Supporting Document 03

Information to support our proposed
base capital expenditure programme

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Summary

This document sets out Scottish Hydro Electric Transmission Limited's (SHETL) approach to the maintenance of our assets during the RIIO-T1 price control period (1 April 2013 to 31 March 2021).

Our 'business as usual' network activities are essential to keeping the lights on in the north of Scotland. We strongly believe that the key to avoiding a loss of supply is to maintain our existing assets. If we can do this successfully, then the likelihood of a fault that results in a supply interruption is greatly reduced.

We have an excellent record in providing a safe, reliable supply of electricity to the north of Scotland, and we aim to maintain this over the coming decade.

Much of our approach is based on implementing industry best practice and, where possible, innovating and improving on this. In particular, we are working to the Network Output Measures that we developed with National Grid and Scottish Power Transmission following TPCR4.

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Most of what we do is looking after the assets we already have to ensure that they provide as good a service as possible for as long as possible. There are two broad activities we undertake on a day-to-day basis:

- Load related expenditure: Investing in new assets to accommodate growth in demand, and
- Non load related expenditure: Investing in replacements for our existing assets to maintain network performance.

These activities involve installing new equipment, for example at substations or on overhead lines. This is because the existing equipment is either inadequate for customers' needs or is old and needs to be replaced.

Our proposed expenditure on each of these activities over the RIIO-T1 period is shown in **Figure 1** and **Figure 2**.

Investing in new assets to accommodate growth in demand

The requirement to use our transmission system comes from two sources:

- Users of electricity who are typically connected to the low voltage electricity distribution network, such as domestic households and commercial premises; and
- Exporters of electricity (generators) who might be connected to the transmission system directly or indirectly through the local distribution network.

In this section we discuss electricity users' needs. We consider the needs of larger electricity generators in the next section.

Looking forward, we do not expect the demand for electricity in the north of Scotland to grow significantly. However, we do expect the volume of generation connected to the distribution network to grow. With stable demand and growing embedded generation, there will be an overall reduction in net demand in the north of Scotland. Thus we expect that we will need to invest in new assets to accommodate this change.

Maintaining and investing in our existing network

Figure 1 **Our forecast load related expenditure**

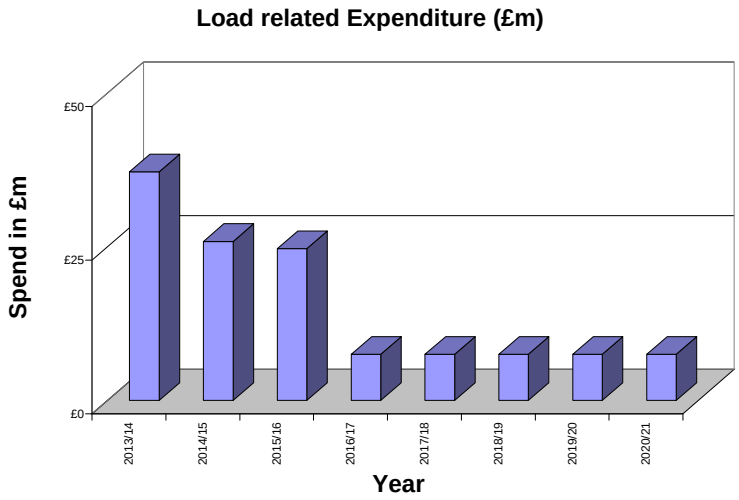
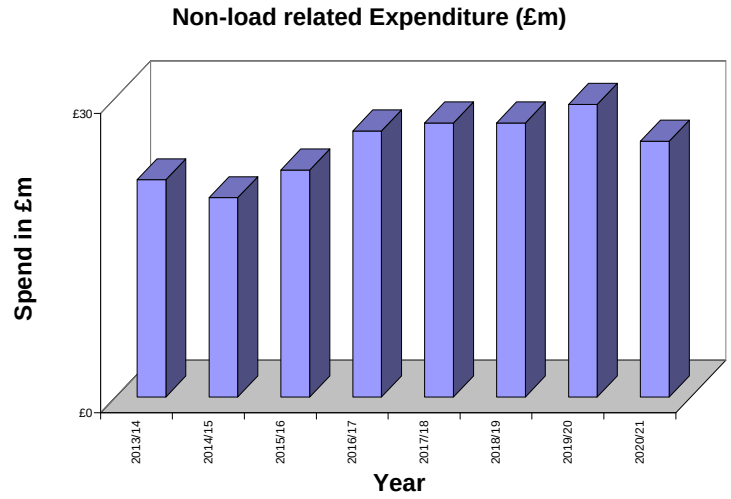


Figure 2 **Our forecast non-load related expenditure**



Maintaining and investing in our existing network

We go through a number of steps to assess the need for investment in new assets to accommodate demand changes. These steps include ensuring that there is sufficient capacity and resilience in the system to accommodate the demand forecast using information supplied from National Grid as system operator. This information includes forecasts for aggregation of small generators connected to the local distribution network.

In doing this, we also ensure that we comply with the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS). This sets out the minimum criteria for the development and operation of the national electricity transmission system, including for connections to the transmission system of new demand or generation, or modification to existing connections.

Our load related expenditure forecast also includes infrastructure investment to maintain compliance with NETS SQSS, and investment to manage fault levels, voltage profile and transient stability on the transmission system.

Further, we may be asked by National Grid, as system operator, to undertake investment in our system to assist it in its operational requirements.

Each item of primary plant and equipment (overhead lines, cables, transformers, switchgear) we own is assigned a capacity rating. We develop our system to ensure that no items of plant or equipment are loaded beyond their capacity, and that voltage profiles and stability on the system are maintained within defined limits.

Forecast increases in demand and embedded generation are compared with transmission capacity. Where reinforcement is deemed necessary, options are identified, evaluated and compared, before proposing a recommended solution. Reinforcements are carried out to ensure that there is no risk of overload on the system for the secured events defined in the NETS SQSS.

We have applied these principles to the period 2013/14 to 2020/21 and our forecast of expenditure is shown in **Figure 1**.

Two specific reinforcement projects account for the main increases in forecast expenditure in 2013 to 2015: reinforcement works to address network needs arising from the re-powering of Shetland; and reinforcement of the Keith-McDuff grid supply group necessary to accommodate a growing cluster of generation connected to the local distribution network.

Maintaining and investing in our existing network

Many load-related schemes involve replacing existing assets with higher capacity plant. As a result, assets may be replaced before they are at the end of their useful lives. However in replacing the assets on this basis, a future need to replace them on a condition basis is deferred. Where it is worthwhile, recovered assets are re-deployed elsewhere on the system, or held as strategic spare stock.

Investing in replacements for our existing assets to maintain network performance

We are constantly aware of our ongoing responsibility to keep our network in good order.

Our policy for managing the transmission assets is assessed and certified as consistent with the requirements of Publicly Available Specification 55 (PAS55) 'Specification for the Optimised Management of Physical Assets'. Our policy focuses on making good stewardship decisions and, through those decisions, improving the management of our network.

Our asset management policy and strategy are detailed in our Asset Risk Management Manual. The foundation of our asset management policy is the recognition of the need to balance three main factors: cost, risk, and performance. Satisfactory network performance must be delivered at an acceptable risk and within the constraints of efficient cost. In managing our assets, safety issues are given priority. Historically, our investment proposals have been developed to ensure that the level of network risk is maintained at an acceptable level.

There are six main principles that govern our asset management policy. These are:

- We embrace the core values of SSE – safety, service, efficiency, sustainability, excellence and teamwork.
- We seek best value by effective prioritisation of all power networks expenditure options.
- We identify and manage risks in all power network management activities.
- We use quality systems to ensure effective asset management throughout the organisation.
- We seek continuous improvement of all asset management activities, including sustainability and through the use of innovation.
- We utilise effective organisational structures and systems for asset management.

These principles are important to how we conduct asset management and are explained in more detail below.

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SSE Core Values

Management of our assets must take into account the requirements of the six core values of SSE commonly know as SSESET.

Best value

Expenditure made in managing the asset base must have clear and measurable benefits in terms of the performance of the network and business. This requires selection of higher benefit-to-cost activities and equipment, and rejection of inferior investment options. Prioritisation according to defined criteria enhances the performance return of the investments made in the network assets.

Risk

The risks in managing a power network arise in many areas. We seek to identify and quantify all risks and then develop the response to each individual risk through appropriate control strategies. We have adopted the approach of managing the risks of each asset separately from managing the risks to the system as a whole.

Asset risks are clearly different from system risks. System risks are termed critical risks, as they pose a critical threat to the function of the system rather than a threat to only one asset. The transition between asset risk and critical risk is managed through regular review of the critical risk register.

Critical risks are defined as: Exposure to high consequence events leading to major supply failure, large financial loss or unacceptable safety violations.

Quality Systems

All documents and processes in the asset management system are subject to SHETL quality assurance mechanisms. Auditing documentation through the use of external consultants and monitoring the implementation of documented procedures ensures that asset management activities are conducted as intended and that documents are used and reviewed appropriately.

Continuous Improvement

Improvements in asset investment and operation can only be made with effective cyclical review and revision of asset management policies, processes and practices. Discussion with and feedback from relevant personnel and providers provides necessary channels for sustainability and innovation in all areas of asset management. Adopting new practices and technologies on a best value basis leads to performance improvements in the operation of the power networks.

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Organisational Structures and Systems

Effective management of all asset management activities is an essential part of delivering best value from the physical network assets. In addition, the organisational structure and systems must contribute to the effective implementation of the asset management policy and processes. Asset management requires the full commitment and participation of each key function. The integration of objectives, information sources, processes and personnel groups is another key aspect of successful asset management. SHETL keep the models for most effective organisational structure and asset management system under continuous review.

We operate our asset management systems according to the generic model shown in **Figure 3**.

The purpose of each of the main activities in the SSE Power Distribution asset management system (**Figure 3**) is described as follows:

Assess Business Objectives

This involves the setting of performance targets, expenditure levels and risk profiles acceptable to the business. Business objectives are set through analysis of business performance and the corporate objectives for the networks businesses.

Identify Asset Issues and Options

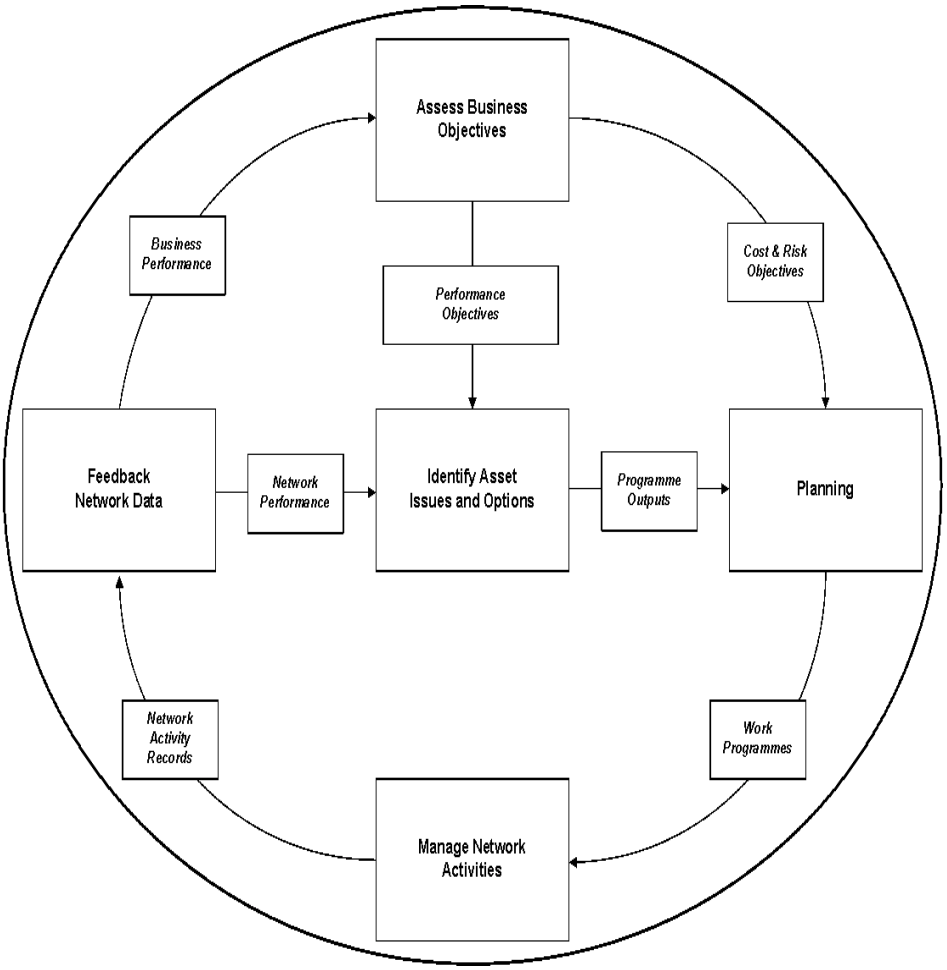
Asset data is analysed to assess the issues with the existing asset base. Issues might include quality of supply performance and asset condition. Options are identified to address the issues in the physical asset base. Existing and new technologies are evaluated to assess potentially beneficial options addressing particular issues.

Planning

The full range of asset issues and prospective solutions to each are identified. However only a subset of the full range of possible activities can be undertaken due to resource and cost constraints. Prioritisation and selection methods are used to develop work programmes, which link objectives to available resources to maximise the value of expenditure on network activities.

Maintaining and investing in our existing network

Figure 3 **Our asset management systems**



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Manage Network Activities

Instructions are issued to service providers (internal or external as dictated by value for money) to schedule and execute network activities specified by work programmes. Network activities include construction, refurbishment, renewal, inspection, testing and condition monitoring.

Feedback Network Data

Data is fed back into the process from all network activities from operations to maintenance teams. Data is also gathered from dedicated gathering exercises such as inspections, tests, diagnostics, national reporting schemes and investigations. The data is entered into the company information systems and maintained.

The links between the main asset management activities in **Figure 3** are as follows:

§ **Business Performance** Information regarding business performance is the main link between the processes for feedback of network data and the assessment of business objectives. A clear picture of the performance of the network assets is required to enable plausible business objectives to be set.

§ **Performance Objectives** The communication of business objectives fulfils one part of the activities to identify possible courses of action on the network assets. Network performance is also an important feed into generating a set of investment options.

§ **Network Performance** The feedback network data is analysed and presented in such a way that the asset issues requiring attention can be clearly identified.

§ **Cost and Risk Objectives** The business cost and risk objectives must be expressed to enable the prioritisation and selection of network activities.

§ **Programme Options** When the asset issues are assessed and a set of options generated, these must be transferred to the prioritisation and selection activity.

§ **Work Programmes** The prioritisation and selection of network activities from a large set of options generate work programmes. The superset of network activity options is filtered by trading off the cost, risk and performance business objectives. Standardisation of options facilitates the generation of manageable work programmes. For example, if a particular set of issues needs to be addressed

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across a population of one type of asset, then a standard solution may be implemented across the full population of assets. This has the benefit of enhancing the quality of the implementation of the solution and providing efficiencies in planning and monitoring the activities required.

§ **Network Activity Records** The progress and results of executing network activities are fed back into the asset management decision making processes through various forms of recording of network activities from manual inspection and written reports to fully automated.

Investing in replacements for our existing assets to maintain network performance

Non load related expenditure is based on our asset condition assessment processes and relates mainly to asset replacement or refurbishment of existing plant and circuits.

We perform condition assessments on equipment to determine remaining useful life and replacement needs. This has been incorporated into our established Network Output Measures Joint Methodology Statement developed with National Grid and Scottish Power Transmission, which also describes how the criticalities of assets are assessed. Criticality is a representation of the risk to stakeholders in terms of safety, environment and reliability.

A high level representation of our priority levels is shown in **Figure 4**.

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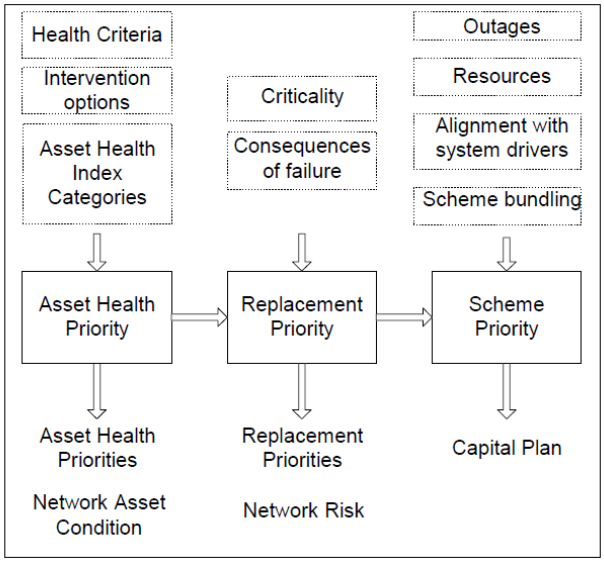
Figure 4 Prioritising asset replacement

	AH1	AH2	AH3	AH4	AH5
C1	RP4	RP4	RP4	RP1	RP1
C2	RP4	RP4	RP4	RP2	RP1
C3	RP4	RP4	RP4	RP3	RP2
C4	RP4	RP4	RP4	RP3	RP2

Figure 5 Assessing replacement priority

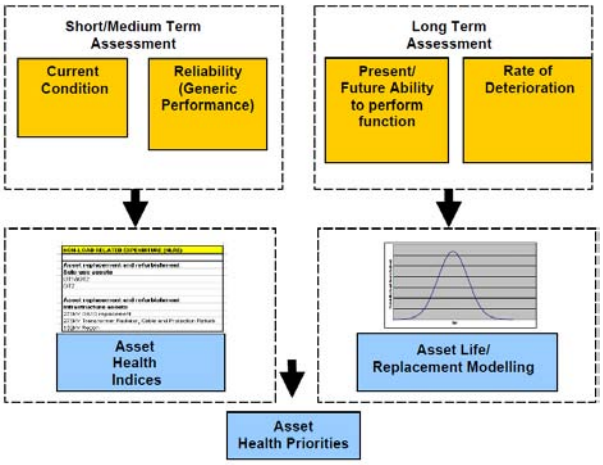


Maintaining and investing in our existing network

Figure 5 illustrates how our asset assessments are collated to develop an investment plan for replacing our existing assets to maintain network performance.

Condition assessments are our primary driver for determining replacement profiles in the short term (traditionally the length of the price control). However, as we continue to provide forecasts further out in time as mandated by the regulatory framework (increasing from five years to eight years and the business plan requirement to report out to 2026), we have to rely on age to determine when assets in good condition at the moment will require replacement in the future. Figure 6 provides an overview of the two approaches.

Figure 6 Assessment timescales



We consider both condition and criticality in developing a prioritised asset replacement programme. Condition assessments are carried out every two years by field staff. We also consider fault performance, spares and obsolescence, safety and age.

From our initial analysis, and to maintain the same level of risk and performance, we expect the volume of asset replacement activity determined by the above methodology to remain broadly the same between now and 2020/21.

Types of schemes programmed between 2013 and 2021 include:

- 132kV overhead line reconductoring and rebuilding works;
- Transformer replacements;
- 132kV switchgear replacements; and
- 132kV gas compression cable replacements.

In some cases, asset replacement schemes can be deferred where interest from generation developers has raised the possibility that reinforcement may be required. In such cases, it is preferable to defer asset replacement, if possible, whilst a clearer picture emerges, to minimise the risk of stranded assets.

Maintaining and investing in our existing network

Other more minor non-load related works have been identified as noted below:

- Flood prevention measures that have been identified for a number of sites based on SEPA data where there is a 1 in 200 year flood risk, or flood risk presented by nearby hydro electric generation installations;
- A number of early solid state protection relays are nearing the end of their life and a replacement programme has been planned to address this;
- Industry work has been undertaken to assess resilience requirements for substation supplies in a black start scenario. It is anticipated that 72-hours' resilience will be recommended and some expenditure has been forecast to implement this;
- Following the decision by British Telecom (BT) to move their services onto internet based platforms, we have reviewed the impact on our network protection requirements. Internet based solutions provide response times that are too slow for our fast acting protection and, as a result, we have had to propose plans to install an internal communications system to meet our requirements.

Our forecast of non-load related expenditure for the RIIO-T1 period is shown in **Figure 2**.

Delivering a reliable service to our customers

System performance

Problems on the transmission network that affect customers are a rare occurrence.

National Grid, as system operator, publishes an annual report on the performance of the GB transmission system. We contribute to this report and provide detailed information about our network.

The reliability of our transmission system over the past five years is shown in Figure 2.4 from the system performance report (shown overleaf).

From time to time, we need to take the transmission system out of service in order to undertake essential maintenance or to upgrade the network – a planned interruption. This will not normally result in an interruption of supplies to customers. We record planned unavailability against three categories:

- User construction;
- System construction; and
- Maintenance.

In addition, we record unplanned availability when we have a fault or event that results in a loss of supply. These events are primarily driven by the health / risk / condition of the network once you take out the effect of severe (often described as 'exceptional') weather events.

As shown in Figure 2.5 from the system performance report (overleaf), when broken down into these categories on a month-by-month basis, the analysis of 2009/10 shows that the overwhelming reason for our system unavailability is planned outages associated with system construction. Unplanned events account for only a very small proportion.

Because of our approach to asset management, we expect the underlying trend in the base level of system performance and reliability to remain the same in the coming years when compared on a like-for-like basis.

Delivering a reliable service to our customers

Figure 2.4: Availability, incidents, energy not supplied and reliability

Percentage annual system availability

Year	2005/06	2006/07	2007/08	2008/09	2009/10
System availability (%)	96.87	95.72	97.74	96.65	97.38

System Security - Number of supply incidents

Year	2005/06	2006/07	2007/08	2008/09	2009/10
Number of transmission system incidents involving 3 or less customers	1	0	0	0	0
Number of transmission system incidents involving more than 3 customers	9	17	18	14	34
Total number of transmission system incidents	10	17	18	14	34

System Security - Estimated Unsupplied Energy

Year	2005/06	2006/07	2007/08	2008/09	2009/10
Unsupplied energy in incidents involving 3 or less customers (MWh)	1423.20	0.00	0.00	0.00	0.00
Unsupplied energy in incidents involving more than 3 customers (MWh)	78.20	176.60	64.20	178.58	21.70
Total unsupplied energy (MWh)	1501.40	176.60	64.20	178.58	21.70

Overall Reliability of Supply

Year	2007/08	2008/09	2009/10
SHETL	99.99924%	99.99791%	99.99973%

Figure 2.5: Planned and unplanned outages

2009/10 Monthly variation in planned and unplanned system unavailability (Unavailability is defined as (100 - availability)%)

Month of year	User connection	System construction	Maintenance	Unplanned	Total
Apr	0.99	3.01	0.56	0.09	4.65
May	0.79	2.98	0.36	0.01	4.14
Jun	0.82	3.93	0.56	0.11	5.42
Jul	0.62	2.62	0.89	0.02	4.17
Aug	1.29	2.05	1.01	0.01	4.36
Sep	0.62	3.05	0.61	0.01	4.29
Oct	0.00	1.44	0.61	0.01	2.06
Nov	0.19	0.42	0.64	0.00	1.25
Dec	0.01	0.23	0.02	0.00	0.26
Jan	0.01	0.00	0.01	0.08	0.c0
Feb	0.00	0.01	0.00	0.12	0.13
Mar	0.33	0.41	0.31	0.03	1.08

Delivering a reliable service to our customers

However, connection and associated system reinforcement activities are forecast to be significantly higher in the coming decade.

In order to deliver the volume of new connections and the wider reinforcement requirements consistent with our planning assumptions, system availability is likely to decrease as sections of the network are de-energised under planned outages to carry out this work. This activity will necessarily increase the risk of unplanned events on the single and double radial circuits on our system. However, in accordance with best industry practice, we will deploy mitigation measures to ensure that, as far as possible, customers do not experience deterioration in the reliability of their supply.

Historically, in order to focus our attention on ensuring that customers experience minimal impact during unplanned outages, we have been subject to a regulatory reward / penalty mechanism on our performance. We agree with the principle of this incentive, and support its continuation in RIIO-T1.

However, we believe that there is merit in exploring whether the incentive mechanism can be more closely targeted at compensating customers who are off supply for an extended period of time due to a fault on the transmission system. Such arrangements exist for electricity and gas distribution companies.

It is our intention to undertake further consultation with customers and stakeholders on the workings of such a mechanism over the next couple of months. A starting point could be an approach, similar to that used by the electricity distribution networks across GB, whereby customers who are impacted by an unplanned transmission outage lasting more than 6 hours could receive a compensation payment. We believe that a mechanism of this form would target specifically affected customers and drive desired outcomes in restoring transmission faults. There are, however, practical difficulties (such as us not having direct relationships with affected customers) that need to be explored.

We have developed our **Network Availability Policy** to address the sorts of issues noted above. We acknowledge the impact that pre planned works could have on both our demand and generation customers and believe we should minimise this by taking appropriate actions both internally and in co-operation with the other Transmission Operators and the System Operator.

Our **Network Availability Policy** reflects this concern and suggests how we will optimise our

Delivering a reliable service to our customers

internal systems to reduce the impact. It is also evident that closer co-operation with the SO is needed to be developed such that constraint costs can be minimised through close co-ordination between us. This will require a different way of working going forward but we are convinced both the SO and Ofgem are committed to following this through and helping us achieve this objective.

Keeping our customers, our colleagues and our network safe

Safety is the most important of the core values of the SSE Group. To comply fully with all safety standards and environmental standards is also one of our network objectives.

Safety is an intrinsic part of how we carry out our day-to-day activities. The protection of the public, our staff and contractors from the potential impacts of our activities is critical to us.

Over the last 20 years our safety record has steadily improved for all of those affected by our activities. However, with the growth in renewables, and the associated requirement to deploy significantly more assets to serve them, we are mindful to ensure our safety systems continue to be fit for purpose and deliver industry-leading performance.

SHETL policy and strategy

Our improved safety performance over the last 20 years shows we are a progressive supporter of workplace and public safety.

As safety has improved, we have sought to strengthen our existing policies and strategies by the introduction of new ideas and concepts. Looking forward, we plan to develop and use four main safety strands:

Robust reporting and addressing of issues

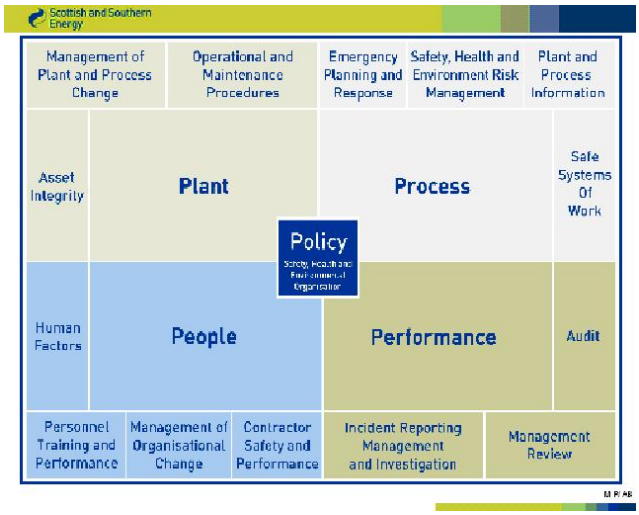
We recently completely revised our incident reporting system to improve its effectiveness. Our new database is easier to access for users, provides much improved management reporting and allows detailed analysis of incidents to improve learning.

Introduction of a new Safety Management System (SMS)

We are currently introducing a new SMS that is based on best practice. It covers four main areas: plant; process; people; and performance.

Keeping our customers, our colleagues and our network safe

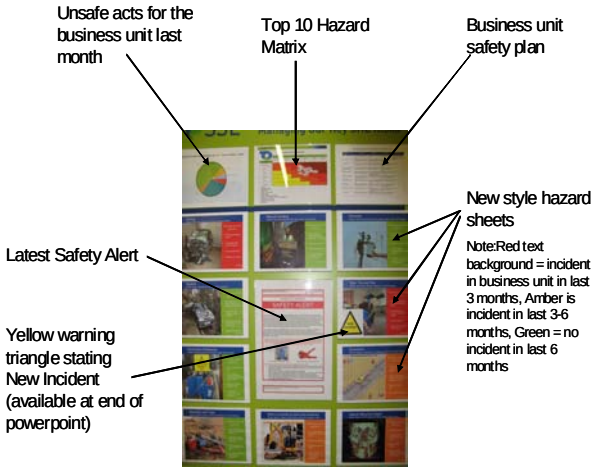
It further subdivides these into 15 important areas that are vital for safety including: safe systems of work; management of change; human factors; asset integrity; and emergency planning and response.



Improving our risk assessment procedures

Risk assessment is a fundamental pillar of working safely. We already use generic and site-based risk assessment to identify hazards to either remove or mitigate them.

We are now developing, through using the new SMS, better ways to risk assess hazards and find more enduring solutions. One example of this is the introduction of Risk Boards within offices and their equivalent for onsite use. These are user friendly and easily accessible to promote wide discussion and acknowledgement of these important issues.



Keeping our customers, our colleagues and our network safe

Introduction of Safety Family Concept

We recently introduced a new safety initiative that we believe will help us reach our target of zero accidents. It is an approach based on being your 'brother's keeper' and emphasises the role everyone has to play in SHETL's Safety Family. The diagram below indicates the concept.

Our safety target

Put simply, our target is to operate in an accident-free environment. We firmly believe this is achievable and will use all the devices at our means to achieve it. Our plans in this respect are embedded in the core of our business.