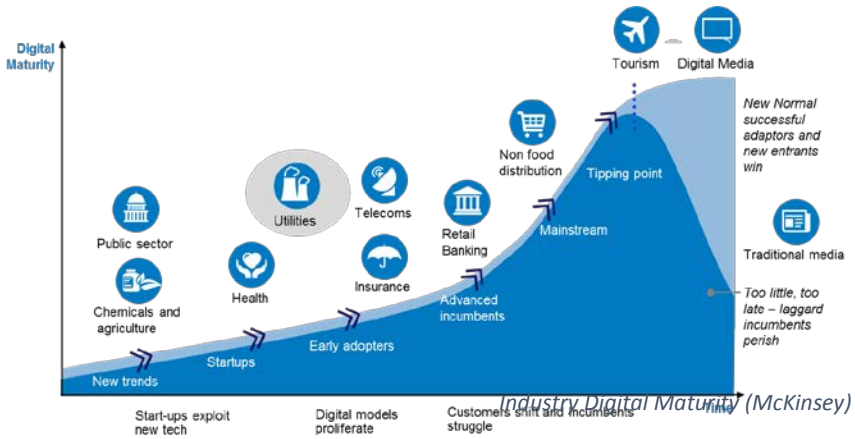
We have reviewed our investment plans internally, and asked Gartner to challenge how we plan to execute our strategy efficiently, and all investments benchmarked within the peer group range of Gartner's independent assessment.

In RIIO-T1 we have seen cost savings and consumer benefit from digitalisation. For example, our piloting of Artificial Intelligence on aerial asset images[1] has allowed us to reduce the cost of managing the approximately 7,200km of overhead lines. This highlights the benefits of BAU innovation and these efficiencies flow through our RIIO-T2 plan.

These investments are a key part of our digitalisation strategy and are entirely consistent with the recent Energy Data Taskforce proposals. Whilst we expect to see some efficiencies from these investments in RIIO-T2, it is unlikely that all of these investments will deliver a return for the consumer within the regulatory period. On this basis, we propose funding these initiatives through the Network Innovation Allowance (NIA), with a 10% contribution from ourselves, to deliver benefits in T2, T3 and beyond for the whole energy system.

Introduction

Electricity Transmission has made significant progress in RIIO-T1 towards leveraging new and emerging technology to reduce costs for consumers and deliver a safe and reliable network yet it is, along with the Utility industry as a whole, at an early stage of digital maturity. As we look ahead to the next regulatory period further changes in technology will offer further benefits and challenges. The competition for Customers is shifting to digital channels, the Industrial Internet of Things promises new ways of managing our assets and the opportunity for a modern digitalised energy system offers new ways of maximising the value of data.

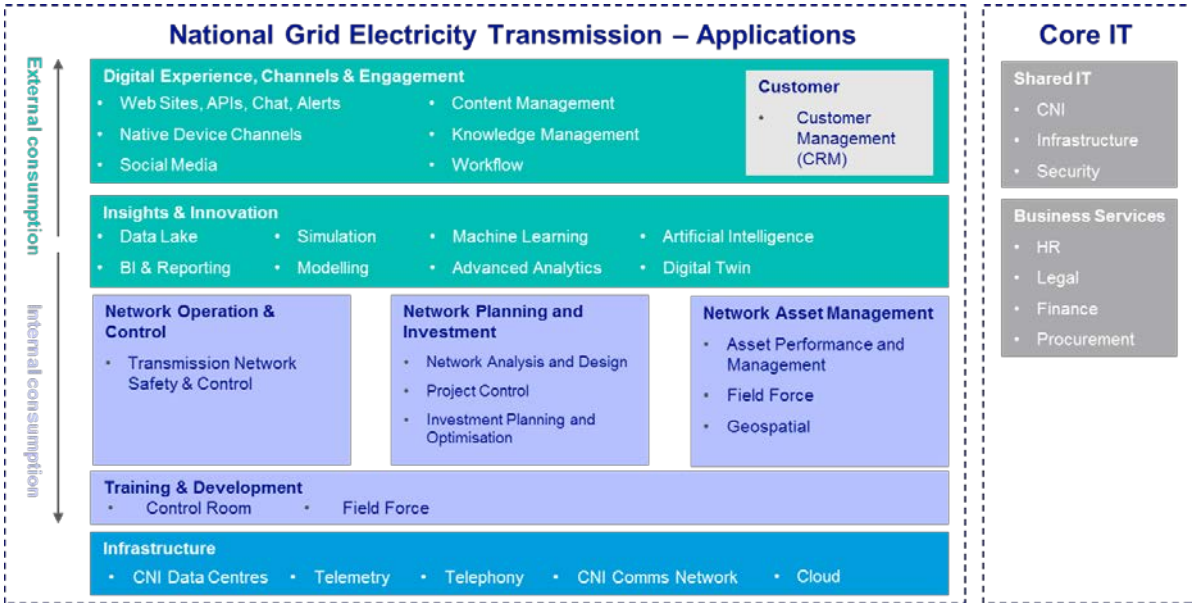


Industry Digital Maturity (McKinsey)

[1] https://www.theguardian.com/business/2018/dec/02/ai-and-drones-turn-an-eye-towards-uks-energy-infrastructure

To take advantage of these developments, we will need to invest in addition to our asset health driven investment in IT systems and this paper summarises those investments. As with our Asset Health investments we will constantly review opportunities to consolidate and simplify our current IT systems and infrastructure and in the lead up to each investment we will conduct a detailed assessment of the need, benefit, solution options and delivery approach.

The diagram below shows our IT architectural landscape, with each box representing the key platforms for Electricity Transmission. A platform is a group of technologies that work together to provide a basis to build applications or services to meet multiple needs. The majority of investment in these platforms is in the Asset Health justification report A14.12.



ET IT Architecture

Our digital strategy and resulting investment and roadmaps are built around four focus areas, Field Force, Asset Management, Grid Operations and Customer and each initiative is linked back to a stakeholder priority. The figure below details the key initiatives in each area and the resulting investment is across IT Asset Health, IT Transformational and Innovation areas. We will take a bimodal approach to delivering against our initiatives to ensure that we can remain agile and innovative.

Grid management			Customer
Asset Management	**Field Force**	**Grid Operations**	**Customer & Stakeholder Engagement**
1. Develop single source of truth	1. Optimize existing processes to enable digitization	1. Develop real-time network model (e.g., deploy ADMS & integrate sensor data - AMI/MDMS, SCADA, etc.)	1. Develop 360-degree view of customer
2. Implement advanced methods of data capture	2. Deploy digital field force tools (e.g. tablets)	2. Automate select grid operations (e.g. expand sensors & network controls; automate grid response)	2. Implement advanced customer analytics
3. Increase data driven engineering, asset design, and construction methods	3. Optimize field force schedule and dispatch	3. Mirror real-time network model to create testing environments (e.g. digital twin, training "sandbox")	3. Reimagine customer journey
4. Enhance predictive modeling	4. Digitize enablers for broader field operations (e.g. Automated stock management, reporting)	4. Run simulations to identify grid upgrade opportunities	4. Develop new digital products and services
5. Optimize central work planning prioritization			

Digital Focus Areas

Background Information

Over the next 3-5 years, we expect to see significant change brought about by emerging technology such as, Artificial Intelligence (AI), on businesses. Data-driven technologies will play a central role in the day-to-day operation of our business, while practical applications like Augmented and Virtual Reality and the Internet of Things will impact how we interact with the world around us. Our customers and stakeholders will come to expect their interactions and digital experiences with ET to be as seamless, rich and easy as their interactions with other commercial organisations. We will use technology and data to deliver value to our customers and stakeholders:

- Reduced whole system costs through the ability to collaborate with a common data platform
- Reduced costs through improved real-time asset information allowing more informed risk based decisions
- Improved analytics and intelligence in business support systems will provide information to allow lower cost decisions to be taken

Artificial Intelligence

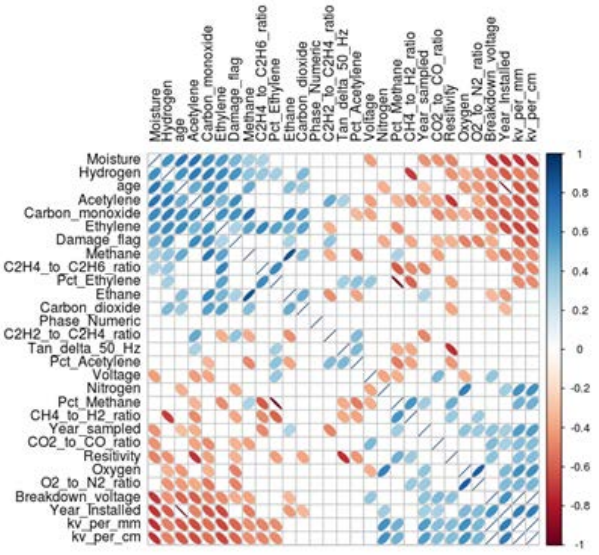
Scope and Investment Driver

The adoption of AI in the Energy & Utilities industry offers great potential and is likely to become a key capability across each step of the value chain from power generation through to end consumers[2].

The focus of E&U specific AI research and application to date has largely been in the role of a System Operator as benefits such as improving the prediction of energy supply and demand, balancing the grid in real time and reducing downtime have a clear link to the development of AI over the next decade.

However, AI will become a major building block for businesses in our sector over the next 10 years. The business will need to develop the capability to consume AI services to build efficiencies and generate value by taking an iterative approach to mitigate risk.

In RIIO-T1 we successfully carried out a small number of AI pilots across both ET and the wider NG group. For example, in 2018 we utilised machine learning and visualisation techniques to identify failures in silicon oil cable sealing ends to reduce unnecessary asset replacements.



Silicon Oil CSE variable correlation visualisation

Our key objective for the RIIO T2 period is to build the foundation of AI capability and explore 4 key AI enabled services (Natural Language Processing, Learning and Reasoning, Digital Knowledge Virtualisation, Visual Recognition) in the following areas:

- Field Operation & Digital Experience
- Asset Risk & Condition Analysis
- Network Safety & Operations
- Knowledge Management
- Asset Investment Planning
- Network Analysis & Design
- Customer Insights
-

[2] *McKinsey Global Institute, Artificial Intelligence, The Next Digital Frontier*

Investment Costs, Benchmark & Cost Profile

Asset Performance Management							Benchmarking
Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals	
CAPEX	2.08	1.72	1.70	2.70	0.85	**9.05**	In range

The costs are within the Gartner recommendation based on equivalent AI spend at similar companies in the Gartner database. The costs are estimated based on costs from previous AI pilots and Insights development costs in NG and feedback from partners.

Breakdown of investment

Capability	Description	T2 cost (£m)	Outputs
Artificial Intelligence	Setup AI Platform and manage health over T2 period [AI001]	[redacted]	• Develop understanding of AI platform and use of appropriate services • Enable ET operations and support to be more effective through natural language interaction and virtual SME • Utilise visual recognition, learning & reasoning to improve o asset risk and criticality identification and forecasting o investment planning decision making o network analysis and simulation o forecast & predict network safety and operations issues
	Pilot virtual subject matter experts with the knowledge of Asset Strategy, policy and Procedure to support field operation. [AI002]	[redacted]	
	Use of advanced modelling, learning & reasoning to improve on network level optimisation, scenario development capability for interventions [AI003]	[redacted]	
	Use of learning and reasoning to improve asset performance modelling, risk assessment and simulate scenarios [AI004]	[redacted]	
	"Pilot AI and DeX capability to improve network safety, business performance, and customer experience. [AI005]	[redacted]	
	Ability to detect and recognise patterns and events from videos and images (Asset condition, helicopter survey) [AI007]	[redacted]	
	Use of AI and advanced modelling for alarm processing, incident analysis, simulate to forecast safety & performance issues, impact assessment and restoration (For TNCC and GNCC) [AI008]	[redacted]	

Asset Investment Portfolio Optimisation and Asset Performance Management

Scope and Investment Driver

Over the past two decades, asset-intensive organisations have struggled to achieve smooth orchestration of their Enterprise Asset Management (EAM) systems with Asset Performance Management (APM) and their more generic capital management and portfolio management systems. This is vital to ensuring that the right asset health investments are made at the right time and at the right scale to achieve best possible results at optimised costs. Asset Investment Planning (AIP) systems help organisations like ours achieve that by enabling proactive investments and interventions based on data-driven insights. These systems incorporate asset condition, asset criticality and the impact of time in their analysis of alternative investment scenarios.

Our general direction over the RIIO T2 period is to move away from generic portfolio management and consolidate our RIIO T1 landscape to one or two 'asset aware portfolio management' products. This will allow us to integrate AIP, APM and EAM and move our transmission business towards a next-generation asset management platform. The majority of this investment is asset health IT investment and represented in the IT Asset Health Justification Report A14.12. We are proposing a further [redacted] in this period to deliver further integration between our Asset Performance Management, Asset Investment Planning, Enterprise Asset Management and our network safety & control solution (current iEMS) platforms.

Asset Performance Management (APM) is a broad term that encompasses the capabilities required for data capture, integration, visualisation and analytics, orchestrated for the specific purpose of improving the reliability and availability of our physical assets. APM helps us in monitoring the condition of our assets and infrastructure in a smart and data driven manner such that risk based interventions can be carried out long before our assets start to develop faults.

Our investments in Strategic Asset Management (SAM) and the Insights platform in the RIIO T1 period has delivered a foundational APM capability. In RIIO-T1, we have achieved cost efficiencies through a better understanding of the condition of our assets. Our strategy for the RIIO T2 period is to work towards consolidating disparate functionalities into an integrated platform and start bringing together our capabilities in EAM, APM and AIP. This will enable us to collect data of different types (both time-series as well as unstructured such as images and video) from a wide range of sources and improve integration with visualisation and analytics systems thus enabling ET's move towards risk and criticality based interventions. Most of this investment is asset health IT investment and represented in the IT Asset Health Justification Report. We are proposing a further [redacted] in this period to fully leverage the capabilities of the existing platform and explore innovation areas (IoT, Digital Twin) through the integration of data management and required tooling. In the RIIO T2 period we aim to extend the functionality of the Insight platform to cover both structured and unstructured data-types to support plug-and-play analytics for visualisation, modelling and rendering services.

Investment Costs, Benchmark & Cost Profile

Asset Performance Management							Benchmarking
Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals	
CAPEX	1	1.25	0	0	1.35	**3.60**	In range

The costs are within the Gartner recommendation based on equivalent spend at similar companies in the Gartner database. The costs are estimated based on costs from previous APM and AIP projects.

Capability	Description	T2 cost (£m)	Outputs
Asset Investment Portfolio	Integrated process / solution for risk & reliability centred asset management (EAM, AIP, APM) [AIP005]	[redacted]	• Optimisation of capital spend and asset risk to realise greatest value from assets • Improved network safety due to sophisticated asset risk modelling and condition assessment • Next generation Asset Management platform bringing together APM, AIP EAM and Network Safety & Control.
Asset Performance Management	Pilot Digital Twin for asset performance management [APM001]	[redacted]	
	Integrated data service on Insight (different data and content types: Conditional and Operational) with core asset register to support asset performance and risk analysis. [APM002]	[redacted]	

Digital Experience (Regulator)

Scope and Investment Driver

In line with our ongoing efforts to drive higher levels of transparency across our different stakeholder groups, we also plan to further invest in our Digital Experience platform to digitise some elements of specific Electricity Transmission engagement with regulators and key stakeholders. Our regulatory reporting process informs Ofgem's RIIO electricity transmission annual report and provides details of our spending, the outputs we've delivered and our financial returns.

To increase the accessibility of data and reporting, we plan to invest in our insights platform to structure our data to support Ofgem's energy data exchange service. We will do this by working with our stakeholders and Ofgem to maximise the value of data held in our business and ensure that key data items are accessible.

In RIIO-T1 no funding was sought for this category and ET made no significant investments.

Investment Costs, Benchmark & Cost Profile

Asset Performance Management							Benchmarking
Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals	
CAPEX	0	0	0.81	0.44	0	**1.25**	In range

The costs are within the Gartner recommendation based on an estimate of other small to medium size portals. The costs are estimated based on costs from recent website and portal deployments in ET.

Capability	Description	T2 cost (£m)	Outputs
Digital Experience	Establish Regulatory Reporting as value chain and improve digital experience of Regulators. [DEX002]	[redacted]	• Greater transparency of data

Geographical Information Systems

Scope and Investment Driver

GIS provides solutions across the entire enterprise for applications in the field force, engineering, environmental management and other areas.

Our investments made during RIIO-T1 helped support the implementation of GIS capability via ESRI and the GeoCortex platform. In RIIO-T1 we implemented ESRI and GeoCortex and decommissioned several satellite mapping applications. Funding was approximately £1.1m in RIIO-T1 though investment far exceeded that at approximately £7m. This was driven by the need to consolidate multiple solutions and reduce Opex. Beyond 2022 the technology risk surrounding these solutions will demand additional investment which is covered in the Asset Health justification report A14.12. That apart, there is also an identified need in improving the capability of the current implementation and encourage adoption across ET and GT. We also see an opportunity for ET to further adopt GeoGrid to visualise risk, hazard, asset health to drive business efficiency and safety. Most of this investment is asset health IT investment and is represented in the IT Asset Health Justification Report. We are proposing a further [redacted] in this period to use GIS Simulation and prediction tooling to support network analysis and asset condition forecasting.

Investment Costs, Benchmark & Cost Profile

Asset Performance Management							Change to submission following benchmarking
Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals	
CAPEX	0.65	0.33	0.33	0	0	**1.31**	In range

The costs are within the Gartner recommendation based on comparative peer groups. The costs are estimated based on costs from recent GIS enhancements.

Capability	Description	T2 cost (£m)	Outputs
Graphical Information Systems	GIS Simulation and prediction to support network analysis and asset condition forecasting. [GIS002]	[redacted]	• Improved business performance and compliance

Insights

Scope and Investment Driver

The investments we made during the RIIO T1 period in the Insight platform gave ET the foundational capability to perform analytics against consolidated data from multiple different systems. It offers a platform to perform information management, advanced modelling and analysis of our asset data and underpins critical operational and financial information in ET.

Additional investments will be required to support both an innovation platform and IoT integration;

ET will require a managed space to continually develop and test new tools and techniques, prior to use in production. This development space will encourage and facilitate innovation, helping to quickly identify and refine methods and models. This will be more than simply a test environment, it will require the flexibility to integrate existing and new data, in new formats, from both internal and external sources.

Industrial IoT, Event Stream processing will be a key area in future for asset condition capture, understanding and maintenance. This use case establishes the foundation IoT capability across Integration, Insight platforms. Also, use of the capability across different use cases is included in the investment

Investment Costs, Benchmark & Cost Profile

Asset Performance Management							Benchmarking
Investment (£m)	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	Totals	
CAPEX	0.65	1.14	1.14	0	0	**2.93**	In range

This consists of two investment lines with the largest being management of the technology health of the existing Insights platform at [redacted]. The costs are within the Gartner recommendation based on comparative projects. The costs are estimated based on costs from recent GIS enhancements.

Capability	Description	T2 cost (£m)	Outputs
Insights	Establish an innovation platform (& capability) for TO and manage risk [INS001]	[redacted]	• Reduced operational cost and managed technology risk by combining IoT, Data Science, Cloud Storage for Data Infrastructure etc.
	Establish IoT capability across Insight, Integration, OT devices [INS003]	[redacted]	

Optioneering

Our proposed RIIO-T2 investments were reviewed against industry benchmarks by Gartner, both in terms of business requirement and forecast cost.

The following two options are to be considered:

A. Do nothing
B. Invest in recommended areas **(recommended)**

Option	Total Cost of Ownership	Business / Strategic Fit	Risk	Status
A) Do Nothing	**AMBER** • May result in increased Capex and Opex investments outside of IT to meet requirements via other means. • Would avoid all proposed capex investment and associated Opex.	**AMBER** • May hinder ET's ability to innovate and deliver further consumer cost savings through emerging technology • Would not support any changes in future ET requirements.	**RED** • Will not enable data and digitalisation enhancements in line with emerging technology	**REJECTED**
B) Invest in recommended areas	**GREEN** • Likely to offer value throughout the asset management lifecycle.	**GREEN** • Supports ET's ability to innovate and explore further consumer cost savings through emerging technology. • Would support any changes in future ET requirements. • Opportunity to consolidate, drive efficiencies, productivity and a better experience for our customers.	**AMBER** • Better support ET commitments to safety, reliability and efficiency.	**RECCOMENDED**

Detailed Analysis & CBA

Please refer to file NGET_A14.13_IT Transform_CBA01.xlsb

For each of the investments proposed in this JR it shows a net investment cost as these are new areas where the baseline involves no expenditure. However, there are unquantified benefits that we expect to flow and based on our experience in RIIO-T1 and more generally the expectations arising from similar expenditures by other companies, means that we believe the investments will yield a positive NPV.

All proposed IT investments, including these, will be challenged and reviewed by the Electricity Transmission Investment Committee to test the final need case, delivery approach and efficiency of forecast costs. Sanctioned projects will then be allocated to a suitable framework provider, who has been appointed through a competitive process.

Dependencies

For the benefits of these investments to be maximized other investment during RIIO-T2 need to take place. This is primarily related to IT investments in Asset Health.

Conclusion

The key driver of these investments is to ensure ET can innovate and explore further consumer cost savings through emerging technology. Each investment has been assessed for business benefit and feasibility and been benchmarked externally with Gartner and collectively offers a realistic proposal for capabilities where the value is currently less clear but where other organisations are pursuing technology led opportunities and are realising benefits for their customers. The 'Do Nothing' option would limit ET's ability to take advantage as technology matures in RIIO-T2.

These investments are a key part of our digitalisation strategy and are entirely consistent with the recent Energy Data Taskforce proposals. Whilst we expect to see some efficiencies from these investments in RIIO-T2, it is unlikely that all of these investments will deliver a return for the consumer within the regulatory period. On this basis, we propose funding these initiatives through the Network Innovation Allowance (NIA), with a 10% contribution from ourselves, to deliver benefits in RIIO-T2, RIIO-T3 and beyond for the whole energy system.

Outputs included in RIIO T1 Plans

N/A