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1. Digital in the Energy Sector

Significant change is underway in the UK energy system, often described by the three key trends of **decarbonisation**, **decentralisation**, and **digitalisation**. The UK's commitment this year to net zero greenhouse gas emissions by 2050 has focused minds on the task in hand, and at National Grid, we see net zero as both a huge challenge and opportunity. We believe in a future that is clean, green and a thriving UK, where nobody gets left behind.

Decarbonisation is fundamentally changing the generation mix. Green technologies and cleaner, renewable electricity generation continue to reduce our reliance on traditional energy sources. With technology advances and falling costs, more distributed and embedded generation has emerged, and we are seeing rising levels of **decentralisation**. Meanwhile, **digitalisation** is allowing these technologies to become increasingly connected through virtual networks. This will only become more important as the energy sector converges with transport, telecoms and other industries, in the drive to full whole system decarbonisation.

Digital – the transformation of physical processes to virtual – is a critical part of the pathway to net zero. It provides an opportunity for the energy sector to bring about cost savings for consumers, improve customer experience, enable greater whole system coordination and transparency, and accelerate the development and deployment of innovative technologies.



2. Where are we today?

At National Grid, we have been developing our approach for digitalisation over a number of years. Our 'Technology Change Roadmap' established several key initiatives during the **RIIO-1 period**, including the development of a mobile workforce, enhancement of our data analytics capabilities and work to establish more effective stewardship of our data.

Our stakeholders have increasingly told us how important Digital is to them, and work carried out across the industry has helped to crystallise and prioritise what needs to get done. In 2017 the National Infrastructure Commission (NIC) published their Data for Public Good report, articulating the benefits of smart infrastructure through data sharing. Further building on this in their 2018 National Infrastructure Assessment report, the NIC made clear how strengthened Digital services are increasingly important for growth, infrastructure, and quality of life. The Centre for Digital Built Britain's (CDBB's) Digital Framework Task Group (DFTG), in addition to the Energy Data Taskforce (EDTF) from Ofgem, BEIS and the Energy Systems Catapult, have since further articulated their views on how we must utilise Digital technology and data to transform our infrastructure and construction sectors. Aligned to the DFTG's Gemini Principles, there are consistent messages that through greater whole-system transparency, increased interoperability, and the emergence of new business models, our data and insights can unlock efficiencies, tackle system costs and enable decarbonisation. In summary, delivering the right Digital architecture for the UK has been made a clear priority for our stakeholders.

It is in this context that we have been developing our **RIIO-2 business plans**. This document sets out how National Grid Electricity Transmission (NGET) and National Grid Gas (NGG) will take forward their Digitalisation Strategy to the long-term benefit of customers and stakeholders.

3. Our Digital Strategy

Our Approach

At National Grid we are clear that Digital presents opportunities in all parts of our business operation, and throughout the energy system. We recognise the importance of a whole system approach to digitalisation and to this end we have developed a joined-up digitalisation strategy across NGET and NGG, with both common themes and fuel-specific initiatives. *To note, in the same way, we recognise the importance of working with others, and we outline our next steps to this end in section 5.*

Our Digital Strategy is based on the three pillars of:

- (1) Gathering Data
- (2) Generating Insight
- (3) Taking Action

Through collecting and integrating our **data**, we will generate valuable **insight** into the cost, risk and performance of our assets. Complementing this with our leading asset management capabilities, we can drive efficient and effective **action** to enable the energy transition to net zero:

- greater transparency
- improved customer experience
- better coordination
- development and deployment of innovative technologies
- cost savings for consumers

With these end goals in mind, we see four distinct areas of our work at National Grid, where Digital can drive long term value. In each of these areas we have the opportunity to build on our core capabilities with advanced Digital capabilities. We can set our specific ambitions, engage with our stakeholders, and prioritise our businesses to deliver.

- Back Office; automation and optimisation of processes and outputs, to drive performance and efficiency for our people and processes, using Digital tools and capabilities.
- 2. **Grid Management;** automation of network modelling and forecasting, application of real-time monitoring and insights, and prioritisation of planning, scheduling and

resources. To optimise resource scheduling and network performance and support the transition to net zero.

- Customer & Stakeholder; digitally optimise and automate the end-to-end customer journey to increase responsiveness and feedback, and deliver the needs of today's and tomorrow's customers.
- New Products & Services; develop and implement new ideas and innovation, to create opportunities which address the evolving needs of our customers and stakeholders.

We note that these goals & structures align with the Energy Data Taskforce report on 'A Strategy for a Modern Digitalised Energy System'. Further detail on how we align to the recommendations from this report are summarised in Appendix 1.

Delivering our Strategy

We are also clear that in order to deliver Digital within National Grid, and increase the pace of the transformation, we must focus not only on the "what" or "where", but also on the "how". We recognise that this requires a comprehensive approach to how we activate Digital throughout our organisation.

- Building capabilities and culture within our businesses will be critical: adopting
 Digital ways of working, developing and bringing in talent, longer-term workforce
 planning, and modernising our underlying IT infrastructure. As a first step, our new
 Digital Enablement hub will ensure that our digitalisation strategy is joined-up,
 shares common standards, and embedded within our day to day business
 activities from IT and HR, to Training and Operations.
- Just as importantly, we will need to continue to engage, collaborate and partner with our customers, network peers, and wider stakeholders, as we develop and refine our Digital Strategy going forward. *We discuss further our approach to engagement in Section 5.*

Our ambition is to transition into a Digital enterprise, to best support and enable the transition to net zero, finding new efficiencies, and continuing to deliver at the pace and scale needed for our customers and consumers.

4. RIIO-2 Priorities & Investment for ET and GT

In the context of our four focus areas (Back Office; Grid Management; Customer & Stakeholder; New Products & Services), and our three pillars of Data > Insight > Action, we have identified our priorities for NGET & NGG as we move into RIIO-2. Both NGET & NGG have chosen to prioritise investment in Grid Management and Customer & Stakeholder.

Grid management: Focusing our Digital investment in this area will allow us to build on our core capabilities in asset management, providing us with the capability to further automate and optimise asset interventions in the future, and investigate the potential for practical applications like Augmented and Virtual Reality to unlock longer term value. However, in addition, these investments will start providing the data and platforms to unlock opportunities for our customers and stakeholders to innovate and optimise their use of our networks.

Customer & Stakeholder: Our customers have told us that 'we must listen, understand and consistently anticipate and deliver against their needs' if we are to meet our ambitions. We must ensure we can provide digital interactions and experiences that are as seamless, rich and easy as our stakeholders expect. We will invest in and exploit Digital capabilities to support our interactions, using flexible and agile IT to tailor our approach for different customers to support them through our network journey.

Across these two areas our RIIO-2 business plans outline the underlying technology and IT investments required to begin to deliver our Digital ambition and drive long term value for customers and stakeholders.

Our proposals for further engagement and iteration of our digitalisation strategy are set out in Section 5: Next steps & Engagement.

	RIIO-2 Digit	al priorities
	NGET	NGG
Grid Management	 Establish a comprehensive data strategy, including master data modelling for assets, and build capabilities for advanced analytics Implement real-time technologies to ingest asset data and enable advanced analytics and insights Innovate with Artificial intelligence 	 Establish a comprehensive data strategy, including master data modelling for assets, and build capabilities for advanced analytics Implement real-time technologies to ingest asset data and enable advanced analytics and insights Increase data-driven engineering, asset design and construction Innovate with Artificial intelligence
Customer & Stakeholder	 Enhance our customer relationship management and Digital experience, redefining our customer journey 	 Enhance our customer relationship management and Digital experience, redefining our customer journey

5. Next steps: Further engagement and refinement

As touched on in 'delivering our strategy', we have set up a Digital Enablement team internally to assess immediate opportunities, review the taxonomy of our business for digitalisation, and to engage with other actors across the energy sector.

This group will also consider interactions with other cross-sector initiatives including the work of the Centre for Digital Built Britain, UK Digital Strategy and National Infrastructure Commission. We are ready to engage with the Energy Networks Association (ENA) in their work on digitisation, as we believe that they could have a key role to play in coordination across the sector.

We will set out our proposals and timeline for further engagement and iteration of our Digitalisation Strategy early in the new year. Initial engagement will seek to establish from stakeholders how and how often they want to engage and see updates to our Digitalisation Strategy.

Feedback or questions on this document and our approach to digitalisation should be sent to:

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National Grid [9 December 2019] NGET and NGG Digitalisation Stra

Appendix 1: Continuing our Alignment with the Energy Data Task Force Recommendations

It is clear that there is a level of consistency between our Digital Strategy and the Energy Data Taskforce recommendations from 'A Strategy for a Modern Digitalised Energy System'. The high-level recommendations align with our ambitions for the Digital Strategy, and focus mainly on our 'Grid Management' focus area, as summarised below:

- Reducing whole-system costs through the ability to collaborate with a common and transparent data platform
- Using advanced analytics and intelligence in asset management and business support systems to provide information to enable efficient and cost-effective decisions
- Reducing costs through improved real-time asset information to optimise and prioritise risk-based decisions

More specifically, the individual outcomes form the Energy Data Taskforce are outlined below, with their specific linkage to our approach and activities.

- Digitalisation of the Energy System is at the heart of our ambitions. Our investments in IT infrastructure, Business Services, work and asset management and customer facing IT systems outlined in this paper are key to enabling the digitalisation of our data assets where this drives value for customers and stakeholders.
- Maximising the Value of Data our work to build a comprehensive data model and data architecture where key information is available for analytics and insights across our operations will be put in place as part of RIIO-2. This will be a key foundation to move to a 'presumed open' principle, where data is discoverable, searchable and understandable, with due regard to the NIS and GDPR Regulations. Technology to create, store, replicate, update and purge data will be core to this design. This is all integral to our digital strategy.
- Visibility of Data our Data Library, together with our investment in Enterprise Content Management, Digital Experience and external portals will facilitate a greater level of sharing of our metadata with energy system users where it is safe and appropriate to do so.
- Coordination of Asset Registration during RIIO-2 we will be investing in our CRM platform and replacing our core work and asset management and asset registration system (Ellipse). This will afford us the opportunity to consolidate our systems and data and provide the capability to integrate with a future single Asset Registration Portal.
- Visibility of Infrastructure and Assets our Geospatial Information System (GIS), Asset Investment Planning (AIP) investments, together with our proposals for the use of Digital Engineering and Digital Twins present an opportunity to contribute towards the development of a Unified System Map of the energy system.

Whilst our initiatives and activities vary in maturity, we see clear value to our business and to our customers and stakeholders in the principles embodied in the EDTF recommendations.

A. Grid Management initiatives

We have identified three priority digitalisation initiatives to enhance our asset management capabilities:

- A1. Establish a comprehensive data strategy, including master data modelling for assets, and build capabilities for advanced analytics
- A2. Implement real-time technologies to ingest asset data and enable advanced analytics and insights
- A3. Innovate with Artificial intelligence

A1. Establish a comprehensive data strategy, including master data modelling for assets, and build capabilities for advanced analytics

Description	Initiative activity
Data catalogue and comprehensive integration platform	Develop a comprehensive data catalogue and appropriate standards to maintain and develop. Integrate our Asset Investment Planning, Asset Performance Management and Enterprise Asset Management systems (AIP, APM, EAM) to bring together all digital asset and engineering data and make it accessible through a common platform. This will provide the base data for our insights platform, and establish a source for sharing data with other platforms. This provides an integration platform that offers services of data integration, API management, B2B Integration, Business Rules Engine, Complex Event Processing, BPM Engine and Business Activity Monitoring amongst others.
—	To generate a Digital representation of all assets and implement an industry leading solution to further enhance our ability to share asset data and develop asset management strategies based on 'monetised risk', delivering benefits to customers through visibility of asset opportunities and enhanced risk-based maintenance/refurbishment/replacement planning. This will provide the capability to integrate with a future single Asset Registration Portal.

A2. Implement real-time technologies to ingest asset data and enable advanced analytics and insights

Description	Initiative activity
Insights platform to assimilate all data types	Digital technologies such as quantum and edge computing will enable the ingestion and manipulation of new digital data types e.g. time series, images and videos, relational design and drawings through metadata. This will provide ET with the capability to assimilate all data types across the landscape, to manage information quality, perform data collaboration, analysis and visualisation and derive insight. In doing so ET will apply advanced modelling and analytics techniques and trigger actions based on data analysis. ET will continue to experiment with modern data types (<i>e.g. LIDAR, 3D models</i>), Digital assets and advanced tooling to identify further value areas. This provides the opportunity to visualise many different forms of data, and maximise the value from this data by both sharing and applying advanced analytics to optimise decision making.

A3. Innovate with artificial intelligence

Description	Initiative activity
Artificial Intelligence	 Will develop an artificial intelligence (AI) platform and use of key AI enabled services (Natural Language Processing, Learning and Reasoning, Digital Knowledge Virtualisation, Visual Recognition) to enable ET operations and support functions to be more effective 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 Artificial Intelligence offers great potential across the sector and is likely to become a key capability across each step of the value chain from generation through to end consumers.

B. Customer and stakeholder enablement initiatives

Our UK customer ambition is for our customers to feel as though they are 'treated like a partner'. Through digitalisation we will use flexible and agile approaches to manage our interactions with our customers and stakeholders.

B1. Enhance our customer relationship management and digital experience, redefining our customer journey

Description	Initiative activity
	An improved CRM will underpin how we manage our entire customer connection process. We will invest to include more parts of the Digital customer journey within the CRM system, we will use the customer insights and data to make sure we can offer a more tailored, bespoke and flexible end-to-end service to different types of customers.
	Our experience has found the CRM system to be the most efficient and effective way to manage customer data and processes, enabling us to manage complex multi touch- point relationships with an increasing number and diversity of customers. The CRM system will also underpin our website and Customer Portal.
	The Customer Portal will provide customers with a Digital channel to apply/manage and interact with us – streamlining interactions with National Grid, allowing customers to self-serve for elements of the connections process and customers will be able to use the functionality to design their own connection. This is in direct response to customers identifying multiple frictions with the existing connections process e.g. customers find the process of managing connections too manual and applying for a connection is inefficient and hard to understand.

Appendix 3: NGG (GT & GSO) digital priorities: further details

A. Grid Management initiatives

To deliver on its ambitious goal of no routine manual inspections in the field, more real-time information enabled by selective sensor deployment, and near zero instability in the maintenance plan NGG has focused on a number of themes in order to:

- A1. Establish a comprehensive data strategy, including master data modelling for assets, and build capabilities for advanced analytics
- A2. Implement real-time technologies to ingest asset data and enable advanced analytics and insights
- A3. Increase data-driven engineering, asset design and construction
- A4. Innovate with Artificial intelligence

In doing this NGG will meet the EDTFs two recommendations and support the building blocks of an Industry data catalogue, a single registration platform, and a digital system map.

A1. Establish a comprehensive data strategy, including master data modelling for assets, and build capabilities for advanced analytics

Description	Initiative activity
Innovation platform and capability	The Insights and Innovation platform provides a consistent repository for our data, supporting our understanding of how the network and our assets are performing. It enables us to take advantage of advanced analytics and data analysis through the use of modelling, simulation and machine learning to optimise our operation of the network and support efficient asset management. A consolidated platform of data supports the removal of siloed data and enables us to monitor and improve data quality. We will continue to extend our Insights platform to assimilate new data types (<i>e.g. time series, Images and Videos, relational design and drawings through metadata</i>), and we will expand on our investments in our Insights platforms to build analytical models using artificial intelligence and machine learning to better understand our assets and the network. This will support us in making asset management decisions, understanding different operational scenarios and exploring the effects of the changing use of our assets.
	We 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.

A2. Implement real-time technologies to ingest asset data and enable advanced analytics and insights

Description	Initiative activity
Data science tools	These tools will bring together and build on the foundations of the Insights platform and existing analytics capabilities, with additional data capabilities through Asset Performance Management (APM) to provide a consolidated view of asset performance.
	Our Insights platform and data lake implemented during RIIO-1 gave GT the foundation capability to consolidate data from multiple systems in one location to perform analytics. As GT looks to move to more mature asset management models (<i>e.g. time, condition, risk, predictive, financially optimised</i>) the correct use of data and analytics to enable informed decisions will be essential
	Our Insights platform also provides our core reporting to support asset management decision making as well as the efficient and safe operation of our network. We use the platform to ensure the governance of our data and create quality rules and metrics to enable us to improve our datasets.
	Data science tools will also support the custom data science / advanced learning capabilities required by GSO where there is a need for specific Advanced Analytics / Data Science platform. This will include integration capability for access to the Data Lake / Operational Data Store and associated technologies for performing deep analysis of GSO data. IT will introduce a platform framework for preparing and outputting analysis results for GSO, including tools, configuration, coding standards, templated data models and machine learning algorithms
AIP – risk and reliability centred asset management	We will be aligned to NGET for the purposes of efficiency and best practice to implement an integrated process solution for risk & reliability centred asset management through EAM, AIP, and APM. Optimisation of capital spend and asset risk will realise greatest value from assets, and improved network safety will result from sophisticated asset risk modelling and condition assessment. A next generation Digital Asset Management platform will bring together APM, AIP EAM and Network Safety & Control.
Advanced analytics-based investment prioritization	We will invest in new capability to meet the demand for more information, from a wider set of sources. To support the GSO modelling and Advanced Analytics capability, investment is required to develop an 'Insights and Innovation' platform to provide a consistent repository for our data. It will enable GSO to take advantage of advanced analytics and data analysis through the use of modelling, simulation and machine learning to optimise our operation of the NTS, support market efficiency and support efficient asset management. For example, this will underpin the enhanced analytical capability needed to support how we meet the needs of customers to move gas on and off the network when and where they want.
	The 'Insights and Innovation' platform will provide a single source of information for all GSO data-driven capabilities and will also enable the delivery of data to all internal and external data consumers. IT will introduce a platform framework for preparing and outputting analysis results for GSO, including tools, configuration, coding standards, templated data models and machine learning algorithms.
	This initiative is constant with the energy data taskforce recommendations.

A3. Increase data driven engineering, asset design, & construction

Description	Initiative activity
	We will improve Geospatial Information Systems (GIS) to enhance NG GTs Asset Protection capability to help predict, rather than react to external threats to the network.
	GIS provides us with visibility of our pipeline network to understand precisely what assets we have, where they are and the environment around them. We use sophisticated spatial analysis, identifying proximity to other features, to study asset risks to the public and support managing the health of our assets.
	National Grid provides the service to investigate sites and ensure NG assets are not impacted by third party work. Currently, frequent site visits are required due to limited geospatial information of underground assets. Improving the different types of information and creating better output will support us in better understanding risks from external factors and allow us to plan mitigation strategies more effectively
	An improved GIS will:
	 Sustain platform performance and broaden the range of applications exploiting the existing functionality
Improve asset protection service	 Improve spatial data location quality. By designing new processes and performing data collection projects using field staff we can resolve data accuracy and integrity issues.
	 Provide geospatial analytics capability to help plan, prepare and response to current and future 3rd party risks and hazards.
	 Improve GIS to enhance NGs Asset Protection capability to help predict, rather than react to external threats to the network.
	 Broaden the range of applications, exploiting the existing functionality and invest in new capabilities such as 3D to better visualize pipeline risk
	 Improve capability to manage modern data types (LIDAR, 3D models) more effectively and make it part of the overall Digital experience for our users
	In keeping with the Energy Data Taskforce's recommendations on a Digital map, National Grid is participating in the Government's Geospatial Commission's pilot on a National Underground Asset Register. Improvements in our Geospatial systems will support our steps to our pipeline locations publish more widely.
	We use Digital engineering to improve our capability for using Building Information Models (BIM) to help in optioneering and delivery of capital projects.
Enhance asset design through Digital engineering and BIM	In RIIO-2, we will move into the Digital workspace and Digital engineering, in line with our suppliers and industry practice. We will expand our content and information management capability to support common data structures and be able to better share data, creating a more collaborative and innovative environment that will meet energy needs of the future.
	Building Information Modelling (BIM) provides a 3D view of assets and allows you to test how asset interventions might be constructed before reaching site and is currently being use by our top tier delivery partners for major capital investments in order to assess, design and construct assets. BIM also incorporates the collection, manipulation, storage and sharing of information on sites and assets between functions, partners, stakeholders and customers which will lead to the reduction in effort associated with creating handover documentation.
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En	hanced asset design through BIM will:
	 Improve our capability for using Building Information Models (BIM) to help in optioneering and delivery of capital projects.
	 Integrate with broader systems (AIP, APM, EAM) bringing Digital Engineering data to and from the common data environment from other key platforms
	 Develop Digital simulations from the integrated data sources to replace human / manual processes
	 Create a Common Data Environment for collaborative working, which will bring together other key elements of our Digital Platform, including Enterprise Content.

A4. Innovate with Artificial intelligence

Description	Initiative activity
	We will enhance our capabilities through the use of Artificial Intelligence (AI) and Machine Learning (ML), and Cognitive Technologies. New technologies can be used to automate how we carry our maintenance and inspections on our assets. We will make targeted investments in this technology to reduce the risks to our employees or members of the public in carrying out these tasks. For example, using analytical techniques to interpret our pipeline inspection data, or
	analyse gas quality data to understand the impact of gas blending on our assets

B. Customer and stakeholder enablement initiatives

Our UK customer ambition is for our customers to feel as though they are 'treated like a partner'. Through digitalisation we will use flexible and agile approaches to manage our interactions with our customers and stakeholders.

B1. Enhance our customer relationship management and digital experience, redefining our customer journey

Description	Initiative activity
	National Grid is committed to exceeding the expectations of our customers and stakeholders. Our Customer Relationship Management (CRM) system supports recording and tracking interactions with our customers and stakeholders within GT which is an essential step towards managing our relationships more effectively. By enhancing the CRM system, stakeholder and customer data will be uniformly managed and collected, with interactions logged in one central location. Making tracking and reporting both easier and more sophisticated. Our engagement with customers and stakeholders will be enhanced as a result of holding better quality data on our interactions.
Customer Relationship	We will continue to invest in digitisation of our CRM tool to bring more aspects of our customer interactions into the system's remit to ensure we can offer a simple, tailored and flexible end to end service to customers.
	We will enhance our systems, online platforms and capabilities to provide a more seamless interaction and Digital experience for our customers. Providing ease of access, consistent and transparent data & information, to deliver a more enhanced and efficient experience that will meet the needs of customers and the changing requirements of our customer base.
	This platform provides us with technology to share data with the market and support customers in accessing our services. This includes providing portals for our customers to communicate with us and the ability for us to share raw data with stakeholders for them to incorporate into their own systems and processes.
	This covers an integrated set of technologies, based on a common platform, that provides employees and external audiences (stakeholders, customers) with consistent, secure and personalised access to required knowledge content, information and applications across many Digital touchpoints.