nationalgrid

Measuring our gas network outputs

A summary of our new methodology

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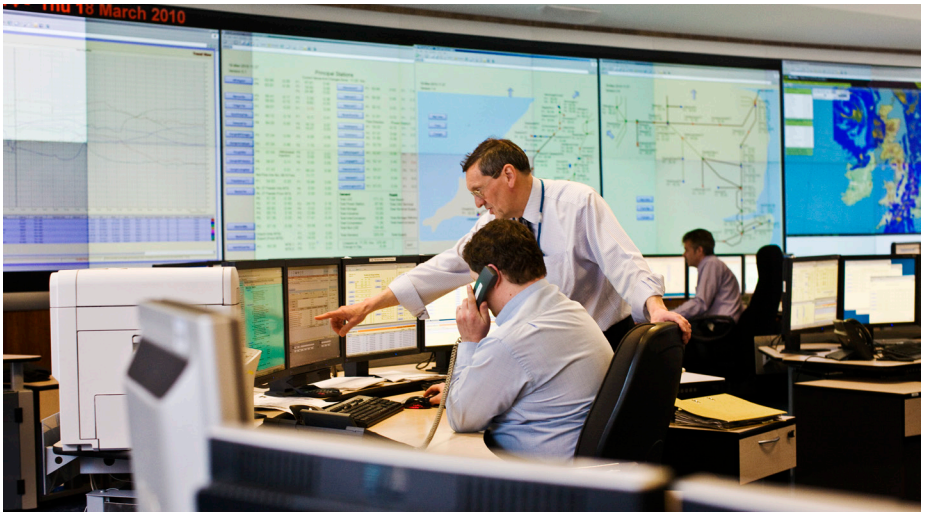
Overview and principles

This paper explains why this is important and how we will do it. As a key stakeholder who engages with our business we are consulting you to get your comments on our approach.

Our new methodology has been built on

5

key princples



Gas Transmission Control Centre, Warwick

We have developed a new methodology to help us meet key objectives set out in our gas transporter licence:

Our licence objective	Our aim
Monitor how effective we are in developing, maintaining and operating an efficient, economical gas pipeline system	Objective met
Assess the effectiveness of money already spent on the network and planned expenditure in the future	Value for money investment matched to stakeholder needs
To allow performance comparison across geographic areas, assets within our network, other UK gas pipeline systems and systems in other countries	Compare and improve our performance
Support communication of relevant information between interested parties	Communicate effectively

Our new methodology has been built on the following key principles

- Using our asset information to understand performance and risk
- Understanding that our network risks extend beyond safety and can impact wider society
- Recognising that different aspects of our performance matter to different stakeholders – e.g. delivering a reliable gas supply, minimising environmental impact
- Using a common financial value for ‘monetised risk’ to better compare different issues
- Using this new value to prioritise our investment to maximise stakeholder benefit and deliver value for money

At the end of paper, we have set out five question themes; we invite you to share your views on our new method and what it means to you.

Our role

As gas transmission owner and operator for Great Britain, it is our responsibility to transport gas from supply points to exit offtake points safely, efficiently and reliably.

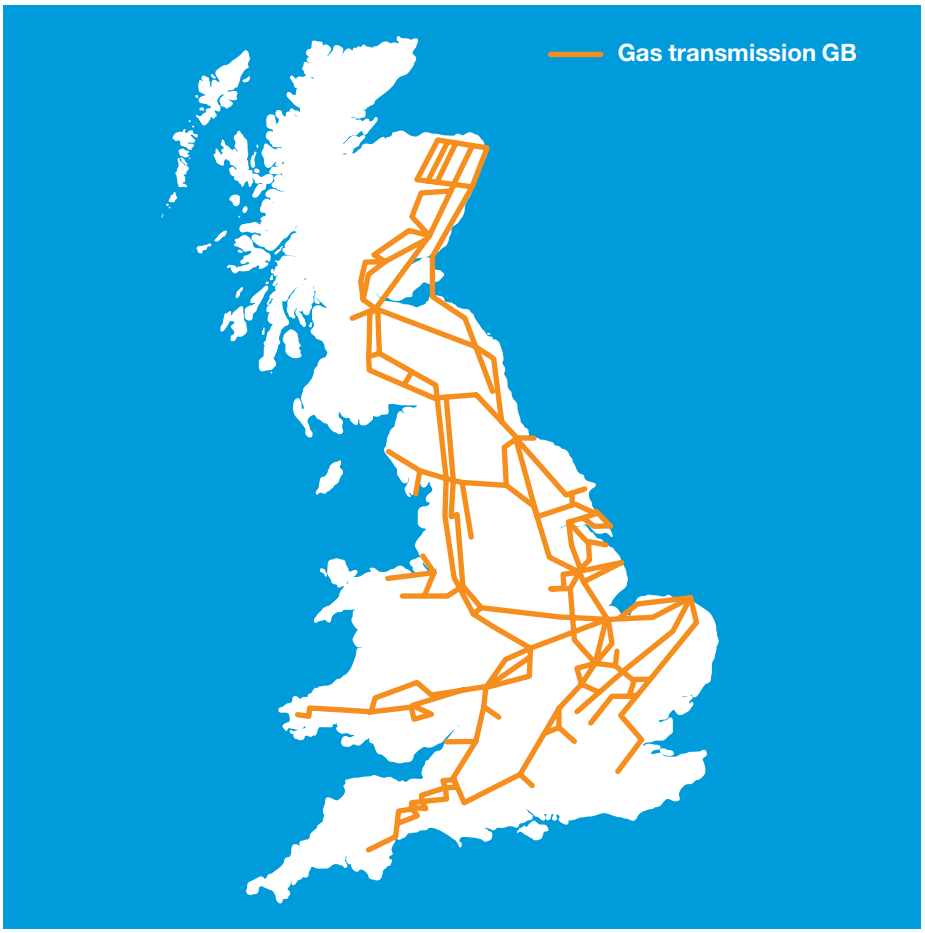
Aylesbury - GTO

At the exit offtake points, gas is transferred to eight distribution networks which supply domestic and industrial consumers including storage sites, power stations, and interconnectors (pipelines to other countries).

Our purpose is to Bring Energy to Life. In its simplest form this means getting the heat, light and power that consumers rely on to their homes and businesses. But 'Life' also means supporting the communities that we are part of, to reinforce economic growth and sustainability of wider society.

What we have in common with companies that run our country's water networks, our rail networks and our electricity networks is that we have equipment of different ages and in different locations spread through England, Scotland and Wales; this includes our pipework, valves and gas compressors. These are our physical assets; managing and maintaining these assets is one of the most important things we do - we are an asset management company.

Not only do we look after each and every asset individually, but we need to think about how our network works together; a small failure in one location could have a much wider impact if we don't understand the importance of these connections and manage them carefully.



Why is the new methodology important?

We need to be able to measure and demonstrate how our assets are performing; without this we can't ensure the money we spend is targeted to improve safety, reliability and environmental performance.

This is hard. There is no simple, universal measure as different aspects of our performance matter to different stakeholders (the people or organisations who are impacted by our operations). Stakeholders have told us they expect delivery of safety and reliability, but whilst reliability may be the key issue for the distribution networks, our site neighbours are more concerned about environmental performance such as effects on local air quality.

This is made more complicated by factors outside our control, i.e. changing energy supply and demand patterns and new, tighter emissions legislation.

To keep stakeholders informed, we publish annual reports on our asset performance and provide this to our industry regulator, Ofgem.

We've created a method to better show how these different aspects can be understood; and to do this we've looked at the risks our network poses. We don't just think of risk as the safety of our systems: if we don't do our job maintaining and operating the network properly we risk not being able to supply gas, or risk causing damage to the environment. These impacts cost money to our business and wider society.

With limitless resources and time we could treat all these risks as equal. We could spend money on everything we own to reduce the likelihood and impact of each risk to a minimum. We can't do this; we are limited by time and what we can spend.

We must manage the network economically and efficiently, spending money wisely in the right places and at the right time

Our new method will help us balance all of the risks we pose and show that our investments deliver value for money matched to stakeholder needs.

Our licence to operate

We are a licensed gas transporter and the sole operator of the gas National Transmission System (or NTS); we have licence conditions which say what we can and can't do.

The new methodology focuses on the Network Asset Condition Measure, the Network Risk Measure and our Network Replacement Outputs measure.

Our licence defines the compliance measures we are tested against and the data we must use to do this. Our industry calls these our Network Output Measures or NOMs. We have five NOMs in our licence relating to:

- the condition of our current assets: how reliable they will be and how much they might deteriorate through wear, tear and failure. We call this the Network Asset Condition Measure
- the risk that our overall gas transmission system is unreliable, because of the condition of our assets individually or when they function together to make the network operate as a whole. We call this the Network Risk Measure
- the performance of our pipeline systems, in particular how it impacts on the reliability and cost of transporting gas. We call this the Network Performance Measure
- how capable our system is (and the spare capacity we have) to accept gas into the network from suppliers, to move it through our pipework with our compressors and then pass it on to our customers at exit points. We call this the Network Capability Measure
- how we perform as an asset management company, by measuring how good we are at replacing and upgrading equipment on our network. We refer to this as our Network Replacement Outputs measure.

We've rewritten our original methodology (published 2008) for assessing our effectiveness against these measures; the new method described in this paper will allow us to better measure if we are meeting them and more clearly reflects how we manage the network.

We will continue to comply with our Network Performance Measure and Network Capability Measure using other governance procedures, so these are not covered in detail in this new methodology. The new methodology focuses on the Network Asset Condition Measure, the Network Risk Measure and our Network Replacement Outputs measure i.e. our asset condition, how we manage risk and how we perform as an asset management company.

Introducing our new approach

The information we hold on our assets tells us about their condition and performance. We have gathered a lot of information on what can cause our assets to fail and what could happen if they do (the consequence); our asset data helps us understand how likely that is (the probability).

There is always room for improvement, so we are undertaking work to improve how we collect and analyse our asset data.

By better understanding our risk measure, we can improve our capability as an asset management company.

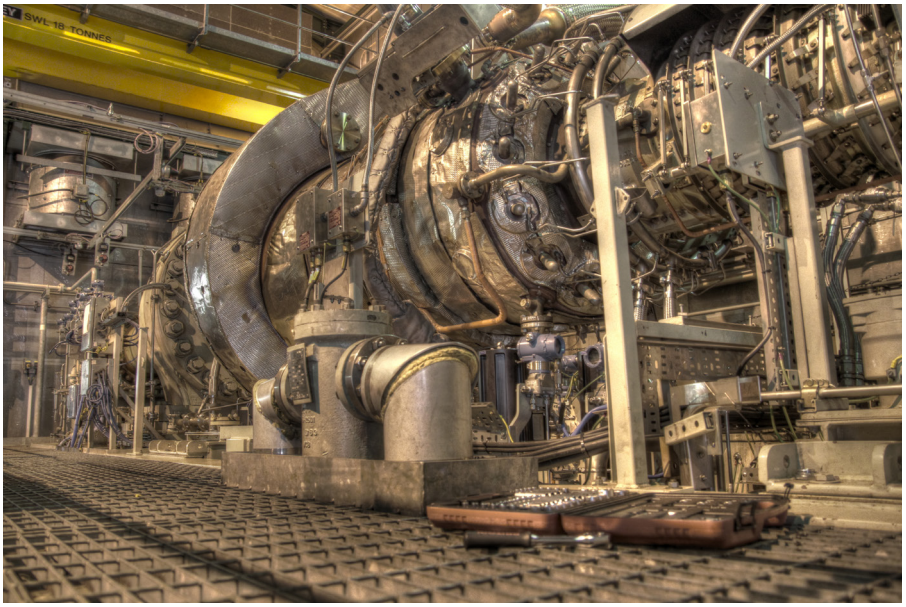
We maintain a register of all our assets, and hold information on inspection, repair and replacement costs. Our asset knowledge is not perfect: as our network ages we can rely less on our historical experience to predict the kind of maintenance and operational problems we will face into the future. There is always room for improvement, so we are undertaking work to improve how we collect and analyse our asset data.

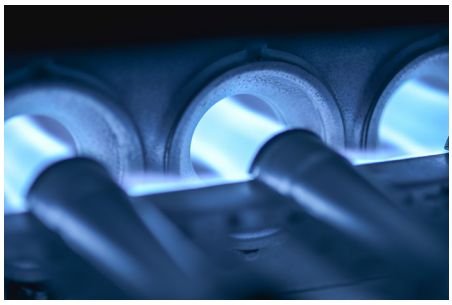
We also continuously record thousands of operational parameters across our network; we track the flow, pressure and quality of the gas into our network, on its journey through our system and onwards to our customers, and carry out condition surveys of our equipment

We regularly update our gas supply and demand forecast, which helps us determine whether we have sufficient capability in the system to respond to short-term fluctuations and longer term trends.

Together these factors provide an overall measure of the risk to our network reliability, either at an individual asset level or when operating together to make the overall system function. This is our 'Network Risk Measure'; the calculation of this is the main focus of our new methodology to assess how we are performing against our NOMs.

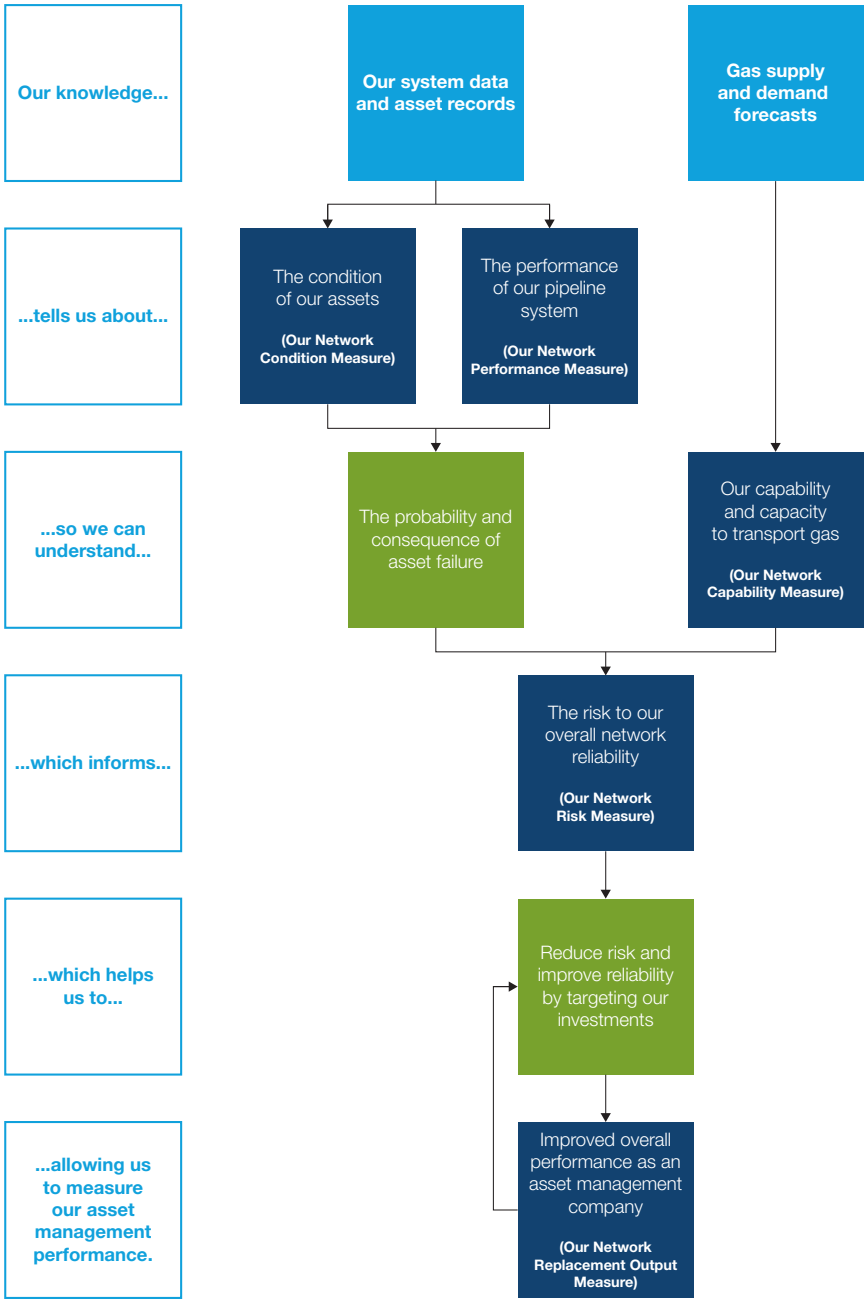
By better understanding our risk measure, we can improve our capability as an asset management company. Translating our gas supply, safety or environmental risks into a financial cost standardises how we quantify these different issues and allows us to better compare their significance; this approach is called monetising risk.





We must have a clear, transparent methodology to determine our Network Risk Measure; this will enable us to report the level of network risk in financial terms (as 'monetised risk') now or into the future. It will also help us to explain and justify our maintenance expenditure and asset replacement works so we can continue to meet our customer requirements and report effectively on our asset management performance.

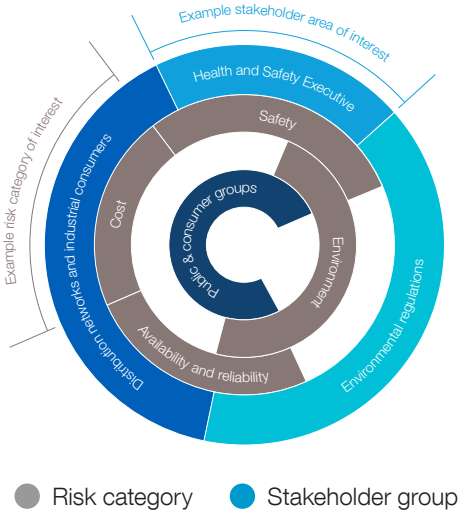
This is how we will understand our asset risk and use the information we learn:



Our stakeholders have different interests which sometimes conflict; so we must understand each stakeholder's drivers in order to assign a financial value to the impact of asset failure.

Stakeholder group	Key drivers
Health and Safety Executive	A safe and reliable network; protecting the safety of employees and general public
Environmental regulators	Protection of the environment and efficient use of resources
Distribution networks and industrial consumers	Value for money connections and supply costs; reliability of supply and connections; maintaining safety and reliability of the wider UK networks
Public and consumer groups	A reliable supply of energy at an affordable price with minimal impact

Asset failure impacts National Grid as a company and potentially wider society, which is represented by our various stakeholders. Our stakeholders have different interests which sometimes conflict; so we must understand each stakeholder's drivers in order to assign a financial value to the impact of asset failure. Our risk wheel below maps our main stakeholder groups (blue) to our four main risk categories (grey).



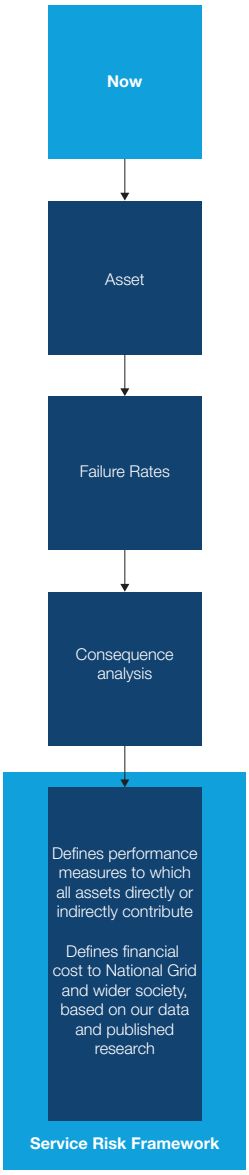
Monetising risk and valuing investment

If one of our assets fails to fulfil its function, and as a result the network performance falls short of the expected level, this can be valued as a financial cost e.g. gas supply obligations may not be met or fines may be payable.

With an understanding of the probability of that failure and the nature and cost of the consequence, the risk that the asset poses can be valued in monetary terms before the failure occurs. This will help us to understand what amount we should spend and where, so we manage our risks better and deliver value for money. These principles are central to our methodology to value the monetised risk of our asset base now, in the future and to understand how investment could change this. This is how it works:

We developed the Service Risk Framework ‘top down’ (i.e. to include both National Grid’s and our stakeholders’ performance requirements for our assets) and also ‘bottom up’ (i.e. analysing our asset base and the consequence of failures).

One aspect of our process to monetise risk was particularly challenging to develop, and is of particular interest to our stakeholders. We developed the ‘Service Risk Framework’ to categorise the main risk areas, helping us to assign a monetised value to each:



The Service Risk Framework describes the expected performance measures for our assets, from our perspective and that of our external stakeholders. It has been designed around the principle of monetising our risks, we use this as a common language to illustrate the different types of risk we manage.

We developed the Service Risk Framework ‘top down’ (i.e. to include both National Grid’s and our stakeholders’ performance requirements for our assets) and also ‘bottom up’ (i.e. analysing our asset base and the consequence of failures). We have identified thirteen measured groups in five categories which reflects these issues. For each service risk measure we have defined a measure for potential severity; this is either based on a measurable value which can be costed separately (such as emission of pollutant gases to air) or the actual cost of remediating any damage.

How did we value external costs?
Estimating the internal cost to National Grid of replacing an asset is relatively straightforward, arriving at a monetised value to society for a major failure is difficult.

We’ve used published data to quantify this, for example the Health and Safety Executive’s approach to valuing a preventable fatality, or UK Government values for carbon dioxide emissions. We’ve also considered the consequences of downstream loss of gas supply (e.g. people not being able to heat their homes) in order to place a value on the reliability of our network.

Service risk framework

Our service risk framework categories and measures and the nature of the cost exposure is shown below:

Category	Service risk measure	Internal National Grid cost	External social cost
Safety	Health and safety of the general public and employees	Yes	Yes
	Compliance with health and safety legislation	Yes	
Environment	Environmental incidents	Yes	Yes
	Compliance with environmental legislation and permits	Yes	
	Volume of emissions		Yes
	Noise pollution	Yes	Yes
Availability and reliability	Impact on network constraints	Yes	
	Compensation of failure to supply	Yes	Yes
Financial	Shrinkage	Yes	
	Impact on operating costs	Yes	
Society and company	Property damage		Yes
	Transport disruption		Yes
	Reputation	Yes	

Applying our new methodology

We will use our new methodology for reporting asset risk and condition and for investment planning.

We will be able to report the current and future risks of our network (with and without investment), including the expected frequency of asset failures and their consequences in monetary terms. This will allow us to better report on our Network Asset Condition Measure and Network Risk Measure. We can illustrate this using risk matrices; these are widely used in many industries

Example Risk Matrix Approach

We could use a risk matrix like this for different types of asset, individually or grouped together.

This shows the number of assets in each risk band, based on the probability and monetary consequence of failure. It also shows a total monetised risk value, and how we can use investment to drive assets from the red 'concern' areas into the lower risk green areas.

This approach shows a lot of information about our assets and may be too complicated; we will be led by Ofgem and our stakeholder opinions on whether we use this or an alternative presentation.

We will also use the methodology to support a move to monetised risk based investment planning, although we will use it alongside our existing approaches (e.g. tracking the asset health status of our plant items). The new monetised risk approach means that we will be able to:

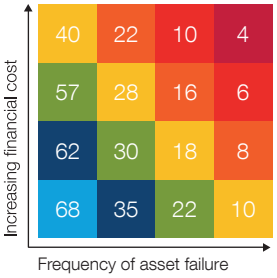
- better plan asset interventions (when we need to do work on our assets) and understand the reduction in risk that maintenance or refurbishment can bring. To help with this we are developing more accurate cost data for potential interventions and maintenance activities so they can be applied consistently
- better plan and articulate our investment proposals using clear cost-benefit principles
- better value our improvements at a network wide or individual asset level against the issues that matter to our stakeholders
- test and compare alternative strategies to improve our network and understand how issues such as changing supply and demand could impact our decisions.

In order to better apply our methodology, we have split our asset base into two broad groups, each with different issues:

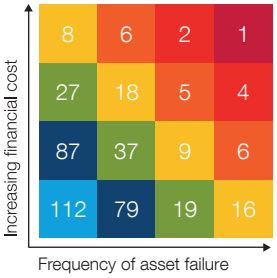
- Our network of largely buried pipelines
- Our above ground assets such as network entry and exit points, and valve and compressor sites.

Whilst we have a common Service Risk Framework, differences between these types of assets bring specific challenges, which we will have to address when applying the methodology; these are discussed in the following tables.

Starting position
Total monetised risk = £1.8 m

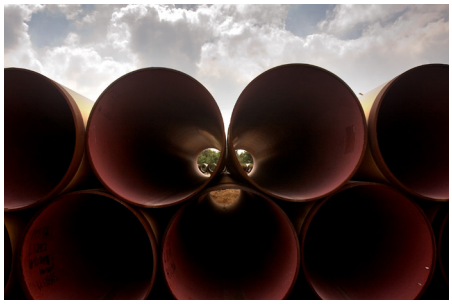


End position after investment
Total monetised risk = £1.2 m



Pipelines

Pipelines have the potential to impact over a wider geographical area, and the consequence and intervention associated with asset failures can be different from one section to the next.



We've split our

7,772 km

of pipeline into nearly

700,000

12 metre pipeline segments

Our pipeline assets are supported and protected by other assets, e.g. river crossings, marker posts or corrosion protection systems.

How we manage our assets	
Asset split	• We've split our 7,772 km of pipeline into nearly 700,000 12 metre pipeline segments; whilst this massively increases the individual number of assets, we can better assign key attributes (e.g. age, pressure, customers served) to each segment. • Having individual segments also helps with associated assets, e.g. markers are associated with a single segment, river crossing with several and corrosion protection systems with many.
Failure mode and frequency	• We've identified five failure modes for our pipes, from failure caused by external corrosion to impact damage from digger strikes. • We've used industry standard models to estimate failure frequency, which we've adjusted based on the characteristics of the pipe segment (e.g. wall thickness), the health of the corrosion protection systems and information about the condition of the pipeline from activities such as Pipeline Inspection Gauge (PIG) surveys and assessment of the condition of our pipeline coatings.
Probability and consequence	• Pipe failure causes leaks and ruptures. In turn, and depending on the probability, severity and scale of the consequence, these impact on one or more of the five Service Risk Framework categories (safety, environment, availability/reliability, financial, society and company) e.g. natural gas (methane) releases are likely to contribute to climate change; leaks or ruptured pipes could ignite risking human life, property damage and causing disruption. They can also impact on our ability to supply gas, directly or when making repairs. • All of these risk factors can be monetised using our new methodology.
Interventions	• We've defined and costed a series of over 15 major interventions (e.g. refurbishment of a major river crossing) which will reduce the probability and consequence of a failure. • The cost and benefit of these can be compared to the monetised risk of asset failure.

Above ground sites

Our above ground sites are complex with many types of asset represented; each has different failure characteristics.

Our assets often have on-site back-up (e.g. a duty / standby arrangement) and are typically protected by multiple instrumented safety systems; these factors significantly reduce the potential consequences of failure in many locations.

How we manage our assets	
Asset split	• We've defined an 'asset purpose' which may apply to one or more asset system on a site. Knowing the purpose of the asset, we can better understand the failure consequences; for example even a major failure of an individual asset may not prevent a system from fulfilling its 'asset purpose' because of our duty/standby arrangement, which would be reflected in a lower consequence
Failure mode and frequency	• We've used historical asset defect data to calculate a failure rate per year. This has been combined with complex failure modelling to determine the nature and likely frequency of our asset failures. • Our asset failure models use data derived from our in-house asset experts, which is benchmarked and tested against wider industry knowledge and expertise. • These models produce statistical graphs which show the rate at which a failure might happen; these allow us to look at factors such as asset health vs. asset age, and an asset's 'effective age' (i.e. where an old but very well maintained asset shows fewer signs of deterioration than a much younger poorly maintained item)..
Probability and consequence	• The consequences of above ground asset failure are wide ranging. Depending on the probability, severity and scale of the consequence, these impact on one or more of the five Service Risk Framework categories (safety, environment, availability/ reliability, financial, society and company). e.g. valve failure can increase noise from a site; failure leading to fire could risk human life; the severity and scale depending on the nature of the fire and number of people affected. We adjust down the consequence where we have safety systems (such as fire detection and suppression). • All of these risk factors can be monetised using our new methodology.
Interventions	• We've defined three classes of intervention, proactively replacing equipment before it has issues, to reactively repairing or reactively refurbishing equipment on failure. • The cost and benefit of these can be compared to the monetised risk of asset failure.

Conclusion

Our methodology is complex, it reflects that we own and operate a complex network of critical assets forming a key part of the UK's energy infrastructure.

We believe that our new methodology will enable us to better meet our licence conditions, and in particular the three Network Output Measures which it targets.

Network Risk Measure	By using monetised risk as a standardised approach to measure our performance and plan our investment our methodology allows us to value the consequences of asset failure against a range of categories which are not easily compared (e.g. safety vs. environmental harm). By including internal costs to our business and wider costs to society, we can directly compare the costs and predict the benefits of investing in our assets, this enables us to assess the effectiveness of money already spent on the network and planned expenditure in the future. We will demonstrate we've delivered value for money investment matched to stakeholder needs.
Network Asset Condition Measure	The methodology will allow us to assess the condition of our assets individually and aggregated together. This will help us to develop, maintain and operate an efficient economical gas pipeline system, meeting our objective as a licensed gas transporter.
Network Replacement Outputs	The methodology will help us to compare and improve our performance as an asset manager, within our network and against others in our sector. Using monetised risk allows us to use a standard, consistent metric which will help us to Communicate Effectively and disseminate relevant info between interested parties.

Our consultation

We want your views on our approach, in particular, whether this methodology will enable us to meet the three specific NOMs in our licence condition.

More information
A detailed technical paper on this subject is available at: http://www.talkingnetworkstx.com/network-output-measures.aspx

Any questions
talkingnetworkstransmission@nationalgrid.com

1. We have explained how we plan to invest in our assets, how successful have we been in describing the method?
2. Do you understand how we manage the risk on the gas transmission network?
3. In the explanations of our new process how clearly did we describe the level of overall risk that our network operates with?
4. Do we provide enough transparency for balancing the risk on the network and its associated mitigation in our investment methodology?
5. We described how we balance investments between different risks for instance safety, environment and reliability, how confident are you that we strike the right balance between these risks?
6. Do you agree that the new process describes the current and the future condition of the gas transmission network?

Share your views
http://www.talkingnetworkstx.com/network-output-measures.aspx

Reviewing and updating our methodology into the future

This methodology, as well as being a licence condition, forms a part of our externally accredited ISO55001 Asset Management System. Our licence and our management system require us to review and update this methodology annually. New information about our failure rates and the positive effect of our investment on overall asset health will allow us to refine the parameters we use in our methodology and the underlying models. The data used in our assessments, which feeds directly into reporting under our licence will continue to be subject to our formal data assurance requirements.

We will always consult on more major changes to our methodology and proposals will be submitted to Ofgem for approval.

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