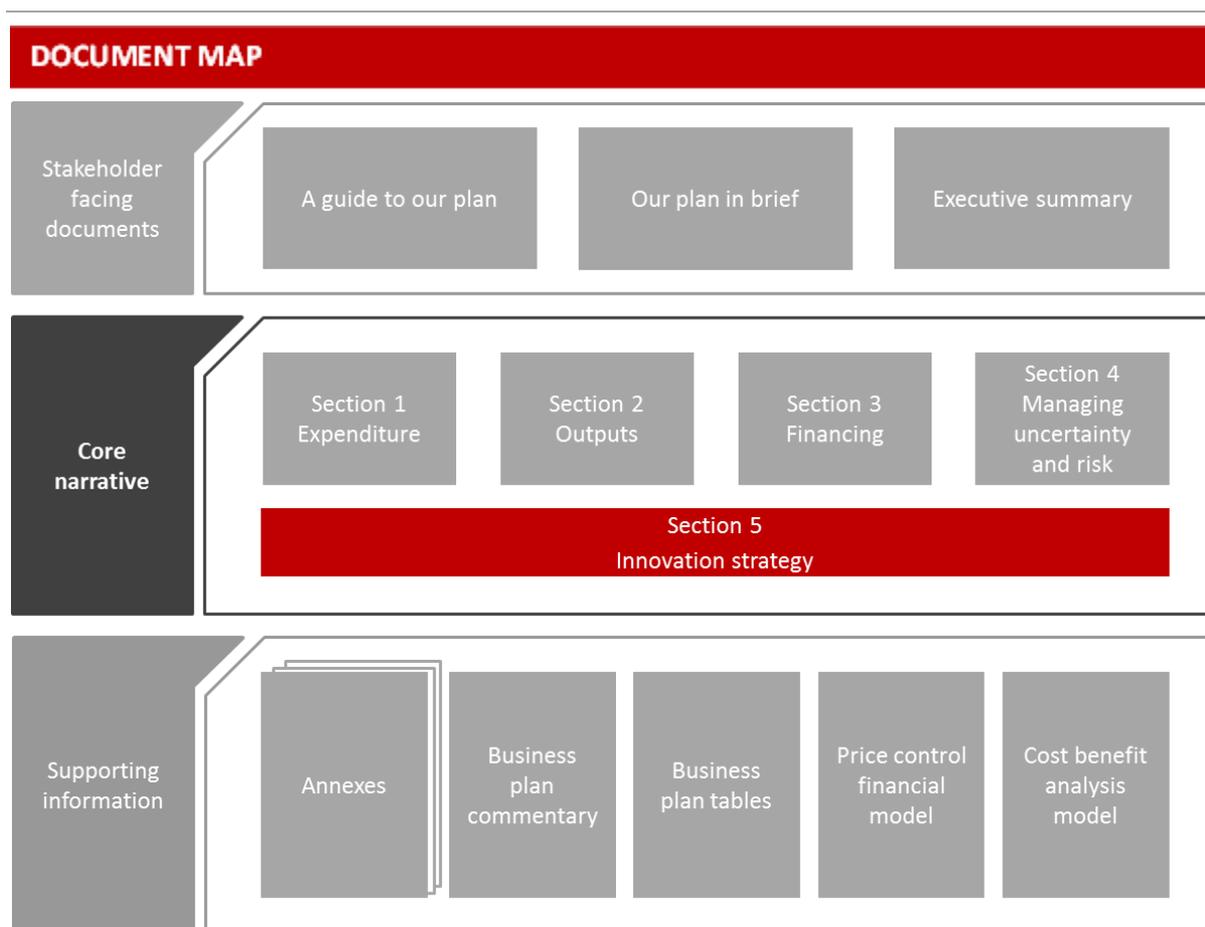


5 INNOVATION STRATEGY

KEY MESSAGE

Innovation is central to our business and is evidenced throughout this plan as a whole. We have identified four priority areas for innovation in the coming period: in relation to the creation of a smarter powergrid, smart meters, web-services and the social agenda. In our view, technological innovation (both sector-specific and general) as well as innovation in business processes and commercial services could yield significant benefits for customers which we will be exploring throughout 2015-23.

As well as the innovation we undertake in our normal business activities, we are proposing to spend 0.6% of our turnover to fund £29m of innovation activity – most of which will be directed towards the release of smarter powergrid benefits that greatly exceed the cost of the innovation. Our regulator has stated that it considers this value to be justified.



WHAT YOU WILL FIND HERE

In this section we set out our innovation strategy for the 2015-23 period. Our key strategies have been determined in line with our stakeholders’ views and priorities and they are geared to tackle the strategic issues that face the business and the sector.

Our process fosters a strong culture of innovation in our company, driven by our executive team, and filtering through our organisation. Crucially, we think our regulator, Ofgem, will expect us to demonstrate that we are looking outside the confines of our own business and even our own sector, to ensure we are adopting the best approaches. We also think that Ofgem will expect us to show how our innovation strategy affects the whole business – not just our response to the low-carbon challenge.

This section also sets out what we have learned from our own projects and also from across the spectrum of research projects funded by customers through the Low Carbon Networks Fund. We demonstrate how we have incorporated this learning in our plan and explain what we think we need to spend and where we expect the deliverables from these or other companies’ similar projects to impact our business.

This document is very similar to the version that we published in June 2013. We were told by Ofgem that we had met the minimum requirements it set out in its guidance on business plans and feedback was largely positive. But prompted by discussion with Ofgem’s Consumer Challenge Group, we have inserted a new section (5.8) to describe how we plan to use data and information technology to benefit customers. We also made some other relatively minor changes to take account of feedback we received from Ofgem itself on the funding and roll-out of innovation.

This section at a glance...

KEY STATISTICS	
2015-23 PERIOD: INNOVATION EXPENDITURE	£29m
Net benefits from smart-grid solutions in 2015-23	£34m
Total smart-grid benefit 2015-31 – net present value high case	>£240m
Total smart-grid benefit 2015-31 – net present value low case	£8m
Innovation funding intensity	0.6%
KEY POINTS	
<ul style="list-style-type: none"> • Innovation projects need to be justified before we include them in our plan and stakeholder views feed into the evaluation process to help us prioritise our choices. • Collaboration will be vital to success and our strategy recognises the managerial challenges associated with partnering with other organisations. • Our strategy allows us to remain flexible to implement new opportunities quickly and effectively, wherever and however they arise. • Our strategy extends to the dissemination of the learning from innovation projects, which is as important as the learning itself. • We incorporate successful ideas into routine operations quickly and our track record shows that we can deliver innovation. • Creating a smarter powergrid is the area of our business that demands the most innovation – although our plan commits us to innovation across all output areas. • The benefits factored into our forecast are: <ul style="list-style-type: none"> - enabling pre-arranged demand-side response; - active network-management to control the network more dynamically; and - smart techniques for meshing high- and low-voltage networks to increase available capacity. • Realising the benefits from smart meters also requires innovation in data handling and customer engagement. • The combination of our smartgrid enabling investment and smart meter data opens up significant potential for innovation in information services for our customers and other stakeholders who are key to the sustainability of the region. • Meeting the challenge of energy affordability demands innovation in our approach to the wider community and the services that we can offer in partnership with others. • Web-based services will transform the way we interact with customers and provide easy access to regional and local information that is complementary to our service. • We are slightly front-end loading our activity to secure the benefits as early as we can. • Some of the benefits will come after 2023 but we think these investments are worth making to yield long-term benefits for customers. 	

CONTENTS

5.1	Introduction and overview	1
5.2	Promoting innovation by creating the right culture, supported by the right processes ..	4
5.3	Generating ideas.....	6
5.4	Filtering, testing and evaluating ideas.....	8
5.5	Implementing ideas.....	12
5.6	Looking forward to a successful period of innovation	18
5.7	Setting the right priorities for 2015-23	20
5.8	Using data to benefit customers today and into the future	25
5.9	Future innovation projects expenditure	29
5.10	Conclusions.....	31

* We have included at [annex GL.1](#) a glossary that explains the key technical terms and abbreviations used in our business plan.

* For more detail on how this plan differs from our June 2013 plan, please refer to [annex G.12](#).

INNOVATION STRATEGY

Innovation is the vital capability that enables an organisation to:

- respond to the changing demands of the wider external environment;
- capitalise on an opportunity to add value for one or more of its stakeholders; or
- become more resilient to a risk that would be best avoided.

*Innovation is
a skill and a
capability*

At Northern Powergrid, we do not see innovation as a department or sideline of our business. We think innovation is a skill. It is a capability more than it is a plan – and it is something that we think will become even more important as this next price control period unfolds. In this section we describe our approach to innovation, paying particular attention to the way that we will operate to make sure that we set the right priorities, promote a culture that drives innovation and get the results from our efforts.

5.1 Introduction and overview

The demand for innovation is shaped by the strategic issues that face the business and the sector.

The demands on our ability to innovate are not only growing, but the nature of them is changing. Clearly, in future we will need to continue to seek better ways to do what we already do, and to find new ways to solve well-defined problems as they arise – and we have been successful at doing this to date.

But we will also need to develop and deliver initiatives and programmes where the objective is to stimulate an uncertain outcome, and where the benefits are not known to us from the outset. And success will not always be dependent on our activities and choices alone: we will need to rely more on co-ordination and collaboration with others in the energy sector. We cannot take a passive role and rely on energy supply companies to drive the changes that will be necessary to achieve a low-carbon future: instead we must be proactive in our approach to innovation and play a full role in facilitating and delivering the necessary innovation.

Although we cannot be specific about the actual innovations that we will implement, we do know broadly the kind of innovations that we are going to have to pursue and the strategic areas in which we will be challenged to innovate. We therefore expect to dedicate more time and effort to looking for innovations in the following areas:

- ***The creation of a smarter powergrid*** is being driven by the low-carbon agenda. The requirement to connect more low-carbon technology and distributed generation will challenge us to operate a more active network, and to find ways to provide network access without simply resorting to ‘overbuilding’ assets. A good example of where we expect to have to innovate technologically in this respect is in the use of smarter technology to control the network and to get more capacity out of existing assets. As explained in [section 1.4](#) of the core narrative of our plan, our innovation plans in this area will facilitate the move to low-carbon technologies and could release over £240m of benefit to customers over the period to 2031. However, as explained above, we are not limiting ourselves to confined

technological improvements that are made directly to our network: we will also explore how we can encourage others to become more active in their pursuit of low-carbon solutions. For example, on the commercial side, we are already planning to start exploring ways of engaging customers to sell flexibility in their consumption patterns to help us limit overall demand on the network.

- ***The introduction of smart meters*** will bring access to new information about network performance in or near to real time. For the first time, we will have access to data which, if cost-effective, will allow us to explore new services that provide customers with information about the state of the network in their locality. In the majority of circumstances, we will no longer need customers to call us to tell us that they are without power. And we will know exactly which customers are driving what capacity requirements on the network. We plan to explore opportunities to use that information to improve our response to power outages and to plan the network more intelligently, including how to more accurately measure and target the reduction of electrical network losses.
- ***Continued growth in web-based and digital-enabled services*** is enabling people to deal with us as they would expect to deal with other businesses. Over the last decade, the trend in customer-facing sectors and industries has been towards offering internet-based applications to deliver services and sell products to customers, with mobile technology demonstrating the most significant growth pattern. In contrast to these sectors, electricity distribution has been a relatively late adopter of web-based service offerings. However, we know that our customers across all demographic groups are increasingly familiar with conducting their activities online, and we expect this trend to keep growing: indeed, it is already the case that many of our customers are surprised at how restricted their online access to us is. We will have to keep finding ways to make better-quality information much more accessible for all our stakeholders, and to offer more of our services directly over the internet and designed for mobile devices. We expect this to be a core area of innovative activity in the 2015-23 period.
- ***Issues of affordability*** are set to become even more prominent as energy prices, most likely, continue to rise. We therefore know that there is an imperative to innovate to keep downward pressure on our costs for the benefit of all customers by improving the way that we design, build and construct the network. We will also need to find better ways to contribute to the social programmes that help those who are most affected by price increases. As explained in [section 2.6](#) of the core narrative of our plan, we plan to explore a variety of new and innovative opportunities to make a more meaningful contribution to the wider social challenge of helping those who find it most difficult to pay their energy bills.

These four strategic priorities are already guiding our innovation activities. We expect them to continue to shape the agenda throughout the 2015-23 period, although we will not limit the scope of our innovation to these areas. We are only seeking part funding for the associated costs through the Network Innovation Allowance.

As part of its role in providing strategic leadership, the executive team will continue to examine the wider picture as we keep our business plan under review. We are proud of what we have already achieved through innovation and that gives us confidence that we will be up to the challenge that is ahead of us.

CASE STUDY: harnessing the low-carbon agenda to reduce traditional reinforcement

Ashton Hayes in Cheshire set itself the target of becoming the first carbon-neutral village in England¹. Simple community action led to 23% reductions in CO₂ emissions, and they are now receiving support from Scottish Power to take this further².

We intend to build on this by engaging with communities and industry to facilitate and concentrate energy-saving action by communities as an alternative to traditional reinforcement.

This manifests itself in two forms in our plan: at the industrial level we are already expecting to use such techniques in our general system improvement plan in 2015-23; at the domestic level we are applying to the Low Carbon Networks (LCN) Fund to develop the idea to the level of a generally deployable solution.

Innovation is a concept that goes beyond just technology developments...

We find it helpful to recognise that there are four types of innovation: the first two relate primarily to the way we manage the business and the second two are driven by the way we use technology. We look for innovation in respect of:

- business processes;
- commercial services and products;
- sector-specific technology; and
- broader 'society-wide' technology trends and developments.

At different times, the weight of emphasis on any one area of innovation is likely to shift. For example, immediately after electricity privatisation in 1990 the emphasis was on business process innovation to reduce the indirect cost base of the organisation, whereas technological innovation was less prominent. Looking ahead, we see a very different picture. The huge changes that will be driven by the creation of a smarter powergrid have brought technological innovation to the fore – both in respect of sector-specific technology and broader communications technology.

Exploring these areas of technological capability, either to deploy proven applications for technology that are not presently used in our context or to seek to develop new technology that can provide new capability, will be a significant proportion of our innovation activity in the 2015-23 period. We will adopt a more co-ordinated, longer-term overview of the potential technological pathways that exist, or might come to exist as technology develops.

To achieve this, we have established a 'Technology Application Assessment' ([annex 5.1](#)) through which we maintain an up-to-date view of potential long-term technological developments, and identify any future business challenges and stakeholder requirements that new technologies are likely to have to address in future.

Nevertheless, we will continue to challenge ourselves to deliver across all four categories of innovation. Examples of specific projects and programmes in each area are provided later in this chapter.

¹www.goingcarbonneutral.co.uk/

²http://www.spenergynetworks.co.uk/pages/ashton_hayes.asp

...and requires a material change in how electricity distributors do business.

On an ongoing basis, we encourage our staff to seek and implement improvements and changes to the way we work, so as to deliver benefits in terms of efficiency and service. However, while this activity is important to us and delivers benefits to customers, we think it is important to distinguish between this 'continuous improvement' and more substantial 'innovation'. Innovative ideas that imply more fundamental changes to the way we operate, or are likely to deliver significant benefits, require us to dedicate the appropriate time and attention to them at the senior level, and to adopt the more structured and targeted processes described in this section.

In general, we expect line management to drive *continuous improvement* as part of its normal function. But a successful *innovation* will usually cut across our existing processes and ways of working. Developing and implementing innovations will therefore tend to need more collaboration across our business, and will probably demand more substantial change. We therefore think innovation needs more active engagement from our senior management.

5.2 Promoting innovation by creating the right culture, supported by the right processes

We think that the most valuable innovation tends to cut across many aspects of our business. We do not, therefore, have an innovation department that is accountable for all innovative activities. Instead, we aim to create and foster a culture of innovation that encourages all of our employees to bring new ideas to the table.

Creating this culture starts with our executive team, and runs right through the business. To do this, we need to establish the necessary process and routes through which innovative ideas can be generated, evaluated and implemented. This section sets out the processes we have in place that we think support a successful culture of innovation.

Innovation is central to the role of the executive leadership team.

Driving innovation is a core part of the work of the executive leadership team. That team is accountable for:

- Driving a culture and supporting processes throughout the company that seek out and evaluate candidates for innovation across the four main areas, and releasing the funding to the chosen initiatives and projects.
- Identifying the gaps in our capability that we need to fill by collaborating with others from outside our organisation, and then forging and maintaining those partnerships with the right people.
- Sponsoring the projects that pursue the innovation, ensuring that they are properly resourced and running well and making sure that any unforeseen problems are resolved.
- Building the positive outcomes into our business plan so that the innovation transitions into 'business as usual' and fulfils its potential.

Because innovation activity is all about either making positive changes to our plan, or improving the way we deliver our plan, we cannot build all of the changes into our plan in advance, particularly those that may happen towards the end of the next regulatory period. This is why our approach to innovation means that we have structures, processes and (crucially) a culture in place that together ensure we:

- generate ideas – including stakeholder interaction;
- filter, test and evaluate ideas; and
- implement ideas - including post-implementation review and improvement.

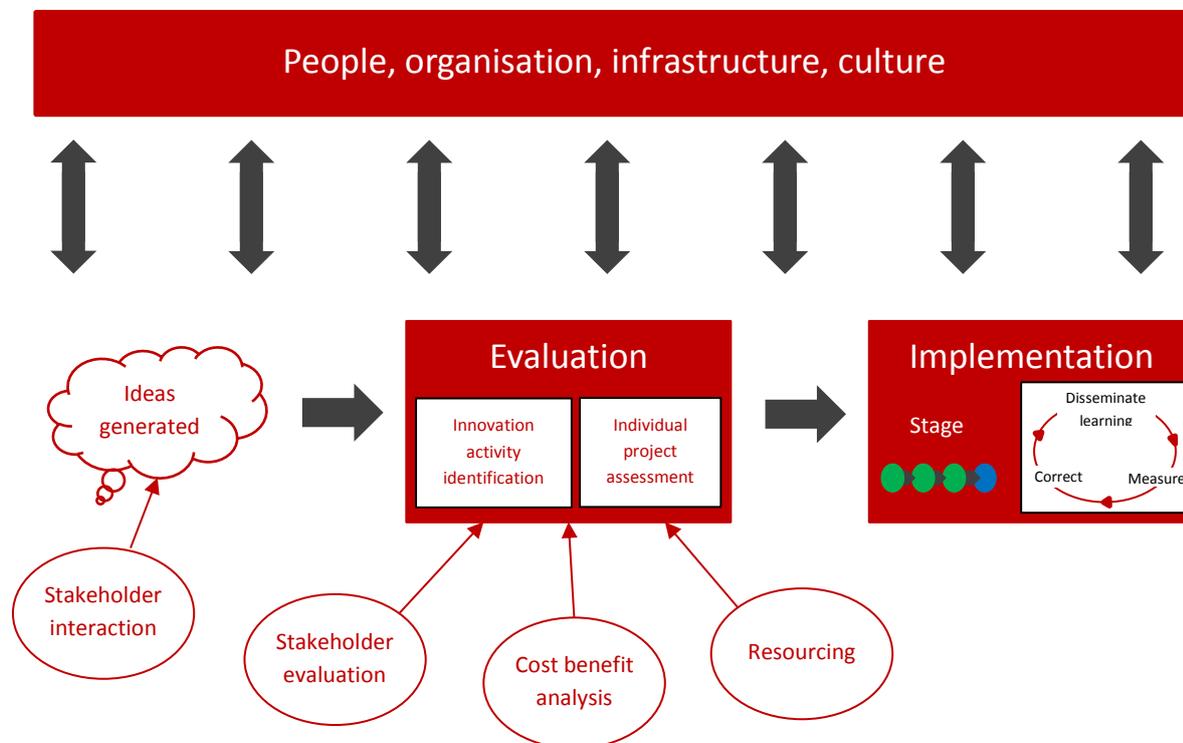


Figure 1: Innovation process

We have progressively built this approach (shown in Figure 1) into the way we run the business and we intend to continue to do so. In the rest of this chapter we will explain how it works in more detail. The detailed implementation is subject to some important guiding principles:

- We design innovation to be at the heart of the way the business is run.
- Innovation is not just about technological improvement.
- We look to explore and stimulate change, as well as being responsive to challenges.
- Innovation is aligned with the strategic drivers that affect our business.
- We build an innovative culture across the organisation - it is an attitude and a capability for the company, not a department.
- We have an open and supportive culture, from the senior level downwards, that encourages anyone in our company with an innovative idea to bring it forward.
- We look outside ourselves and outside our sector to discover best practice.
- We collaborate with other parties – and recognise that this is a skill in itself.
- We apply our best-practice disciplines of financial control and project management to our innovation projects.

- We do not dismiss projects where benefits are not known at the outset or where the pathway to success is not clear...
- ...but we do subject these projects to more rigorous scenario analysis, and seek to understand our options and the range of potential outcomes, in order to maximise the chances of success.
- We always have a clear view of how to implement any innovation project we undertake, and we require that each project establishes specific recommendations to guide implementation.

CASE STUDY: innovation through partnership

The prime example of partnership leading to innovation is the alliance we have formed to deliver the Customer-Led Network Revolution, which is the largest project funded to date under Ofgem's LCN Fund. This partnership has brought us great benefits and it continues to do so.

Early in the development phase of our approach to the LCN Fund, we identified that we wanted to spearhead work that blended the technical engineering challenges of smart grids with the sociological and commercial challenges of engaging real customers in the process. We knew we could not do that on our own, so we formed an alliance with British Gas, Durham University and EA Technology.

Each organisation brings unique capability to the partnership.

British Gas has brought its understanding of customer needs and behaviours, as well as its base of customer data.

EA Technology's expertise is in the application of its new technologies and it has designed pioneering management systems for smart networks.

Durham University, together with its Durham Energy Institute, brings world-class research capability and an academic rigour that challenges the entire team to work to high standards.

This partnership style of working has already led to a number of spin-off initiatives, all of which are currently in the evaluation phase, but may well lead to further bids for innovation funding.

5.3 Generating ideas

Sources of new ideas include learning from research projects (such as those under the LCN Fund); new products from energy suppliers; technologies and services from other industries and universities; ideas and suggestions from our customers and other stakeholders; scientific literature; trade journals; activities of other DNOs; benchmarking; external consultants; employees; increases in IT capabilities; and many others.

Recently, we have benefited in particular from a heightened external focus, looking beyond our company to other leaders in our sector (in the UK and abroad), and indeed beyond the energy sector itself. We expect and encourage our senior people to look at business models and approaches outside our company far more than in the past. This is now central to our approach to innovation. We aim to:

- identify new approaches that might improve our business, based on tried-and-tested solutions; and

- build partnerships with other organisations that have different capabilities and are willing to help us generate ideas, solve problems in different ways and pursue more ambitious projects.

CASE STUDY: importing ideas for web-based services from other sectors

Small and inexpensive web applications are increasingly widespread in service industries. Recognising this, we looked for opportunities to adopt similar models in our own business.

We saw the opportunity to provide better information to our customers in two simple online applications:

- linking to the industry database to tell customers who their electricity supplier is; and
- linking a mobile 'app' to our trouble management system to allow customers to check if they are part of a known power cut.

We formed a Web Concepts Board to control future system developments, and tendered for a long-term supply partner. We now have a long-term partnership agreement with a digital developer with a strong track record in a range of sectors that include retail pharmaceuticals and commercial music-download services.

Once it went live, our 'who's my supplier?' site began to take traffic away from our telephone enquiry lines, and improved service feedback. It was therefore clear that we could successfully deploy similar services more widely across the customer-facing aspects of our business.

Together with our digital development partner, we have developed a series of web-based business improvements that help our own people (via our corporate intranet) and our customers (through online self-service for activities that we previously managed via letter or telephone). These innovations have proved successful, earning very high satisfaction scores from users of these systems.

Now we have an established control process, we will continue to develop web applications to improve the customer experience.

By looking at service models in other sectors, and partnering with outside experts, we have generated innovative ideas for new services that enhance the customer experience, and new working models that allow greater flexibility for handling customer enquiries.

This approach of 'horizon scanning' to locate and implement the best ideas that are being deployed outside our business also means that we continually look for new developments elsewhere in the industry. We review our business plan annually, and as part of this review we undertake a comprehensive assessment of where our performance has the potential to improve by comparison with performances we can see in other companies.

Our shareholders play an important part in that process. As a privately-owned company we are part of a much larger organisation, but we know our shareholders personally. When we take them through our business plan, they challenge us by reference to performance standards and developments that they see elsewhere, both in the MidAmerican group, but also in the wider Berkshire Hathaway family of companies. In the recent past, this has resulted in a number of formal best-practice-sharing projects in areas such as procurement, capital investment management, customer service management and safety management.

CASE STUDY: adopting best-practice technologies from other DNOs***Use of the monitoring functions of Bidoyng units***

Electricity North West's projects used the monitoring facility on Bidoyng units to assist in connection of low-carbon technologies (LCTs).

We were already installing Bidoyng units to address LV reliability issues, particularly intermittent faults, but had not been using them in this way.

We have picked up on this idea and we are now further developing the uses of this functionality in our Customer-Led Network Revolution (CLNR) project.

Use of tracer additives in fluid-filled cables

UK Power Networks previously had an Innovation Funding Incentive project considering the use of perfluorocarbon tracer (PFT) additives in fluid-filled cables.

A known problem of such cables is that, when damaged, either by mechanical impact or by corrosion, they leak insulant into the environment. By adding tracers to the insulant, leaks and damage can be found more quickly.

This has been adopted as 'business as usual' for the 2015-23 period.

5.4 Filtering, testing and evaluating ideas

Innovation projects need to be justified before we include them in our plan.

Any project or programme that we implement in our business plan is subject to rigorous scrutiny and appraisal to ensure that the expenditure is justified, and innovation projects are no different.

Since the mid-1990s, we have made objective, detailed, rational investment appraisal a key priority in our engineering group. This investment appraisal, described in detail in [section 1.2.2](#), drives the selection of capital investment projects and determines our maintenance policies and schedules of work. In the power industry, these techniques were an innovation in themselves: they were largely adapted from the pioneering work done in the high-hazard industries such as nuclear and petrochemicals. Our established appraisal process has distinguished us as one of the most efficient businesses in our sector, and we believe our discipline on quantified investment appraisal is second to none.

To evaluate innovative business ideas, we apply those same techniques for rigorous assessment and appraisal. We develop a clear proposition, assess project costs and understand the benefits that the investment is expected to deliver. We also consider alternative methods of achieving the same outcome, the availability of internal and external resources and project risks before validating any item of expenditure.

We have therefore already established strong processes that will ensure customers and stakeholders get the best value for money from our innovation activities.

We know that innovation projects, particularly those that introduce additional complexity to our operations, can introduce new risks to our business. To manage these risks effectively, our evaluation of innovation projects incorporates a strong focus on the practical implications of adopting a new idea or process, and an assessment of any associated technical risks. We ensure that we test new technologies thoroughly to understand their properties and evaluate their benefits.

For example, we might restrict the deployment of new, untried technology to a limited number of sites, and ideally we would select locations on the network that have relatively low criticality if the new equipment were to cause problems. Once we have built up a period of service history and track record, we roll out the successful innovations more widely.

Where a new technology introduces new risk or practical complexity, a higher hurdle in terms of the benefits it will deliver must be cleared before we decide to implement it. We think this is a prudent and sensible approach to take, both commercially and in terms of delivering benefits to customers.

CASE STUDY: 'high-tech' fault current limiting devices

In recent years, we have introduced two new devices that are designed to dynamically change their electrical characteristics very quickly to limit the amount of fault current that passes through the network when a short-circuit develops.

First, we deployed arc suppression coils in a pilot programme. These devices work particularly well on rural networks that are prone to lightning strikes. They effectively suppress the fault current as soon as it develops.

The short-term impact is often to cause a slight increase in faults as the device flushes out any weak spots on the existing network. But after that initial period the pay-off is huge – radically reducing the impact of faults on those rural networks. Arc suppression coils are now a standard part of our toolkit for protecting our rural networks.

The second device is a superconducting fault current limiter. This is an even more sophisticated piece of equipment that is still in the relatively early stages of development – but the signs so far are promising.

If the performance continues to match what we have seen so far, and the manufacturing costs of fault current limiters fall as they become more widely used, they have great potential to help us fit more distributed generation onto the network.

Stakeholder views feed into the evaluation process to help us prioritise our choices.

Stakeholders feed into the evaluation process in two important ways. First, we periodically consult internal and external stakeholders and analyse their requirements. Through this, we seek to understand the potential for innovation to meet stakeholders' needs. And by involving stakeholders at the early stage in the development of ideas, we may maximise the opportunity to access external funding to complement the range of incentives for innovation that exist within our regulatory framework.

CASE STUDY: LV monitoring at distribution substations

For many years, distribution engineers have considered installing LV monitoring at distribution substations. However, the cost of doing this was considered prohibitive, and could not be justified on the basis of the benefits.

The LCN Fund first tier projects run by Scottish and Southern Energy, Western Power Distribution and UK Power Networks looked again at the potential to introduce substation monitoring. These projects provided sufficient indication that the potential for this technology had improved and that the benefits might be starting to outweigh the costs.

We have therefore decided to include LV monitoring in our plan for 2015-23. We will adopt this as standard for new distribution substations and fit it retrospectively at points on the network where demand growth is a concern. This is a good example of enabling investment that is necessary to lay the foundations to efficiently accommodate the higher volume of LCTs forecast for the 2020s.

Table 1 below summarises a set of technology-innovation objectives ranked in order of priority according to stakeholder requirements, based on the stakeholder engagement we undertook during the planning phase for the next regulatory period. This type of analysis is used to shape and inform our portfolio of innovation activities on an ongoing basis, to ensure that we target our efforts at areas that our customers prioritise.

Objective	Requirement	
	Relative	Rank
Increase network availability	17%	1
Increase network reliability	16%	2
Reduce unit cost	14%	3
Increase speed of connection	13%	4
Reduce hassle of interacting with NPg	7%	5
Adapt to climate change	7%	6
Improve power quality	6%	7
Meet government mandates	4%	8
Minimise impact on National Grid	4%	9
Increase customer safety	4%	10
Increase asset visual amenity	3%	11
Reduce noise pollution	3%	12=
Reduce oil pollution	3%	12=

Table 1: Stakeholder prioritisation

The second way in which external input feeds into our evaluation process is through the creation of a series of expert advisory panels, to help us develop our thinking and evaluate our proposals, particularly in areas where we regard our expertise as limited.

- Our Social Issues Panel is chaired by Derek Lickorish MBE, Chairman of the Fuel Poverty Action Group. Its remit is to consider the effect that our work may have on vulnerable customers including the fuel poor, evaluating our approach to these groups and helping us formulate appropriate ways of adapting our business to better serve them.
- We also do a similar thing to test our thinking on our plan to improve customer service. Our Customer Service Panel is chaired by Lynne Mills, Director of Client Services at the Institute of Customer Service. We look to the panel to challenge and advise us on how we can make our service offering more accessible, effective and beneficial to our customers.
- Our Web Concepts Board evaluates all of our new web-based projects against technology-specific criteria that have been developed with the help of our digital partner.
- Even in areas related to our core-skill area of engineering, the world is changing fast. As we recognised in the four key challenges set out above, technological innovation around smart

Expert advisory panels have guided fresh thinking

grids is one of the primary areas of innovative activity for the medium term. To help challenge us to stretch ourselves in this area, we asked a leading academic in the field of smart grids to form a panel of independent experts who would serve as a challenge to our own technical team. The resulting Technology Advisory Panel is chaired by Professor Phil Taylor of Newcastle University. Our business plan for 2015-23 contains a range of technical assumptions that we have incorporated as a direct result of the challenge provided by the Technology Advisory Panel. In particular, we have incorporated the use of real-time thermal rating and fault-current reduction as advised by this panel. Further detail of the costs and benefits of these innovative technologies is provided in [section 1.4](#).

- We have also formed an overarching Stakeholder Panel that has met three times inside the last 12 months. External panel members represent key stakeholders from all aspects of our business operation covering the full span of our outputs - the focus is not limited to customer service improvements. The objective of the panel is to discuss our business plan and future priorities in order to ensure that we are identifying and being responsive to the needs of our stakeholders. Panel meetings are attended by our Chief Executive and our operational directors with accountability for all outputs areas.

Innovation projects are required to create new solutions, practices and processes...

In this section of our plan we have set out what we see as our four main innovation priorities for the next 10 years. They will not govern every single aspect of our innovation programme, but they will certainly determine most of it. In any event, the demand for innovation is driven by the need to achieve a certain objective where the method to achieve it is not yet part of our established routines; it may be that there is a solution in other companies or sectors that we need to adapt to suit our circumstances or, in more extreme cases, it may be that the solution is not yet available anywhere. In each instance, innovation is required when new solutions are required to fill the gap between where we are today and where we need to be in the future.

*Innovation fills
a gap by
generating new
solutions*

In Table 3 at the end of this section of our plan we detail a number of innovations that we believe will need to be developed over the next decade in order to support the objectives we have set out in our plan. These are all new processes that currently do not feature in our business as usual practices. If we do not run innovation projects to develop these solutions, and if we continue to work in the same way that we do today, we can be confident that we will not meet our goals.

In the case of a smarter powergrid, the objective is clear: we need to develop solutions to enable customers to connect significantly increased volumes and concentrations of renewable generators and low-carbon loads at a reasonable cost. These new solutions need developing, many of them either from scratch or from very early research-phase ideas, so that they can be proven prior to large-scale deployment on a public power network that has not previously been developed to operate in this way. This clearly requires innovation projects in order to develop both the network technology such as active network management systems and the new commercial arrangements such as I&C demand side response. We give more detail of our thinking in this particularly important area in [section 5.7](#).

For smart meters, our primary objective is to ensure that we harvest the benefits to customers made possible by the nationwide roll-out of this enabling technology. Again, the objectives are clear as set out [later in this section](#) and in our smart meter benefits case. For instance, we will use the data coming from smart meters to produce a faster response to faults. To achieve this plan commitment

requires innovation projects to develop the data hub, the changes to our internal systems network management fault logging systems and our operational dispatch processes.

Similarly, for web-based and digitally-enabled services, our plans described further in [section 5.7](#) include development of online systems that allow customers to track progress of their connection orders. This is just one part of a transformation that is taking place in customer service for our connections customers. These order tracking systems require investment in new web-based applications and modification of our back office processes. This business process re-engineering requires an innovation project.

In the area of [energy affordability](#) there is a significant gap between our stated aims and the know-how for each step to deliver on those objectives. Building partnerships and working collaboratively with regional agencies to assist customers who are fuel poor is a significant element of what we need to achieve. We have much of the core competence for this existing in the organisation but the methods and processes to be adopted require further development and implementation. These organisational firsts again require innovation projects.

... and innovation is funded from a variety of sources.

We often fund innovation from our business-as-usual cost base when the work required is well-defined and there is a relatively high likelihood of success. Examples from our recent past include our pioneering use of digital channels to improve our customer service and our work to develop new metrics to measure asset performance and translate these into techniques that improve our efficiency and output delivery. In both instances we had a clear view of what needed to be delivered and also, in the customer service example, had confidence in the chosen solution by looking closely at the experience in other industries and by working with partners (e.g. our digital-services specialist supplier) who could transfer that pre-existing learning into our sector.

In contrast, innovation projects are funded through the ring-fenced innovation allowances or annual competitions when the path to deliver the change is less certain – either in the design of the appropriate solution or in the perceived likelihood of success. Another innovation project category that would qualify for this innovation funding treatment, although less common, is the situation where the benefits are expected but these are far into the future or the timing is relatively uncertain.

5.5 Implementing ideas

The final stage of innovation is the delivery and implementation of an idea, and the subsequent transition from an idea to 'business as usual' if it proves successful.

The value from rolling out innovations is assessed in a manner consistent with other investment decisions.

In our plan we set out our approach to investment where we consider the various investment options to achieve any given service level. The right choice across different expenditure or input options is the solution that delivers the best cost and service outcome for customers in the long run, while keeping our network safe for employees and members of the public, and maintaining the reliability and underlying health of our asset base. This methodology is as applicable for the implementation of innovations that are then rolled out at scale as it is for other categories of investment.

The foundation of any of our appraisals is a detailed, and invariably, quantified view of the risk that is being reduced or the opportunity that is being created. In all of our investment appraisals, we set out that as the basis for everything that follows. From there, we evaluate the option(s) being considered against a series of specific value areas, such as safety risk, reliability or resilience improvement, environmental risk reduction or simply reduced costs to run the network. We apply the same techniques to evaluating the benefits of innovation as we do to any given investment proposal. Having proved the benefits, we also consider the risks of implementation and the changes that might be needed to make sure that the execution of the proposal will go smoothly. These processes are deeply embedded in the way that we manage the business and are discussed in much more detail in section 1.1 of the core narrative to this plan.

Senior leadership is essential where innovation demands significant change to the way we operate.

As explained earlier, all but the narrowest of technological innovations demand a change in the way that we manage our business. We see it as the executive team's job to make sure that changes that affect multiple parts of our business are implemented effectively and efficiently, to ensure that the full benefits of change are achieved.

Innovation is embedded into our annual planning and weekly management routines

As part of our annual business planning round, we set specific corporate goals, including objectives related to innovation. We differentiate these management goals between those that can be delivered by an 'incremental improvement', and those that need us to make a 'step change'. Step-change projects reflect high-priority targets for our business, and tend to require significant executive input. These targets are reflected in our senior managers' personal objectives, meaning our leadership teams have strong incentives to implement new ideas successfully. We publish an annual stakeholder report that tracks our progress and sets out our priorities for the year ahead, so that our Stakeholder Panel and other interested parties can hold us to account on our performance and commitments.³

Our Chief Executive and his leadership team review progress against the key aspects of our business plan every week, with a formal review at the Board every month. This review includes progress on implementing innovations. Senior managers or executive leaders take primary responsibility for leading this stage of the process. Rigour is ensured through the use of standard format written reports that focus on progress and outlook with reference to agreed outcomes, success criteria and key project milestones.

A senior manager is assigned to lead the implementation of each step-change innovation project, and an executive director is accountable to the wider executive and the Chief Executive for ensuring progress and implementation, which are monitored at least monthly. Typically we assemble internal project delivery teams with the express purpose of implementing these innovation projects. Progress on all such projects is reported directly to the executive team until they are completed.

³ <http://report14.yourpowergrid.co.uk>

CASE STUDY: implementing 'step change' innovation to reduce unit costs

At the last price control review, we were judged by Ofgem to have the most efficient set of support costs in the industry, but we were challenged to achieve some improvement in our unit costs of capital investment.

In the areas being targeted, we needed to reduce those costs by around 10-20%, or we would have overspent our price control allowances and failed to deliver a reasonable return for our shareholders.

We sought to achieve these unit cost reductions through a series of co-ordinated innovations. In 2010 and 2011 we substantially re-engineered a large proportion of our capital investment programme, in order to deliver this significant reduction in the capital unit costs. The benefits from this work are built into the investment plan for the period 2015-23 and over that period deliver a benefit to customers of £180m.

This performance improvement was highlighted specifically in our business plan as a major 'step change', and was communicated clearly throughout our business.

A collaborative approach to project delivery is vital – but can introduce managerial challenges.

Although it carries an overhead, we are committed to continuing to pursue collaborative projects as part of our approach to implementing innovation: we think this is essential if we are to innovate in the more progressive challenges that we face. However, as well as bringing benefits in breadth of outlook and capability, external involvement can also increase delivery risk and require more complex project management.

Our experience of working collaboratively on projects like the Customer-Led Network Revolution or our Web-Services Development Programme has taught us that we need to adapt our managerial routines if we are working across external organisations. Issues such as intellectual property rights, confidentiality and the apportionment of delivery risk all have to be dealt with up front – and they are things that we do not need to worry about when we are working on our own.

Collaboration is not only beneficial for major one-off projects: we believe it can also help us to deliver better innovation projects across the full range of our activities, as illustrated in the two case studies below.

Collaboration for delivering better innovation***Modelling the network to improve planning***

The ability to model networks and activities, and to translate those models into useful information, is incredibly useful to us, to other DNOs and to our regulator.

Recent projects led by Northern Powergrid have developed health indices and condition-based risk models. Collaborative approaches to these modelling projects across the DNOs can provide an efficient way of tackling key improvement issues, and sharing knowledge.

The work to date involved developing mathematical models and translating these into software-enabled tools that can be used to support investment decision-making. We will continue to develop the range of models used for this purpose.

It is also clear from the Customer-Led Network Revolution project that the ability to integrate these models with small-scale physical simulations offers a new set of possibilities.

Several universities already have greater skills and more extensive experience in this area than are available within Northern Powergrid. We are therefore planning to attract a long-term strategic partner to deliver modelling projects, giving them the time necessary to get familiar with our network.

We have included funding in our innovation cost plan for this and anticipate this will form part of our Network Innovation Allowance spending in 2015-23.

Joint industry innovation projects

In the 2015-23 period, we believe that the ethos of the LCN Fund needs to develop so that we enter into more bilateral and multilateral projects with our industry peers.

Based on the innovation portfolios of other DNOs that we have seen, we believe there is a significant opportunity to collaborate for mutual benefit. Although this may not reduce the overall industry spending on innovation, it will increase the quality of shared learning, enabling quicker and lower-risk roll-outs of new technologies and approaches across the sector as a whole.

We think the Energy Networks Association's (ENA's) working groups will continue to provide a useful platform for projects where all DNOs have a common interest. The activities are likely to include co-ordinated dissemination of innovation project learning, good practice guides and engineering standards for new smart technology and support for the development of European smart grid standards.

To investigate a range of relatively small-scale technology options and other projects (up to around £50k each) we anticipate that something similar to the Strategic Technology Programme will continue in the 2015-23 period. This programme is jointly funded by all of the distribution network operators, and managed by EA Technology.

We need to remain flexible to implement new opportunities quickly and effectively, wherever and however they arise.

We also recognise that we have to be ready to implement an idea that addresses new and potentially unexpected issues. A good example of this is our recent innovation in the field of protective clothing for our field operatives, who are now kitted out in what we believe might be the only properly arc-flash-rated clothing in use in the UK power industry.

CASE STUDY: improving the standard of safety workwear

When we changed our company branding, we recognised the need to refresh and update our workwear to reflect our new name.

Given that we were intending to replace our protective clothing, we took the opportunity to assess whether we could upgrade the quality of it. We looked around and saw that our US sister organisations issued arc-flash-resistant protective clothing to their field staff, of a type not used in the UK.

We carried out a full study of the short-circuit energy-discharge levels for all operational activities on our network to determine the level of protection needed from any new clothing. Our studies confirmed that we needed a protective clothing solution with a higher specification than anything we had previously seen in the UK.

We engaged industry experts to help us arrive at a suite of workwear products offering a combination of arc-flash and flame protection, whilst at the same time providing comfort and convenience for the user. This clothing improves arc-flash protection and offers high standards of weatherproofing and durability.

We developed the clothing via extended field trials that covered different weather conditions and a range of practical applications, which were followed up with careful and detailed specification of the required standard of clothing to our suppliers.

We now have a multi-layered workwear solution that has been proved by arc-flash testing and provides sufficient protection to our employees for all activities on our network. We have issued all the clothing, and organised specific dedicated training on its correct use, setting a new standard for safety clothing in the UK industry in the process. We think this will soon become the universal standard.

We believe that this innovative approach to combining fabric technology, workwear design and user application sets Northern Powergrid aside as the UK leaders in arc-flash protection on distribution networks. The development was recognised by the British Safety Industry Federation (BSIF), the leading trade body within the safety industry, awarding Northern Powergrid and J & K Ross (the garment manufacturer) its BSIF Safety Excellence Award in May 2013.

Dissemination of the learning is as important as the learning itself.

The quality of the dissemination of results has improved markedly over the years, from when we tended to regard this stage of a project as an afterthought. This change in culture has been stimulated by the introduction of the LCN Fund, which has brought with it an obligation to make sure that we get the learning into the public domain.

We have developed processes and capabilities to promote and share learning widely through the Customer-Led Network Revolution project. This has started within the project team itself, which spans organisational boundaries, where we have developed the use of web-based file-share systems to collaborate on the production of outputs. Externally, we have made use of social media, video content and websites to make the learning accessible in addition to the more traditional release of analysis papers, presentation slide-packs and spreadsheets with trial data (see separate [annex 5.2](#) on the Customer-Led Network Revolution for a listing of the project outputs). We expect these techniques, along with the associated controls on data protection compliance and management of intellectual property rights, to be carried forward into future projects funded through both the Network Innovation Allowance and Network Innovation Competition in the 2015-23 period.

For internal projects, we have recognised the importance of ensuring the communication supports either delivery of a project or adoption of the output from a change. The Customer-Led Network

Revolution again provides a good example of the former, where briefing and awareness amongst contact centre staff and operational engineers have been critical to supporting the handling of customer enquiries and the safe roll-out of new network technology respectively. For the latter, the arc-flash protection clothing provides an example of where communication formed an essential part of the initial mass roll-out of this new workwear as well as the subsequent process to respond to queries and issues identified by users. This ensured it was used correctly and the maximum value was obtained from the significant investment. Again, all these approaches will be used in the 2015-23 period to ensure that innovation is successfully delivered.

Successful ideas must be incorporated into routine operations quickly.

Transitioning successful innovations into the routine operation of our business is challenging. We have learned the need to be deliberate about locking worthwhile innovations into our everyday operations.

We now recognise that we will need to set out some clear guidance and instruction around our approach to embedding learning into the organisation, and take steps to make sure that our people are trained and practised in the new techniques or approach we are seeking to introduce. The specific way that we capture the new requirements will vary to suit the application, but some of the most important instruments that we use are:

- ***Technical standards*** – if the innovation is technological, then we will almost certainly need to alter the standards and specifications that we use to procure goods and services or to design, build or maintain our network. The smart-grid area is a good example of where this is likely to be needed, and we have also introduced new standards as learning and innovation have developed in flood protection for Critical National Infrastructure. Changing standards is not straightforward because our company standards are almost always influenced by or drawn directly from standards that are owned by industry, national or international standards organisations. Whenever we want to roll out an innovation, we have a choice to make about the extent to which we can set the standard internally or whether we need to align our approach to an external standard. Very often that will mean we will need to work collaboratively with other network operators through the Energy Networks Association to agree a new industry standard approach that we are all prepared to adopt. Sometimes we will need to bring our expectations in line with international technical standards, if the innovation is going to make use of technology that will serve the international market. Our group of technical experts who work on our standards and policies take the lead in this aspect of implementation.
- ***Company policy and codes of practice*** – as an operational business that works routinely with live electrical equipment we are very well attuned to using controlled documents that define policy and procedures. We update these documents whenever we adopt an innovation that involves changing the way that we carry out routine tasks. For example, safety codes of practice have been introduced around new battery storage technologies that are being tested through our Customer-Led Network Revolution (CLNR) project. These updated policies and codes of practice are held on a central system that can be accessed by the relevant people who are required to meet the policy or practice, and are made available on our intranet.
- ***Training*** – embedding a new innovation into routine business is also likely to require some level of training. We have a variety of approaches available to us, which we tailor to the specific training need. For example, we have a significant in-house training programme, which is an important part of developing skilled craft workers and maintaining safety competence, and which is often done on an off-the-job basis. We also adopt a ‘train the

trainer' approach and invest specific formal training in a smaller number of people who are then released to train their colleagues in the field (for example, we adopted this approach in our recent successful roll-out of a new outage management system). Finally, online training techniques are proving to be a very useful way of rolling out new skills and know-how to a large number of people.

The final step in embedding new innovations is a feedback loop to check how the new development is settling into our processes, and how we might be able to improve its implementation. Depending on the innovation, this will draw on the insights of a potentially wide group of people in the business who are affected by the new developments.

On those occasions where we think that a particularly thorough and formal review is required, we have, in recent years, started to use our Internal Audit team to perform special audits at the executive's request to look at new areas that we have introduced. The new web-based services that we have been bringing forward during the current regulatory period are an example of that. We think that this approach, which might use a specially assigned project team, or be part of an external accreditation process, will become increasingly important in the 2015-23 period.

5.6 Looking forward to a successful period of innovation

We believe that the culture and processes we have been developing, and will continue to promote, will encourage innovation right across the company. But in the end, we have to be judged by the results of our innovation to date and the quality of our plans for future innovation. We believe we can be trusted to deliver innovation-based value through this business plan, because we:

- have a track record of delivering innovation that puts us in a strong position to deliver in 2015-23; and
- are setting the right priorities for our innovation programmes in the next price control period.

2010-15
innovation spend
>£18m
(0.6% revenues)

We think that we pass both of those tests, and in the rest of this section we expand on what we have delivered, and what we expect to do in the future.

Our track record shows that we can deliver innovation.

We have a strong track record of leading in our industry and delivering innovative solutions and approaches. We think our proven ability to generate and implement good ideas is a direct result of our approach to innovation described above.

During the current regulatory period, we plan to spend at least £18.1m (0.6% of revenues) on innovation projects that have been paid for through the funding mechanisms that Ofgem introduced at the last price control review. This is four times more than we invested in these kinds of projects in the preceding (2005-10) period. A summary of all of those projects is contained in [annex 5.3](#) where we explain how these projects have impacted upon our plan.

The case studies provided in this section demonstrate examples of where we have been successful to date. Full details of these and other examples of our successes are provided in [annex 5.3](#). We think this track record demonstrates that we have delivered real value across a range of types of innovation – from specific new technologies that we have introduced, to new business processes, commercial solutions and service offerings that we are pioneering. This demonstrates that we are

capable of delivering benefits for stakeholders, and that we are properly set up to continue to meet the innovation challenge in 2015-23.

Our more recent track record proves that we are able to make rapid progress on new themes and strategic priorities as they emerge. This is most evident in our two major areas of innovation in the past few years – low-carbon networks and web-based services.

From a standing start in 2010, both areas were identified as strategic priorities. Since then we have moved into a position where we are leading the largest smart-grid project in the UK, and we are widely regarded as leading our sector in the introduction of web-based services. This gives us confidence that we can deliver across all four of our priority innovation areas. Our future plans represent a continuing theme where we will be building on existing strength.

For smart grids in particular, we are proud to have moved quickly and effectively in response to Ofgem's introduction of the LCN Fund. The LCN Fund made sure that the focus on innovation in 2010-15 would be on the role of the network companies in enabling the transition towards a low-carbon economy. At the beginning of the current regulatory period, we set ourselves the objective of being a leader in the field of understanding how smarter powergrids can form part of the low-carbon future that is planned for our country.

Given the scale of this ambitious project, we think it is reasonable for us to be asked what we have learned already, what we expect to learn in the near future and, crucially, what difference it has made to our plan for the 2015-23 period. There is already a great deal of information in the public domain in relation to this project, so that everyone in the industry can make use of the findings.

To help stakeholders who want to understand how the project is paying dividends already, we have put together a summary that explains the significance of some of the key public-domain information. You can find this in [annex 5.2](#).

CASE STUDY: CLNR – the country’s largest smart-grid project

The Customer-Led Network Revolution (CLNR) is a £54m project that brings together technology, social science and commercial innovation to explore the potential for engaging customers in low-carbon networks. It is our flagship project in the low-carbon networks area and, although it is only part-way through, it is already delivering results that are being regarded as internationally significant.

We produced a full set of new load profiles for demand customers, including for homes that already have low-carbon technology. This showed that customers with their own generation tend to prefer to shift their own load to consume the power that they are producing.

We have found that customers with low-carbon technology have been very keen to get access to time-of-use tariffs and they have proved a willingness to shift some of their peak demand within the day, delivering a 14% reduction in peak demand for those properties.

We have confirmed that there is already some appetite amongst industrial and commercial customers to contract for demand-side response. As a direct result, we have decided that, in the next regulatory period, we will present customers with the opportunity to sell back capacity in an auction before we commit to major reinforcement on the network.

We can use weather sensors to reassess in real time the maximum capacity of an overhead-line circuit – generally the results create higher capacity ratings than would traditionally be used. As a result, this technology will be adopted as standard throughout the next regulatory period to be offered to connections customers in order to reduce their costs.

Later this year we will commence live operation of a fleet of six electricity storage facilities on the live network, together with a new generation of integrated control system that will establish the feasibility of linking industrial- and domestic-scale demand response in real time with the rest of the power network, including the electricity-storage facilities.

We have also recently partnered with the country’s largest provider of electric vehicle charging points to allow their customers to participate in our electric vehicle network trials. Our objective is to provide the industry with some of the most comprehensive insights into the impact of electric vehicle charging on an electricity network, which will be crucial for the long-term development of the powergrid as greater emphasis is placed on decarbonising transport.

5.7 Setting the right priorities for 2015-23

Looking into the next regulatory period, we will target our innovation activity towards the four strategic challenges of low-carbon networks, smart metering, web-based services and affordability. Across these four themes, we have a clear view of where we need to go in the early years of the plan and, as the specific challenges become clearer in the later years, we will build further innovation priorities into the business plan.

Not all of this innovation is proposed to be funded through Ofgem’s Network Innovation Allowance. For example, our plans to improve affordability and introduce more web-based services (see [section 2.6](#) and [section 2.4](#) respectively) do not require additional funds to our cost base: we are planning to deliver substantial improvements in these areas without increasing costs, by introducing innovative approaches.

Creating a smarter powergrid is the area of our business that demands the most innovation.

The low-carbon transition and its demand for a smarter powergrid is undoubtedly the area that demands the most significant innovation, both technological and commercial. As discussed in [section 1.4](#) of the core narrative of this plan, our plan builds in a comprehensive set of solutions to prepare for the ramp-up in the use of LCTs in 2015-23 and the further period from 2023-31.

Our smart-grid development plan ([annex 1.9](#)) is part of our detailed planning activity to tackle this challenge. It identifies the key technological capabilities that we expect to have to develop over the medium-to-long term. It is a live document that we will keep under review and update as we learn from our own innovation projects and those completed by others.

Our current view is that some of the most important requirements will include:

- Systems that enable pre-arranged demand-side responses to be triggered in real time as and when network constraints are encountered.
- Cost-effective control systems to allow the use of domestic-scale generation to provide low-voltage network support.
- Methods of engaging customer groups on a local level to create community-scale benefit from aggregated demand response.
- Smart switching device applications and use of power electronics to improve low-voltage network reliability and flexibility.
- Active network management techniques and use of state estimation to control the network more dynamically by building on the foundations of our CLNR project.
- The use of AC/AC converters and fault-current limiters for reconfiguring distribution networks.
- Development of smart techniques for meshing high- and low-voltage networks to increase available capacity.
- Integration of smart-metering data into network design processes and tools to provide more accurate views of available network capacity for new or modified connections and more targeted investment to reduce electrical network losses.

A key theme in our approach will be to continue to explore the different ways that end-users of the network can be encouraged to play a part in providing demand-side response to reduce overall energy system costs. Our findings to date suggest that, if it can be made easy enough for domestic customers, there is a realistic possibility of higher engagement when smart meters are widespread. For larger business customers the signs are that, if the commercial arrangements are simple and accessible enough, the technology is already capable of delivering a meaningful contribution to balancing the needs of the system in real time. So, in the first half of the next regulatory period, our aim is to develop projects that blend technology and commercial innovation to make it possible for this to happen.

The expected benefits of this type of innovation will be felt directly by customers in the overall cost of running the network and in their own energy efficiency. But we can also see that the combination of our smartgrid enabling investment proposals, smart-meter data and our innovation programme will allow us to explore the potential for a range of powerful additional services that could be introduced in the medium to long term. These services would probably be less directly related to the cost of running the network and would stem from combining:

- the use of high-powered data processing and pattern recognition capabilities;
-

- smart-meter data;
- our proposed smart-grid enabling investment; and
- the type of unifying control schemes currently being trialled in our CLNR project.

These capabilities could be blended to create responsive information services that might, for example, detect unusual energy consumption profiles in a given property and trigger some form of notification or even a predefined control system response. Innovation of this type is becoming commonplace in other technology sectors, where data is gathered for one purpose and then reused and reprocessed to create products and services that were not originally envisaged. In this context, it is possible to envisage potentially significant benefits in respect of community energy projects, detection of electricity theft, losses reduction and enhanced care for vulnerable members of our communities.

Given that the whole of the smart-meter roll-out is still ahead of us, we see those second-phase innovation challenges as coming later in the 2015-23 period. But we think they illustrate the importance of linking up the thinking in the primary activities of investing in smart-grid enablers and extracting benefits from the smart-meter roll-out. It is through our innovation programme that we intend to forge these links.

Further detail of the above areas is included in [section 1.4](#) and [annex 1.9](#).

The value of innovation in supporting the low-carbon transition is recognised in the regulatory framework through the Innovation Roll-out Mechanism (IRM). We will make use of this mechanism as necessary in the two periods specified by Ofgem (2017 and 2019) to fund the roll-out of novel and proven solutions for low-carbon applications.

TARGETED INNOVATION: life-size smart-grid demonstration

One of the exciting projects that we are exploring now, with a view to its being a big part of our plans in the 2015-23 period, is the development of a partnership that could build and explore the use of a 'life-size' smart grid that involves a range of technologies and users.

We have entered into high-level discussions with Newcastle City Council and the University of Newcastle, who are already committed to the Science Central project.

Science Central aims to build a fully-equipped smart grid in a regeneration zone in the centre of the city.

We are already engaged with the project with a view to making it a major part of our innovation programme during the 2015-23 period.

These are exciting times for us, and the rest of the industry, as we explore innovative solutions to enable the transition to a low-carbon economy. It is obviously early days in a journey that will probably last for the next 30 years, but we feel we are well positioned to continue to play a leading role in the sector in developing and promoting cost-effective and innovative solutions.

Smart meters provide innovation opportunities in the plan period.

The implementation of smart meters will be led by the energy suppliers and, as such, the bulk of the work we will do in the early years of the next regulatory period will be routine network support activities to make it possible for the meters to be fitted. However, as the population of smart meters grows, so too will the insights that result from data that records half-hourly electricity consumption in every household, and from alarms that are sent to us automatically if power is lost to the property. These insights will help us understand how best to measure actual electrical losses on the

network, which has until now not been a cost-effective proposition. As part of that work we will explore the impact of low-carbon technologies on losses on low-voltage networks, allowing us to improve our ability to reduce network losses more effectively over the long term.

Our enabling technology plan has built in expenditure to transition our systems into this new world – and we are planning to concentrate a lot of our innovation effort on how best to combine this new data source and existing metering data-flows with our growing capability in web-based services to provide a much richer set of information services for network users.

This is covered further in [section 1.5](#).

Web-based services will enable us to serve customers in innovative and more cost-effective ways.

We have committed to substantial improvements in customer service and customer satisfaction in the 2015-23 period. We believe this commitment will involve providing a significant increase in web-based services, inclusive of mobile technology development, which will require us to continue to innovate in this area, and pioneer these approaches in our industry.

Our experience to date has shown us that:

- There is a real appetite from customers for this type of service – typically we have seen a 70% take-up of services once a web-based option is made available. This learning cemented our commitment to make this one of our strategic priorities.
- The web-based services are particularly well suited to information provision – which allows us to redirect human resources to more complex tasks. This, combined with the 70% take-up we have seen, has been the basis of the proposals that we have made to radically improve service without adding cost.
- There are pitfalls in any new medium – for example, trading with customers over the internet introduces complications (such as the distance-selling regulations) that we didn't anticipate and have had to adapt to in order to be able to manage this change.

Our progress in recent years is a good example of where innovation is funded out of our core expenditure allowances, and arises as part of our 'routine' business operations. We do not receive a special allowance for this kind of work, and it was not factored into our original cost projections for 2010-15.

*Web-based services
70% take-up*

In addition, many of the improvements that we make in our web-based services are currently not captured in the customer satisfaction measure that Ofgem runs. Nevertheless, we decided in 2011 that this would be an area where we would take a lead and we have done so, in effect, at our own cost. We have learned a great deal in a short space of time and that will shape our approach in the forthcoming regulatory period. Much more detail of our plans for new web-based services is provided in [section 2.4](#) and the associated [annex 2.6](#).

Meeting the challenge of affordability requires us to be innovative in the social sphere.

A crucial part of our responsibility towards vulnerable customers is to find ways of keeping downward pressure on costs across the board, and ensuring the lights stay on. But we can also go a lot further in meeting social objectives that protect vulnerable customers and improve affordability.

Our output commitments include a significant step-up in our participation in the wider social programmes that play a part in combating fuel poverty and in supporting those in our communities who most need help, particularly when the power is off. We think that the innovation demands in

this area will centre on finding the right partners for us to collaborate with and adapting our approach to sharing information with local authorities or trusted service providers.

We do not expect this to be a heavy burden on our technological or commercial innovation streams, but we do expect it to demand change in our business processes. Much more detail of the changes and improvements we plan to make is provided in [section 2.6](#).

Our plan commits us to innovation across our other output areas.

Our business plan for 2015-23 makes commitments to improve outputs in every key area, and spend less on the like-for-like routine running costs of the network. We will not be able to achieve that if we do not find new ways of improving performance and, in some cases, solving problems that we do not yet know that we will face. This is particularly true in relation to the challenges to create a smarter powergrid, but the challenge is not restricted to that area. Delivery of our output targets is dependent on some level of innovation.

As well as finding better ways to deliver the outputs, we are committed to continuing to find ways to keep pressure on the cost of doing business. We will continue to look for technological innovations that lower the cost of working on our assets or running our business support functions.

We are familiar with the disciplines of finding and deploying innovations of this kind and we are confident that the routines that we have in place to challenge our standards, our designs, our procurement contracts and our delivery teams will continue to drive the innovation necessary to keep delivering an efficient service.

TARGETED INNOVATION: enabling 20% shorter power cuts

Our commitment to deliver 20% shorter power cuts will need us to make more use of remote control and automation on our network.

We will also need to equip our field force with more hand-held technology in order to shorten the time it takes to dispatch them and clear them to operate on the system.

We will not be the first people to solve those problems, but nevertheless we will need to innovate in those areas. Our enabling technology plan includes the necessary projects that will enable those innovations in the delivery of our services

As we have already explained, prioritisation of the specific projects that we will undertake in the period will be part and parcel of the ongoing management of the business. When looking at a 10-year innovation programme it is not realistic to expect the innovation programme to run according to a script. The nature of innovation is that the objectives and the route to best achieve them will change. So, we will continually review our portfolio of opportunities, challenges and project proposals in order to create the best impact.

In order to provide a strategic framework for that ongoing process of prioritisation, we have taken our more detailed assessments of potential sources of innovation benefit and set them alongside each other in order to identify the time period in which the solutions are likely to be needed and/or become available. This gives an indication of the likely sequencing of business change that will be necessary to support the innovation.

Our analysis is summarised in table 3 at the end of this section of the core narrative. Specific future initiatives are grouped by priority area. And in each priority area we have set out the toolkits we think will be the most likely sources of innovation.

The analysis reflects the heavy emphasis that we expect will be placed on the smart grid area of innovation, but it also clearly reinforces the view that some very significant innovation activity will take place in the rest of the organisation, with little or nothing directly to do with the low-carbon transition. In the areas of IT-enabled process improvement, for example, the investment in IT systems that we are making now, and will continue to make into the 2015-23 period, will create some significant opportunities for us to improve the way we do business. The capability of an asset and cable records system that incorporates spatial as well as asset and network connectivity data is sure to unlock some significant potential in the way that we can interact with our customers and other agencies who need to know where our assets are located.

5.8 Using data to benefit customers today and into the future

We have a clear view of how we will develop our use of data and information technology.

We have updated our plan to take account of some very constructive feedback from representatives of the Consumer Challenge Group that commented on our June 2013 innovation strategy. In response to this feedback, in this new section of our innovation strategy, we set out how we plan to use data and information technology to create sustainable benefits for our customers and other stakeholders.

A route map enables a clear view of the required outcomes

Inevitably, this perspective on our innovative activities draws together many of the initiatives that we discuss elsewhere in our plan, so it is not our intention to duplicate those descriptions. Rather, this data-centric view of our innovation plans shows how we see the common threads that relate to the information and the capability that we deploy to manage it run through the rest of our operation.

In our view, the most important thing in an area like this, where the use of information technology is being evaluated, is to maintain a very clear view of the outcomes that we have in mind. With that in place, we are able to plot a route map that tracks the capabilities that would become available as our data management capability matures, or to highlight the gaps in our capability that would need to be filled in order to support a given outcome.

Figure 2 below sets out our thinking. Primarily it divides the outcomes into three principal layers. The foundation layer involves using data to enhance our engineering operations. In general these improvements are invisible to our customers but they provide an improvement in our fundamental service, typically by either improving network reliability or increasing efficiency. As we move up the diagram, we show the layer of activity that supports better customer contact, and then above that we move from simply improving the ability to get in touch with us and make a better job of communicating the things that we already communicate, into what we are calling enhanced services. In this top layer we go beyond just improving the exchange of existing information, which largely requires bigger and faster data management systems and good use of communication technology, to apply intelligent analysis to the information that we have in order to provide services that are not the norm at the moment.

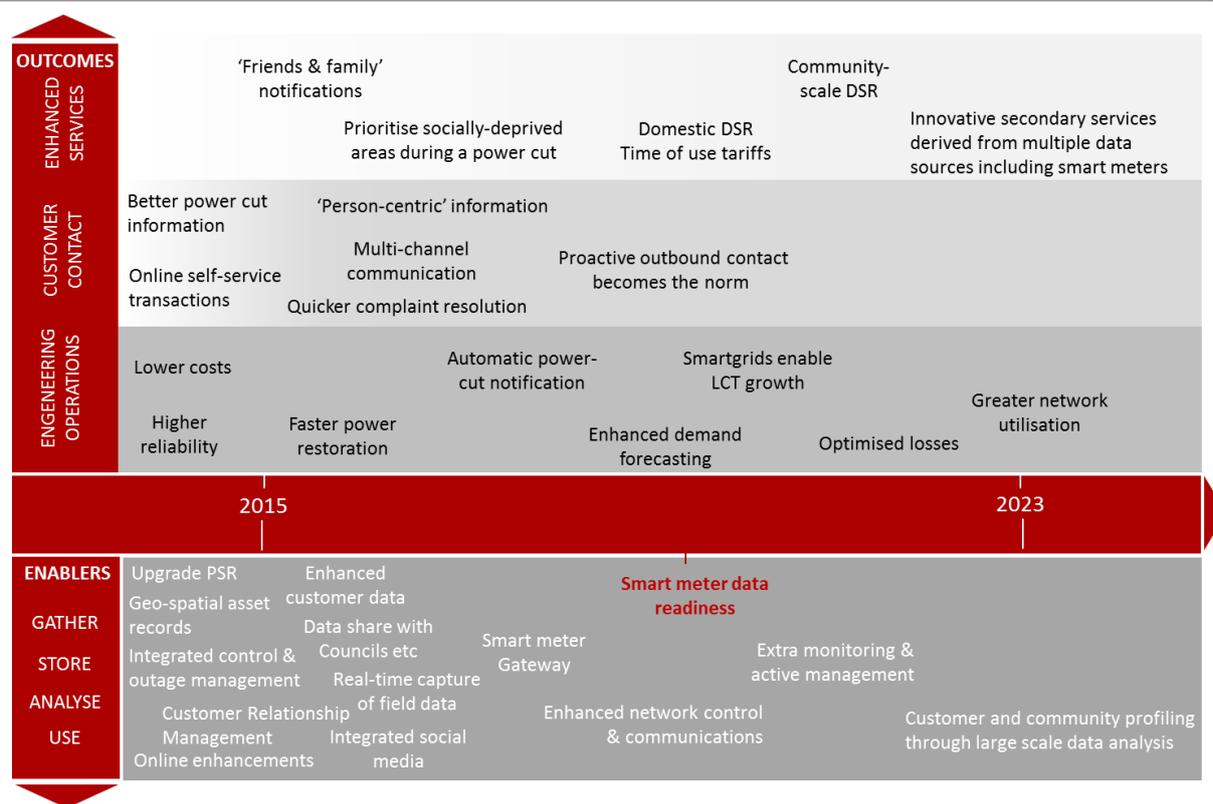


Figure 2: Delivering customer benefits through data use

Improvements planned to engineering operations will transform our routine tasks...

The activities to improve our engineering operations have been very prominent in the last 10 years and they have delivered significant benefits for our customers. We are not finished in this area – but we do regard it as a relatively mature area for us. The next stages in this area are mainly to do with us developing our data and information management capabilities to support a more sophisticated real-time control of the network. In essence, this is the data and information end of the drive towards smart grids. Increasing our capacity to operate more of the network automatically will require us to gather much more information on the state of our network in real-time, and to have the tools and technology to gear the system up to respond to those signals. The outcomes for the customer include the ability to connect more low-carbon technology at a lower cost, improved information when the lights are off and enabling new demand side response services. [Section 1.4](#) of the core narrative to this plan discusses this in much more detail.

Central to those efforts will be our access to, and use of, smart meter data. As the national smart meter program delivers vast quantities of customer data on the use of electricity throughout the day and a loss of supply on the power network, our challenge will be to build the systems that can handle the scale of data flow and make good use of it. In this area, the fundamentals of the engineering are well-proven, but being able to handle the huge increase in the volume of data and building it into our routine business processes in real-time will require us to innovate in terms of how we process this much larger volume of information.

Specific projects that we expect to deliver in the next 10 years:

- Conversion of our paper-based network and substation records to electronic graphical information and dynamic data.
- Integration of our power-cut contact centre and network management systems and data.

-
- Accurate and timely capture of information from site using smart phones and tablet devices.
 - Upgrade of numerous systems to handle the proliferation of smart meter and smartgrid data – including dynamic local network data (power on/off and voltage levels), more accurate local load profile data, linking new data to control systems to enable real-time network management and demand-side response, and enhancing asset health data and indicators to better target investment.

...and customer contact processes are being upgraded to support our core service improvements.

We are focussing our efforts on using technology to streamline the way that customers contact us, giving them more ways of getting to us and putting them in control of how they want to deal with us. Success in this area will involve us making good use of web-based technology, particularly mobile technology. Internally, we see those things as the route to us acquiring much more precise, detailed and up-to-date information on our activities in the field, which can then, very quickly, be processed and made available to our customers through a range of channels. Whereas at the customer's end, we expect to be doing a great deal of work to use technology and the information we hold about our customers and our system to allow them to drive more of their interaction with us on a self-service basis when they prefer this approach. All these developments are discussed at length in [section 2.4](#) of the core narrative to this plan (customer satisfaction).

One of the important developments that we are keen to see happen across the industry is to bring an end to the era where we, as distributors, are not given access to the customer's name and contact details. At the moment, we can ask the customer for those details when they do deal with us, or we can try to acquire the information if it is in the public domain. But we do not have access to the information held by other parts of the energy industry. The investigation into the response by the power network companies to the storms in December 2013 has highlighted this issue again and we are strong supporters of a change to industry rules that would give us access to more customer data. We think that this information would enable us to lay a much stronger foundation for enhanced levels of service to our customers. Significantly, for those customers that are vulnerable, the commitments in our plan rely on developing our data handling and information sharing with other trusted organisations in the region (e.g. local authorities and charities working in the care sector) in order to improve the customer contact processes and combined support mechanisms.

Our plans to target improved customer contact include:

- Provide more frequent and more accurate updates on when power cuts will be resolved in a format that customers find easy to access – increasing the amount of outbound calls and messages so that customers are kept well informed.
- Obtain improved customer data that, in addition to minimum data such as name, records preferred contact channel information and customer type.
- Offer connection customers accounts with local network capacity headroom information and data related to low-carbon technology generation – inclusive of summary and detailed level information on their current portfolio of active and previously completed projects.
- Offer power care data with quality of service information, data triggers for communication before, during and after power cuts, and enhanced support information for vulnerable customers and minority groups.
- Cleanse the priority services register in order baseline accuracy upon which to provide improved targeted services.

-
- Broaden the scope of customers on the priority services register to include fuel poor and temporarily vulnerable customers. The initial phase of this enhancement went live in 2013.

In addition, data will be used to support new services to benefit customers.

In our data management priorities we are not only seeking to do a better job with today's activities. Rather, we plan to innovate in order to deliver sustainable enhanced services described in this plan for customers and other stakeholders in the years that follow. There is much to do to get to this point – and not all of it is technological or data-driven. But much of it is and we see these enhanced services, which are largely dependent on us becoming more sophisticated in the way that we analyse information and exchange it with others, as being something that we should be working towards throughout the 2015-23 period.

The data and information technology priorities supporting enhanced services include:

- Implement friends and family proactive contact data for alerts in a power cut situation.
- Share data with other organisations to improve overall service to customers and local communities (particularly to help people more effectively during power cuts).
- Apply socio-demographic data overlays to our full service territory to enhance our operational decision making and local community support during power cuts and to better plan our investment in network upgrades.
- Link spatial and network utilisation data to enable indicative and/or firm self-serve connection self assessments and transactions over the internet.
- Combining the power of the web-based capability that allows communities of customers to communicate with each other and co-ordinate actions with enhanced real-time network control – all leading to community scale demand-side response.
- Provide a more personalised customer service response by using new smart data and systems – smart data places customers more in control of the services they want and how they want to receive them.

The future use of data opens up all sorts of exciting opportunities that could emerge from the bringing together of a significantly greater volume of data from a greater set of disparate and previously unrelated sources. These are good examples of where we are responding to the challenge laid down by our regulator to deliver more value from our regional presence to benefit communities and individual customers – particularly with those who are more vulnerable in society. It is not possible at this time to be definitive about how we may innovate with our processes and systems to capture the opportunities presented by this growth in 'big data'.

Potential areas for development of 'big data' services:

- For vulnerable customers - spotting life-threatening changes in daily patterns of electricity use triggering a support organisation or family members to act (e.g. irregular use of essential medical equipment or an elderly customer not heating their home during a low temperature period). Our part in this might simply be to make the information available to other organisations better-placed to deal with a given type of problem or else there may well be potential to create synergies between this sort of data analysis and the rest of our 24-hour trouble-call services.
- For the local community – shared data enables collaboration at a domestic level on community demand-side response contributing to energy efficiency and reduced bills.

- For the efficient operation of our network – combining smartgrid data and active network management with customer engagement on demand-side response enables improved 24/7 network utilisation, reducing network investment requirements.
- For network resilience and emergency response – linking our own network and customer data with meteorological forecasts and other utilities and emergency response organisations to improve our resilience investment, forecasting and real-time management of widespread network disruption.

5.9 Future innovation projects expenditure

We plan to spend £29m under our regulator’s Network Innovation Allowance...

As described above, we expect the bulk of our innovation expenditure in the 2015-23 period to be associated with the investigation and development of smart-grid solutions. We are proposing expenditure of £28.9m for this work (equating to 0.6% of revenues). These costs are included in [section 1.6](#) of the core narrative of this plan. But the full explanation of these costs is set out here.

Our regulator categorises this form of expenditure as the Network Innovation Allowance (NIA). It is intended to cover relatively small-scale innovation projects where the outcomes are uncertain. These types of project, when instigated and managed in line with the appropriate rules, are charged to customers through our use-of-system charges.

£m (2012-13 prices)	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2015-23 Total
Northern Powergrid projects	3.7	3.6	3.4	3.3	3.3	3.2	3.1	3.0	26.5
Collaborative programmes	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.4
Total	4.0	3.9	3.7	3.6	3.6	3.5	3.4	3.3	28.9
% of revenues	0.62%	0.60%	0.58%	0.57%	0.56%	0.55%	0.53%	0.52%	0.6%

Table 2: Network Innovation Allowance expenditure

*2015-23 innovation
spend - £29m
(0.6% of revenues)*

As can be seen in table 2, we propose to carry out certain projects ourselves and also undertake collaborative work with other companies. This is a continuation of the work undertaken in the 2010-15 period where company-specific projects have been undertaken as part of the LCN Fund first tier and the Innovation Funding Incentive (IFI); and collaborative work is also ongoing with other distribution network operators.

The guidance issued by Ofgem was that our proposal for innovation expenditure should be between 0.5% and 1% of revenues. We believe that the £28.9m forecast (equating to 0.6% of revenues) is an appropriate amount for our customers, striking the right balance between the cost and developing solutions for the problems that have to be overcome to facilitate the low-carbon future. There is scope within the envelope of costs proposed by Ofgem for us to scale back our plan and reduce costs further. However, we believe that the challenges we face require us to solve problems and overcome barriers to the same degree as any other network company and, whilst larger companies may be able to plan for a lower percentage of base revenues in this area, we believe our proposal is the right one for our customers.

There is much interest from regional stakeholders in collaborating on projects to determine the solutions that will benefit our customers within the region and more widely across Great Britain. Our

existing innovation work has already built on the proud heritage that exists from electricity sector innovation in the Northeast and there is a continuing appetite to add to this legacy over the next 10 years.

...and we are front-end loading this expenditure to secure the benefits as early as we can in the plan period.

We have profiled the expenditure to deliver more at the start of the 2015-23 period than at the end. The modelling supporting our smarter-powergrid work to determine the investment required to connect low-carbon technologies concluded that many of the new solutions will need to be implemented in the 2015-23 period in order for us to be prepared to deploy them on a greater scale in the decade that follows, when the need is expected to be higher. Further, we recognise and support our regulator’s stated objective to turn down and ultimately turn off the stimulus package for innovation. It is for these reasons that we consider it important to focus our efforts early in the next period.

The baseline level of innovation activity for 2015-23 is similar to the level of activity in the current regulatory period. Figure 3 compares both periods.

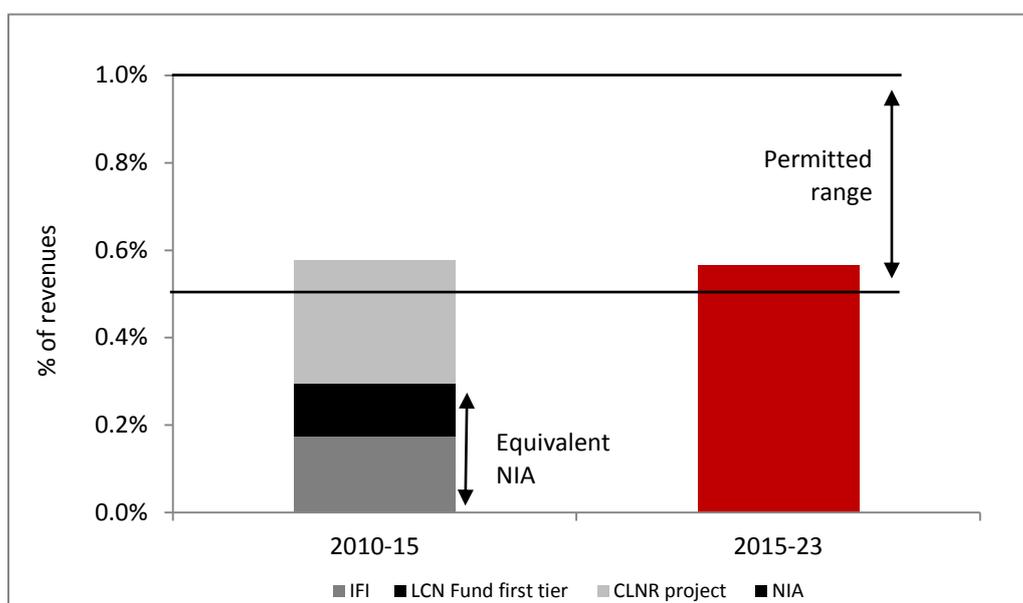


Figure 3: Network innovation expenditure

As shown in figure 3, in the 2010-15 period our specific innovation spend is focused in three areas. Other than the expenditure already committed on the CLNR project, this analysis assumes no other expenditure on LCN Fund second-tier projects that are subject to the last annual competition for funding in 2014.

Further, for the 2015-23 period, we have not assumed that any funding will be secured through the replacement mechanism for the Network Innovation Competition. However, we are participating in this competition for funding in the current period and we fully expect to do so in the future too.

Therefore, the planned expenditure for both periods may be considered as a conservative forecast, since it is reasonable to assume that there will be future projects delivered with funding obtained through either of these competitive routes. We believe that our ability to deliver the CLNR project has demonstrated our capability to flex to meet the required demands.

This expenditure does not represent the limit of our innovation activity. As part of our business-as-usual activity, and within our baseline cost allowances, we will explore new solutions to the challenges that we face in the existing areas of our business. For example, within our existing cost allowances we will explore opportunities to step up the role we play in respect of the social agenda.

The Network Innovation Allowance (NIA) is designed to fund relatively small-scale higher-risk innovation. As we have already identified, much of our innovation can be characterised as business process improvement or information-technology-facilitated service or operational improvement. These costs are not included in table 2 but represent increased innovation spending above and beyond that allowed for in our NIA plan.

Some of the benefits will come after 2023...

Not all of the benefits associated with these projects will be realised in the 2015-23 period; some will set up benefits for future periods beyond 2023. In some cases, the benefit is not a reduction in the *existing* levels of cost. Many of the innovations that we will be pursuing, particularly in the smarter-powergrid area, will create benefits by enabling the smarter powergrid to be created at *a lower cost than would otherwise be the case*.

For example, in this business plan, our forecast for reinforcement costs (using the models developed by all of the network companies as part of the Ofgem and Department of Energy and Climate Change (DECC) Smart Grid Forum) contains assumptions that we will respond to the growth in low-carbon technologies (such as solar cells, heat pumps or electric vehicles) by deploying new solutions that allow users to connect to the network with less traditional reinforcement in larger transformers or cables. These measures include the introduction of load-balancing devices for the low-voltage network, distribution-transformer voltage control and temporary network meshing. The reduced costs associated with these investments are already assumed in our forecasts, because they are built into the outputs of the model.

...but we think these investments are worth making to yield long-term benefits for customers.

In [section 1.4](#) we describe how our investment of £139m in 2015-23 will enable the connection of increased volumes of low-carbon technologies. This gap between the forecast cost of traditional and innovative solutions becomes wider in the 2023-31 period. Our modelling has shown that our cost saving to 2031 could be in the range £339m to £395m. The associated high-case benefit for the net present value of this investment is over £240m. The innovation expenditure that we are projecting for 2015-23 will be needed to develop these smarter solutions so that we may unlock these benefits. If we do not do that, it will cost more to connect to the network.

5.10 Conclusions

Innovation is crucial to success in the 2015-23 period. It will be a central feature of our efforts to:

- create a smarter powergrid that enables our customers to contribute to the low-carbon challenge;
- capture benefits for our customers from the new smart meters that will be installed and combine this with other data from multiple sources to provide new services;
- progressively introduce more and more services through digital channels to give our customers more control of when and how they deal with us; and

-
- make a more significant contribution to the affordability challenge that faces society, as many in our communities find it difficult to pay their rising energy bills.

We have set out in some detail the approach that we intend to take to making it a central feature of the way that the business is run, in order to innovate on a broader front than we have done so far. The approach we have described is a product of our experience in recent years, in which we have delivered a range of innovations that have improved the way we deliver services to our customers and helped to explore the way things will need to change in the future.

We know that we still have distance to travel, but we believe that our overall philosophy and approach, coupled with the measurable successes that we have achieved over the past decade, should give stakeholders confidence that we can develop and implement cost-effective innovative solutions in the areas we have identified. Our overall aim is to develop our approach to innovation to the point where we progressively reduce the dependency on a special stimulus from our regulatory arrangements as we approach the price control period that will commence in 2023.

Table 3 Innovation roadmap

As described in [section 5.7](#), the following table contains our current view of the key innovation activities that we envisage will make up the majority of our innovation programme for the next 10 years. It records our *current* view of the work we envisage as adding the most value for our customers.

Inevitably, things will change and we expect to use this simple analysis to help us evaluate new developments and review our priorities. The breakdown does not represent a firm activity schedule. We have included it here to provide interested stakeholders with an indication of our current view of possible future developments.

PRIORITY TOOLKIT	Network environmental footprint				Network reliability and availability				Network management and flexibility				Demand-side response			
	Self-healing cables	Substitute technologies	Eco-design	Power system efficiency	Network automation	Condition monitoring	Fault reduction	Operational response	Generation support	Energy storage	Active network management	Real time thermal ratings	Time of use tariffs	Capacity auctions	Flexible connections	Community engagement
OUTPUTS																
Safety						•	•	•								
Reliability & availability	•			•	•	•	•	•	•	•	•			•	•	
Environment	•	•	•	•		•	•		•				•	•	•	•
Connections									•	•	•	•		•	•	
Customer satisfaction			•		•	•	•	•					•	•	•	•
Social obligations		•	•	•				•	•			•	•			•
INITIATIVES																
2013-14	<ul style="list-style-type: none"> Self-healing technology for pressure filled cables to reduce leaks Pursue eco-designs for low-carbon substations 				<ul style="list-style-type: none"> Network automation On-site condition monitoring Alternative HV reclosing technology to reduce network stress 				<ul style="list-style-type: none"> Development of ANM³ and state estimation engines EHV/HV generation for network support Energy storage for network support 				<ul style="list-style-type: none"> Trial of I&C⁵ DSR contracts and tariff-driven DSR EV smart charging trials Customer engagement in DSR 			
2015-19	<ul style="list-style-type: none"> Smart meters facilitate faster fault response Technology solutions for low-voltage restoration Fault anticipation systems 				<ul style="list-style-type: none"> Reduce losses via smart metering data Technologies to improve phase imbalance Develop alternatives for pole preservation 				<ul style="list-style-type: none"> HV circuit monitoring for ANM systems Generation support at LV via use of switched capacitors Alternative LoM⁴ generator protection schemes Mesh networks Automation 				<ul style="list-style-type: none"> Energy efficiency measures to manage demand growth DSR planning tool to assess impact on network security Community rewards for aggregate DSR I&C capacity auctions I&C tariffs for peak demand management 			
2020-23	<ul style="list-style-type: none"> Replacements for SF₆ Reduce losses by power factor correction Composite material to increase and/or reduce environmental footprint 				<ul style="list-style-type: none"> Sensor technologies to improve thermal rating and fault location Acoustic sensors to monitor asset health 				<ul style="list-style-type: none"> Fault current limiters in mesh networks to improve network flexibility Self-islanding networks Power electronics applications and data analytics to improve network management 				<ul style="list-style-type: none"> Technologies to support DSO⁶ role Smart meter data-enabled domestic/SME tariffs for peak-demand management 			

³ Active Network Management

⁴ Loss of Mains

⁵ Industrial and Commercial

⁶ Distribution System Operator

Network planning and design				Communication and engagement				IT-enabled process improvements				Social obligations			
Reliability improvement tools	Design tools	Network planning tools	Operational planning tools	Online information	Mobile messaging	Stakeholder engagement	Large-scale data analysis	Online transactions	Geo-spatial vector records	Hand held technology	ebusiness tools	Greater accessibility	Power cut support	Energy efficiency solutions	Partnership collaboration
	•	•	•			•	•						•		
•	•	•	•	•	•	•			•	•			•		
								•	•					•	
	•	•	•	•	•	•	•	•	•	•	•			•	•
•				•	•	•	•	•	•	•	•	•	•	•	•
				•	•	•	•	•		•	•	•	•	•	•
<ul style="list-style-type: none"> • LCT network planning and design decision support tools • HV reliability analysis tools based on actual circuit performance data 				<ul style="list-style-type: none"> • Power cut app. improves information to customers • Micro websites keep local communities informed • Expert stakeholder groups to challenge business plans • Online customer service training 				<ul style="list-style-type: none"> • Online self-services • Hand-held technology improves power cut updates 				<ul style="list-style-type: none"> • Better power cut support with more and enhanced customer support vans • Extended reach – new four-category definition of vulnerability 			
<ul style="list-style-type: none"> • Geo-spatial tools for asset & network planning • Power system design tools • Planning & real time data exchange with transmission system operator • Upgrade asset planning tools for new condition data 				<ul style="list-style-type: none"> • Push notification of power cut information • Online communities test new services • Local heat maps let customers see connections capacity • Instant customer satisfaction surveys 				<ul style="list-style-type: none"> • Vector records on an open standard improve external sharing of records • Online systems allow customers to track progress • Geo-spatial views of work enhance co-ordination of activities • Electronic payment of guaranteed standards 				<ul style="list-style-type: none"> • Proactive contact with friends or family for extra personal support • Good neighbour scheme to increase PSR • Introduction of vulnerable household tool kits • Real-time multi-agency sharing of PSR data • Use of web and onsite leaflets to signpost PSR customers to support agencies 			
<ul style="list-style-type: none"> • Operational decision support tool for dynamic networks • Outage risk management decision support tools 				<ul style="list-style-type: none"> • Open systems standards allow enhanced information sharing between communities 				<ul style="list-style-type: none"> • Open access gives opportunity for community-led solutions for local network issues 				<ul style="list-style-type: none"> • Enhanced large-scale analysis on data from multiple sources including smart meters e.g. to support welfare checks • Collaboration with other organisations to identify heating solutions for fuel poor • Partnerships to explore options for rural, off-grid, fuel-poor households 			