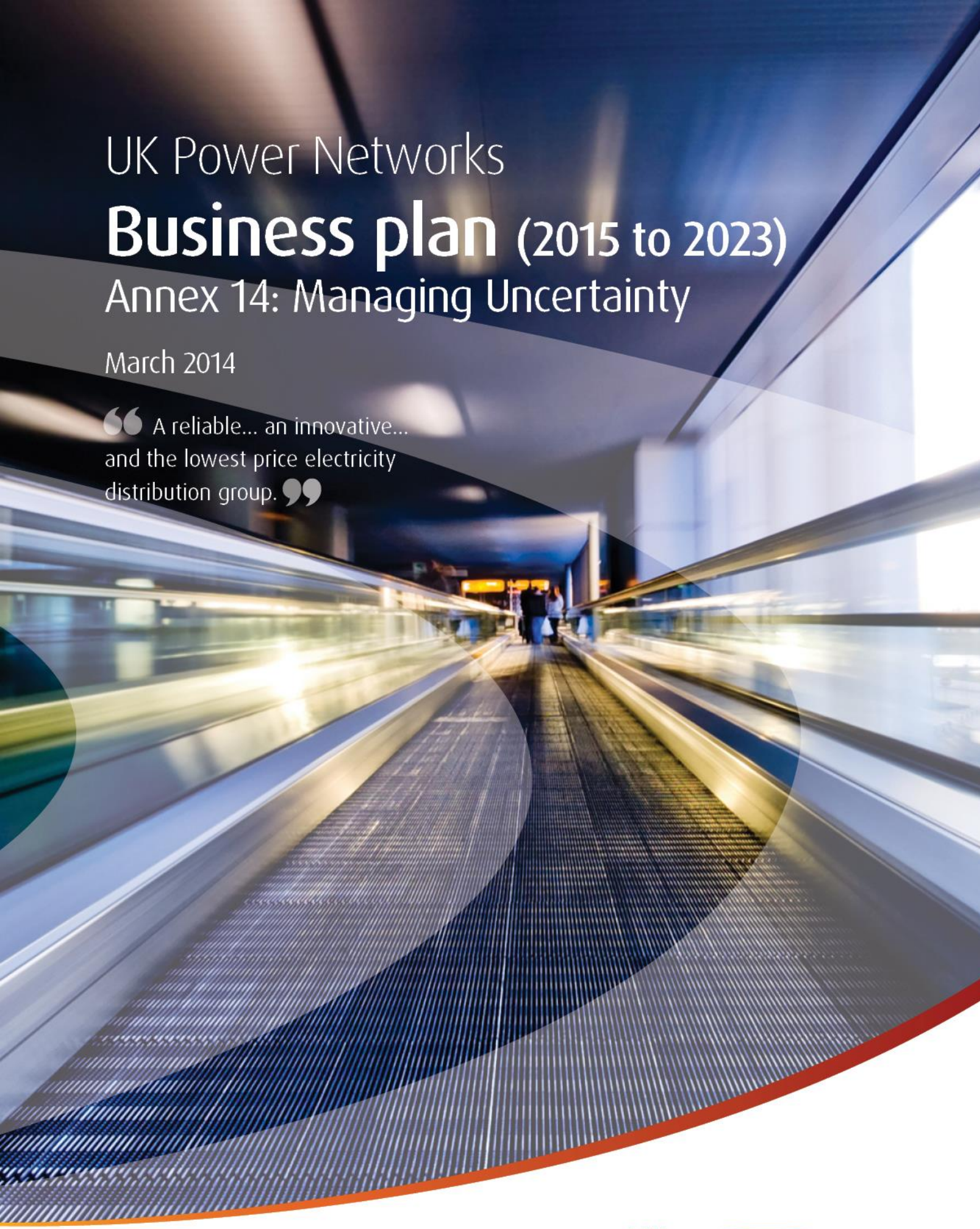
UK Power Networks

Business plan (2015 to 2023)

Annex 14: Managing Uncertainty

March 2014



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Delivering your electricity

Document History

Version	Date	Revision Class	Originator	Section Update	Details
1.0	09/03/2014	N/A	Adrian Searle	N/A	Initial version (ED1 July 2014 resubmission baseline)

Contents

1 Executive summary

Customers benefit from distribution companies being regarded as a 'low-risk' business, for example, it allows them to borrow money at low interest rates. This low risk status is achieved by a fair sharing of the financial impacts of uncertainty and risks between our shareholders and our customers. Our overarching principle that risk should be placed with those best placed to manage it.

Many of the risks and uncertainties we face are well understood and we have a robust and mature framework to manage them. The overall approach we take to managing risk is explained in more detail below and is comparable to frameworks found in most organisations.

We see our risk and uncertainty in three broad categories, revenue, price and volume. Revenue risks are set as part of the broader regulatory incentive framework and are discussed in the Financing annexe.

Today we are experiencing new levels uncertainty in well understood **price risk** areas. For example, the uncertainty surrounding the recovery of the general economy means that it is difficult to predict future prices for products and services.

In addition, as we look forward, there are new emerging **volume uncertainties**, the most significant: being our involvement in the smart meter roll out and the uptake of low carbon technologies, e.g. heat pumps and electric vehicles.

We are expected to manage the impact from the uptake of low carbon technologies for our customers. This presents a number of potential new challenges in knowing when they will appear and being ready to deliver an increased volume of network reinforcements. To mitigate this we are adopting a new and innovative approach to managing this risk. Our approach will use leading indicators to track trends and provide us with advanced warning for when rapid uptake of technologies, and use them as they become robust to justify early investment in network capacity. We expect this approach to benefit customers by enabling our business and supply chain to adapt in time to avoid the increase in costs that can result from rapid increase in workload.

We are expecting to visit customer properties during the smart meter installations to inspect and fix equipment for which we have responsibility. We are expecting much greater volumes of work than in the past during the roll-out, but the timing of this is uncertain. We are proposing to share the volume risk with customers allowing us to recover efficient costs while helping the roll-out of meters to homes. The smart meter roll out also brings benefits including improved service to our customers and lower operational costs and this is further described in section 3.2.2.

In this annexe we set out:

- The UK Power Networks approach to risk management
- How we will manage the key risks for RIIO ED1

The table below sets out our view on the key risks facing our business, who should bear the risk and a high level overview of the mitigating actions.

Risk description	Who bears the risk?	How risk is managed
Serious health and safety incident	Company	Internal company safety management processes
Failure to achieve required network outputs	Company	Internal company risk management process
Faster than forecast economic growth	Shared between company and customer	Detailed modelling and analysis of future load requirements undertaken to produce forecast Efficient cost increases will be shared with customers via IQI mechanism
Impact of major network event	Shared between company and customer	Detailed system emergency plan in place and practiced annually Major high profile network sites identified
Increased degradation of asset base	Shared between company and customer	Leading edge asset degradation tools used to develop forecast Efficient cost increases will be shared with customers via IQI mechanism
Key costs increase faster than inflation compared to business plan	Shared between company and customer	RPE sensitive costs identified and regularly monitored Company procurement policies and procedures in place Efficient cost increases will be shared with customers via IQI mechanism
Significant rise in streetworks costs compared to business plan	Shared between company and customer	Streetworks strategy in place Streetworks key performance indicators embedded within the business Efficient streetworks costs will be funded once additional costs exceed 1% of base revenue
Costs of facilitating smart meter rollout are higher than business plan	Customer	Efficient roll out costs will be funded in full
Costs of facilitating the transition to the low carbon economy higher than business plan	Shared between company and customer	Modelling of forecast low carbon technology penetration undertaken at a licence level Multiple scenarios analysed Innovation strategy in place Efficient cost increases will be shared with customers via IQI mechanism

There are a range of costs that we are allowed to pass-through to customers as they are deemed to be outside our control. These are:

- Specific National Grid exit charges
- Business rates; and
- Ofgem licence fee

These costs are already treated as pass-through under the current regulatory framework. We believe it is sensible to maintain this approach.

1.1 The UK Power Networks risk management framework

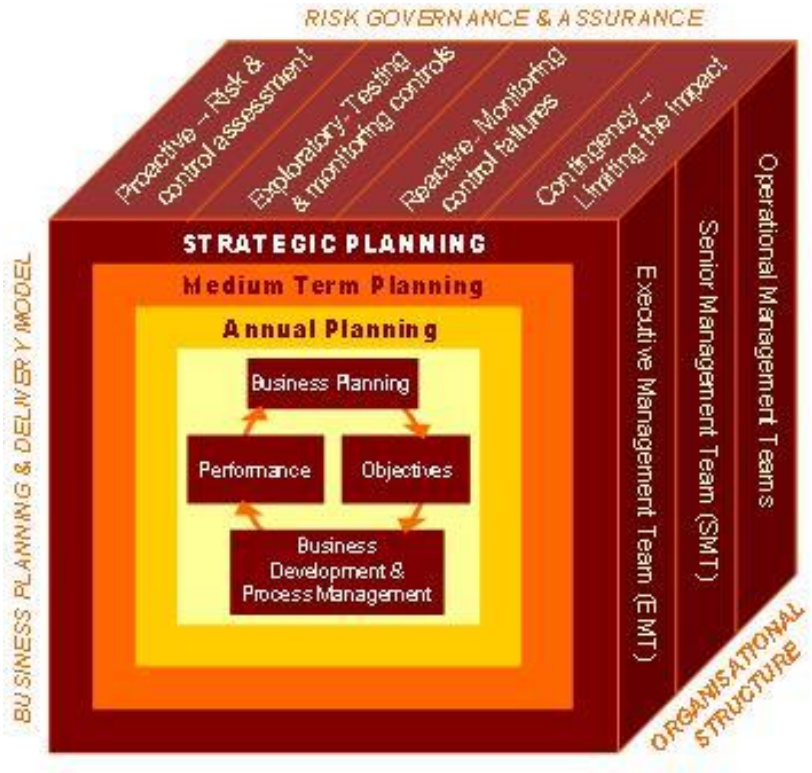
Risk management is a core activity within our business. UK Power Networks recognises that risk is inevitable and risk taking is an essential requirement for any dynamic organisation seeking continued success.

The UK Power Networks risk, control and compliance framework has three dimensions:

- The Business Planning and Delivery Model
- Four areas of Risk Governance and Assurance
- The Organisational structure

These elements are described pictorially in what is referred to as the 'Governance and Assurance Cube' and are described in more detail below.

Figure 1 Governance and assurance cube



2 Introduction

2.1 Business planning and delivery model

The Business Planning and Delivery Model describes the cycle through which the business sets and delivers the organisational strategy on an annual, medium term and strategic basis. For risk, control and compliance principles to be effective in supporting the delivery of the business strategy, it is important that these principles are embedded throughout the cycle.

- Business planning: Identifies the long, medium and short term strategies of the business
- Objective setting: Sets the objectives required to deliver the strategy
- Business development and process management: Describes the underlying business processes already in place and the new business developments required to meet the objectives
- Performance monitoring: Monitors performance of new business developments and existing business processes in delivering the objectives and overarching strategy

Risk Governance and Assurance

UK Power Networks has broken down risk governance and assurance into four distinct areas. They are:

- Risk and control identification and assessment
- Monitoring and testing of controls
- Monitoring and learning from exception
- Monitoring business continuity and contingency arrangements

These four areas of risk governance and assurance have been defined to ensure that:

- The exposures of the organisation are understood
- Adequate controls are in place to mitigate those exposures
- Processes are in place to manage and learn from adverse events

The overarching aim of embedding these principles within the organisation is to improve the control environment which will reduce control failure and also contribute to the strategic decision making process.

Organisational Structure

To ensure the success of the Risk, Control and Compliance Framework, it is important the elements described above are embedded at all levels of the organisation from the Executive Management Team (EMT) through the Senior Management Team (SMT) to the operational management teams. The EMT plays a critical role in embedding the Risk, Control and Compliance Framework throughout the organisation.

The output of this risk framework is the UK Power Networks risk register. The current top ten business risks are shown in the table below:

Table 1: UK Power Networks Top Ten Business Risks

Rank	Risk description
1	Very serious incident (VSI) - employee or contractor
2	Failures in the asset management systems results in VSIs
3	Providing incorrect or misleading info to Ofgem
4	Inability to deliver against capex plan outputs
5	Customer service performance
6	Inaccurate unit costs impact management of performance and forecasting
7	Failure to achieve an acceptable outcome in RIIO reset
8	Adverse outcome from Ofgem's finalised decision on dpcr4 losses close out values
9	Network fault at major public event
10	Multiple events leading to losses of supply

There are a number of our current top ten risks where we do not expect the economic regulatory framework to provide mitigation for the risk impacts. Principal amongst these are health and safety risks and the associated legislative compliance. Managing these risks is a key focus for the business and we believe that we have the processes and systems in place to achieve the necessary compliance. It should be noted that in our plan we have assumed no changes to the existing health and safety legislation.

Similarly, it is our responsibility to ensure that we have the necessary resources in place to manage the business effectively and deliver the required outputs. From a regulatory perspective our responsibility is to ensure that ED1 settlement provides sufficient expenditure allowances for this to be achieved.

3 Identification of key risks for RIIO ED1

The risk impacts facing distribution network operators can be categorised into three categories:

- Unit cost risks
- Volume risks
- Revenue risks

The latter is driven by the type and scope of the incentive framework. This is discussed in more detail in Annex 17: Financeability of Business Plan. The remainder of this section focuses on the identification of the unit cost and volume risks.

3.1 Unit cost risks

3.1.1 Real price effects

The principle unit cost risk we face is that our costs rise faster than inflation. This is commonly referred to as real price effects (RPEs). We have commissioned NERA to undertake an assessment of the likely RPE effects we will face in the RIIO ED1 period. Their analysis is presented in Appendix A.1. The main conclusions of that analysis are:

- Labour costs: NERA's central estimate is that over the period 2013/14 to 2022/23 labour costs in the electricity distribution will increase on average by 0.5% more than RPI. The range of uncertainty in this forecast +/- 0.5%
- Materials: NERA's central forecast is that the materials RPE returns to the weighted long run average of 1.0%. This is bounded by 1.2% on the upper side and 0.7% on the lower side
- Plant and machinery: NERA's central forecast is that the RPE for these costs reverts to the long run average of -0.6% with an upper and lower bound of -0.2% and -1.5% respectively
- Other costs: NERA's view is that these costs should rise in line with inflation

The current economic climate makes forecasting RPEs difficult as evidenced by the ranges above. However, the management of this risk is not new to DNOs as it has been present through the DPCR5 period. In our opinion we are best placed to manage this risk, rather than customers, and hence believe that continuing the existing approach of providing an ex ante allowance remains the most suitable approach.

3.1.2 Innovation risk

In developing our RIIO-ED1 plan we have included a number of innovative solutions where we expect to use these to displace traditional reinforcement mechanisms thereby delivering a lower overall cost plan to the benefit of customers. However, with the scale deployment of any new technology there is a risk that it is not successful and the company has to deploy the higher cost traditional solution for which it was not funded.

We believe that we have a robust approach to managing the risks and uncertainties inherent in deploying new technologies. This is set out in our Innovation Strategy document. In addition, we receive some relief from any additional costs under the IQI mechanism.

3.1.3 Impact of streetworks legislation

A further risk that we face is the impact of rising streetworks costs associated with our operational activities. Streetworks legislation related costs are one of the most significant areas of costs for us over RIIO-ED1. The effects of Streetworks legislation impact on costs across our whole business covering maintenance, repair, replacement, new connection and other capital schemes as well as requiring back office and indirect costs. Hence they have a direct impact on customer bills for using our network.

To increase the understanding of how this legislation affects our activities we have invested significant time and resource into working very closely with and lobbying bodies such as local authorities, policymakers and the London Mayor's office. Our goal has been to find an approach which balances the need to manage the impact our works have on road congestion with the desire to minimise customer bills. We have also innovated in our work delivery process to manage the time and impact of our Streetworks. We have introduced a number of new initiatives including:

- The integration of a number of IT systems that help to monitor and deliver street work information
- Implementation of a clear business performance score card for street works that form part of the executive management performance pack
- Working with contractors and our own staff to shorten the work delivery cycle from excavation to reinstatement
- Use of new site information boards to provide more information to the travelling public

Our business plan includes our forecast of the impact of changes in streetworks legislation, based on the legislation that is currently enacted. However, as was evidenced in DPCR5 local authorities are implementing streetworks legislation at varying rates which could add significant uncertainty to our cost base. In addition, from 2015 the government have declared that local authorities can write their own permit schemes and approve them. This removes the present arrangement of checks and balances of having the proposed scheme reviewed by the Department for Transport lawyers to ensure it complies with the legislation. This arrangement will lead to a greater variety of schemes and will make it more difficult to ensure compliance across the DNO areas.

We are therefore pleased that Ofgem has retained the streetworks reopener mechanism for the ED1 period which should significantly mitigate this risk and reduce it to a level comparable to DPCR5.

3.2 Volume risks

There are four main volume risks that could arise during RIIO ED1:

- Increased capacity requirements due to faster economic growth
- Increased asset replacement due to the smart meter roll-out programme
- Increased security investment in critical infrastructure
- Impact of a major network event
- Increased asset replacement due to more rapid degradation; and
- Increased capacity requirements due to the growth in specific low carbon technologies e.g. heat pumps

3.2.1 Impact of economic growth

How the economy will grow is outside the control of any DNO and in the current environment is extremely difficult to predict. However, with respect to the impact of economic growth on our network we have experience of both the key drivers and its impact. In our planning assumptions we set out the background and basis to our economic related planning assumptions.

In addition the regulatory framework provides significant via both the Information Quality Incentive and the specific load related reopener mechanism. Under the former a DNO will only bear a proportion of the cost under any efficient underspend, the proportion being dependent on how efficient its initial business plan submission was. Under the latter if the growth results in expenditure deviating by more than 20% from the baseline then all of the expenditure above the 20% threshold would be refunded.

3.2.2 Smart meter rollout

A consequence of the smart meter rollout is that the DNOs may be required to undertake increased levels of asset replacement. The absolute volume of this replacement is impossible to predict at this stage. However, under the RIIO-ED1 framework there will be a volume driver for DNO related call outs that are attributable to the roll out of the smart meters, which will be settled on an annual basis. An ex-ante allowance is being provided based on a 2% call-out rate. The volume driver will apply if actual volumes of call-outs are higher or lower than this. There will be no dead band.

Unit costs for the interventions will be subject to benchmarking across the DNOs. Where the intervention rate is <10% of all installations in a given year, the benchmarked unit cost will apply. A taper mechanism will apply to any increment above 10%, as follows:

Intervention rate	Unit cost to be applied
10-15%	0.75 * benchmarked unit cost
15-20%	0.50 * benchmarked unit cost
>20%	0.25 * benchmarked unit cost

It is noted that suppliers and DNOs are developing SLAs covering the remedial work required from DNOs. Ofgem states that additional costs caused by issues that do not relate to the DNOs (e.g. a requirement to attend out of hours) should be funded by the supplier under the SLA. These costs will not be funded through the volume driver.

Therefore, on the basis that the unit costs for undertaking this work is set appropriately to reflect regional cost differences then we believe that the proposed regulatory mechanisms sufficiently mitigate this risk.

3.3 Increased investment in critical electrical infrastructure

During DPCR5 we have worked with Ofgem and various Government agencies to identify key sites on our network which are critical to maintaining the supply of electricity in our licence areas. We have invested to enhance the security of these sites to ensure that they are protected against current known threats.

However, due to the development of the network it is likely that further sites may be deemed critical in the future. We cannot forecast which sites may be affected and hence have not included expenditure in our plan for this eventuality. If such sites are identified the RIIO-ED1 framework allows us to apply ex post for additional funding, subject to the costs exceeding a materiality threshold of 1% of our base revenue. If the costs do not breach this threshold then they can be logged up for consideration at RIIO-ED2. We believe that this provides sufficient protection to us from this risk.

3.4 Impact of a major network event

A major network event e.g. wide-scale flooding can have a considerable financial impact, due to both the cost of resolving the event and the penalties associated with the impact on customer performance metrics. With respect to the latter the proposed Quality of Service incentive mechanism removes the impact of such events, hence reducing the financial impact on the company. This is dependent on the company demonstrating that it acted efficiently in responding to the event. Also, in common with other cost variations, the financial impact of an exceptional event would be shared with customers under the IQI mechanism. These mechanisms have not materially changed from the existing DPCR5 mechanisms and hence we continue to believe that they provide adequate protection.

The key unknown whether the impact of climate change will result in more large scale weather events. We have, in common with the other DNOs, identified how we expect to respond to climate change adaptation and where appropriate e.g. flood protection have included the necessary expenditure in our business plan. This is detailed within our climate change adaptation annexe.

3.5 Increased asset degradation

In developing both our non-load related investment programme and our fault cost expenditure forecast we have to make assumptions about how our asset base will degrade over the next review period. If these assumptions are incorrect then we may be required to invest more to ensure that we deliver the required network health outputs.

The majority of the current asset base was installed in the 1960's and managing such an aging asset base presents significant challenges to ensure that the overall network health is maintained at an efficient cost. In common with load related expenditure we have developed a significant knowledge base on the key drivers associated with asset degradation. In combination with this we have invested significantly in developing leading edge asset modelling tools which has given us a solid foundation upon which to base our non-load related expenditure forecast.

Also, as with the load related expenditure, the IQI mechanism also allows us to recover a proportion of any efficient overspend. In our opinion the risk in ED1 in this area has not changed significantly compared to DPCR5 and we are confident that we have both the tools and experience to manage this risk.

3.6 Impact of the transition to the low carbon economy

The transition to the low carbon economy is the most significant uncertainty that all DNOs face. The principal reason for this is that there are that the level of take up of the key technologies is dependent on both the public perception of these technologies and whether they are economically viable. Consequently, unlike both economic growth and asset degradation we have limited historical experience on the drivers of this demand and how it will impact the network.

To better understand the scale of the uncertainty we have modelled both the DECC scenarios and our own core scenario in our own load related modelling tool and the Transform[1] model. The table below compares the expenditure forecasts for each of our core planning scenario against the extremes of the DECC scenarios. It should be noted that the underlying economic assumptions in both models are not the same.

Table 1 Scenario comparison from UK Power Networks model

Scenario (to 2023)	EPN	LPN	SPN
UK Power Networks scenario	100%	100%	100%
DECC High	98%	103%	121%
DECC low	77%	88%	83%

Table 2 Scenario comparison from Transform model

Scenario (to 2023)	EPN	LPN	SPN
UK Power Networks scenario	100%	100%	100%
DECC High	105%	130%	128%
DECC low	92%	105%	86%

The models predict very similar outcomes for SPN by the end of ED1. For EPN the UK Power Networks model shows little variation between the DECC high and core scenario by the end of ED1, with the Transform model showing the DECC highs scenario as slightly higher than the UK Power Networks scenario. However, by 2023/24 the DECC high scenario has overtaken the UK Power Networks scenario. This suggests a small differential in investment timing between the two models. The output of the transform model for LPN look counter intuitive, as the UK Power Networks scenario is lower than the DECC low scenario. Our view is that the complexity of the LPN network makes it difficult for it to be approximated in the Transform model and hence the results are less representative

The tables below show the same analysis but for the ED2 period.

[1] The Transform model is a high level demand forecasting tool developed by EA technology for the UK Distribution Network Operators

Table 3 Scenario comparison from UK Power Networks model

Scenario (to 2032)	EPN	LPN	SPN
UK Power Networks scenario	100%	100%	100%
DECC High	127%	119%	174%
DECC low	53%	81%	53%

Table 4 Scenario comparison from transform model

Scenario (to 2032)	EPN	LPN	SPN
UK Power Networks scenario	100%	100%	100%
DECC High	188%	179%	
DECC low	8%	15%	

This shows that the UK Power Networks view and the DECC view diverge significantly from the through the ED2 period. The principal reason for this is that under the DECC assumptions the penetration of heat pumps in particular ramps up significantly post 2020 whereas the UK Power Networks scenario assumes a much more even take up.

A key issue that is not immediately evidently is the change in HV and LV circuit investment requirements from RIIO ED1 to RIIO ED2. This main form of reinforcement is likely to be the installation of new underground cables, particularly at LV. Table 5 below sets out the scale of peak circuit reinforcement implied under each of the scenarios during ED1 and ED2.

Table 5 Peak annual HV and LV circuit reinforcement during ED1 and ED2

km	EPN	LPN	SPN	EPN	LPN	SPN
UK Power Networks core	437	73	111	869	162	308
DECC high	490	130	225	1464	363	788
DECC low	149	68	47	335	111	87

As the table shows, if the DECC high scenario was to occur then we will face a significant ramp up in the volume of circuit reinforcement between ED1 and ED2. Large scale replacement of LV cable in particular presents some significant challenges, with respect to being able to physically undertake the work, due to the level of disruption it would cause to the general public.

3.7 Our overall approach to managing the low carbon uncertainty in ED1

Based on our analysis above the range of outcomes that we can expect for ED1 in this area falls within a narrow enough range that we believe we can flex our internal/contractor resource to meet these scenarios. The problem that is facing all distribution operators is that we do not where these technologies will appear on our network and at what rate. For example if the DECC high ED2 penetration rates were to occur in ED1 this would present us with a significant work delivery challenge.

To mitigate this risk we have developed three approaches which we will deploy in ED1. They are:

- Develop better leading indicators – In our opinion we do not believe that simply monitoring actual deployments will provide sufficient lead time to address potential issues. We believe that better leading indicators are required and we have developed a low carbon activity index which is set out in more detail below. It would be our intention to develop this in ED1. This is set out in more detail in Appendix A.1 of this document.

- Increase network monitoring of the HV/LV network – During ED1 a significant proportion of our existing remote terminal units are coming up for replacement. We believe that it is cost effective to replace these units with ones with better data capabilities to provide us with the network information we need to identify potential issues and have included this expenditure within our current ED1 plan. The background and justification to this investment is set out in out in each licensee's SCADA investment annexe.
- Further develop our smart solution toolkit – There are a number of projects currently underway looking at the impacts of low carbon technologies on the network and the possible solutions to address these impacts. Our approach to developing and deploying new technologies is set out in more detail in both our Innovation Strategy and the associated Future Network Development Plan.

4 Mitigating the risk impact

4.1 Building our capability during ED1

We will take the following steps during the regulatory period to start to build up an approach that will allow us to respond to the observed trend in uptake of these low carbon technologies:

- Identify Leading Indicators – Starting now, we use customer surveys and desktop studies to identify which indicators can be used to determine our customers' willingness to recommend and purchase new low carbon technologies. We start tracking a wide range of indicators now to build up our understanding of their relative importance
- Build the Activity Index metric – When over time we have better understanding of and confidence in the correlation between the indicators and the uptake of the new technologies, we can refine the selection and starting building the Activity Index; a repeatable assessment methodology to forecast short-term uptake based on real customer data
- Use the metric to inform our investment decisions – Further into ED1, when the Activity Index has been used and tested, we will link this information with our regional load growth data and use the index to inform investment cases

The section below illustrates these steps in more detail.

4.2 Identifying leading indicators

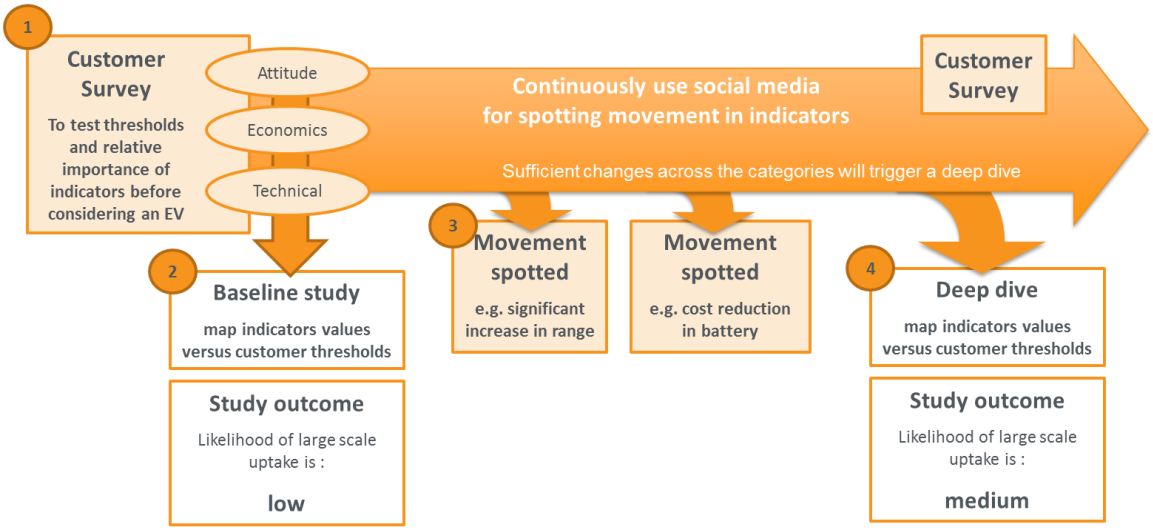
A Leading Indicator represents the customers' overall willingness to adopt a specific low carbon technology and consequentially has an influence on uptake. By monitoring these variables, we can infer whether a sudden change in uptake trends is more or less likely in the near future.

To identify and track the relationship between the selected indicators and the attitude towards the technology (which drives uptake), we will use the following approach:

- Understand customer's motivations and reservations for considering the technology – by running a customer's survey interrogating their willingness to pay, requirements, sensitivities and priorities
- Baseline study – perform a detailed study to map current indicators values versus customer thresholds identified in the survey
- Use social media to track change – social media can be used to continuously track trends and changes in the three main areas – attitude, economics and technology
- Deep dive when change is spotted – when the social media identifies a significant change (e.g. trending of a technology breakthrough or a new commercial proposition on twitter) , we perform a new deep dive to understand the change and map its impact on uptake

Figure 2 provides an overall view of our designed approach.

Figure 2 our approach to track and test indicators over time to build better insight in customer's appetite



4.3 Finding the killer indicators

Leading indicators vary across low carbon technology types, yet they broadly belong to the following macro categories (with examples for electric vehicles):

- Economics (e.g. purchase cost, running costs per km, resale value)
- Technology (e.g. time to charge, range of battery)
- Attitude (e.g. image, new functionality offered compared to alternatives)
- Policy (e.g. reduced road taxes, free parking)

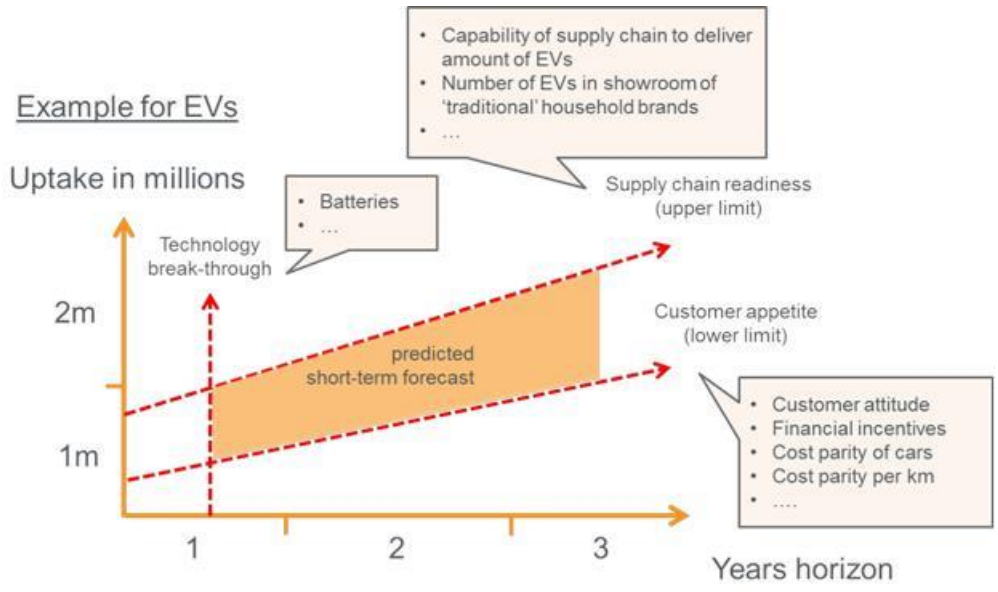
Although policy is an important driver and is a category in its own right, the impact of policy acts either to modify the economics (e.g. reduced purchase cost through incentive) or influence attitudes (e.g. use of bus lanes). For the purpose of the assessment, we will focus on Economy, Technology and Attitude, as is illustrated in Figure 1.

Within these categories we will seek to identify the 'killer' indicators; those who will strongly correlate with the uptake of the technology. The correlation between the indicators and the uptake can be calibrated over time as more data becomes available. Until it becomes clearer over time which are the critical indicators, our approach would be to start tracking a wider range indicators and filter out the lesser important ones in the future.

Demand is the critical driver behind uptake. Our approach assume it is the customer's attitude (the demand) towards low carbon technology will drive the uptake (technology pull), not the product manufacturers' readiness to supply higher volumes (technology push).

Using the three main categories above, Figure 3 provides an example of a forecast envelope for EVs. It is important to note the third limit in the required breakthrough in the limiting technology before this technology could become viable for mainstream use, e.g. the capacity of batteries.

Figure 3 Electric vehicle conceptual model



4.4 Building the activity index metric: case study for EVs

Initially the individual indicators will provide insight in our customer's attitude towards new low carbon technologies. When over time we have better understanding of and confidence in the correlation between the indicators and the uptake of the new technologies, we can refine the selection and starting building the Activity Index; a repeatable assessment methodology to forecast short-term uptake based on real customer data.

Reviewing all the values to determine the Activity Index requires a high degree of human interpretation, especially until more historic data is available. Our assessment framework will capture this human interpretation, so that the outcome of the study will be trackable and repeatable. This is necessary in order to use the Activity Index for investment planning.

We will capture the human interpretation, based on the outcome of the sensitivity and priority analysis from the customer survey, via:

- Setting the thresholds or bands for each indicator
- Setting the weighting of each indicator to the Activity Index

4.5 Setting the banding

The sensitivity values from the customer survey will inform setting the 'bands' of an indicator, e.g. when is an indicator considered 'very low' (value is '1') up to 'very high' (value is '5'). For example, if the survey indicates that 50% of the customers feel that 250 km is an acceptable range, than the indicator banding threshold could be set as:

Band	1 (very low)	2 (low)	3 (medium)	4 (high)	5 (very high)
Range threshold	<150 km	150 – 250km	250 km-300km	300 – 400 km	>400km

If the study finds that the current average range of an EV is 170 km, than the 'range' leading indicator would have the value of '2'.

Setting the weighting

Every leading indicator will have a weighting towards the total Activity Index. This weighting is also one of the outcomes of the priority analysis of the customer survey.

Figure 4 provides an example how multiple leading indicators build up to the (example) Activity Index for EV uptake.

Figure 4: Example Activity Index for Electric Vehicles

Indicator		Value	Banding (value between)					Band	Weight	Score
Category	**Metric**		1	2	3	4	5			
Attitude	Range anxiety – current average range	240km	<150	150	250	400	>400	2	0.20	**0.40**
	Customer choice (upcoming models)	5 UK models	<4	4	10	15	>15	2	0.05	**0.10**
	Willingness to buy survey results (1…5)	1	1	2	3	4	5	1	0.20	**0.20**
Economical	purchase cost EV vs ICE	25€k/20€k=1.25	>1.05	1.05	1	0.95	<0.95	1	0.25	**0.25**
	£/km of EV vs. ICE	1.1	>1.1	1.1	1	0.9	<0.9	2	0.15	**0.30**
	..	..	..	..	..	..	..	..	..	..
Technical	Battery life time	6 years	<7	7	10	15	>15	1	0.15	**0.15**
..	..	..	..	..	..	..	..	..		

Activity Index for Evs	**1.4**

Using the metric to support investment cases

The metric will form a measure of activity that when appropriately translated into regions and demographics would then be used as supporting evidence for investment relating to our proposals for network reinforcement. The metric is intended to provide us with sufficient lead time to invest in an efficient manner such that we can assess priorities for investment against a measure of the risk of rapid growth in load. We can appropriately assess the size of investment for a network area based on the predicted activity in that region – enhancing our existing understanding of the potential for clustering of technologies.

5 Risk management triggers in RIIO-ED1

As we describe above low carbon technologies are unlike the slow moving and well understood traditional drivers of growth, such as housing, floor space and jobs growth. The emerging low carbon technologies are developing and remain immature such that significant deviations from our central scenario could occur when one of more underlying factors change. It is possible that one or more of the emerging low carbon technologies reaching such a tipping point in the next decade and as a result become widely acceptable to the mainstream. When this point is reached we would expect to see a significant change in the rate of uptake compared to the past. The uncertainty is when and indeed if these triggers will occur during the business plan period. For example, a trigger for a tipping point for EV uptake could be a technology break-through (resulting in a step change in price or range) or a new financial incentive (as the Feed-in-Tariff did for domestic renewable energy uptake).

Traditional growth drivers are subject to public planning processes or have a long history of being predicted. In contrast to this, the low carbon technologies are largely based on individual's decisions and can be connected to the network without prior notification. The time required to respond to growth in customer demand from our network depends on the circumstances, but could be months to years in dense urban settings, due to planning permission for streets works or reinforcement work at substations.

Information is key to efficient decision making. Therefore, it is important that our risk management framework includes a reliable metric to signal the likelihood of near-term deviations from our chosen scenario. We see this as a part of the evidence base that we would use to justify any change in expenditure we would apply for in the relevant reopener windows in 2017 and 2020.

6 Appendices

A.1 NERA Economic Consulting reports

NERA Economic Consulting (NERA) was commissioned by UK Power Networks to estimate the real price effects (RPEs) and expected improvement in productivity ("on-going efficiency") to inform our well-justified business plan. The report that follows sets out NERA's estimates of both future RPE's and future productivity growth.