Department for
Business, Energy
& Industrial Strategy

NATIONAL PREVENTIVE ACTION PLAN: GAS

Completed for EU Regulation 2017/1938

March 2019

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National Preventive Action Plan: Gas

Completed for EU Regulation 2017/1938

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1. Executive Summary

As set out in the UK National Risk Assessment for Security of Gas Supply, the UK gas market is well placed to remain resilient to all but the most extreme combination of severe infrastructure failures or supply shocks. This Preventive Action Plan describes a number of preventive actions which have been or are being taken to ensure this remains the case.

1.1 This document forms the Preventive Action Plan required by the EU Regulation on Gas Security of Supply (2017/1938) ('the Regulation') and fulfils the requirement on the competent authority of the United Kingdom under Article 8 of the Regulation to outline the measures needed to remove or mitigate any risks identified in the Common and National Risk Assessments.

1.2 The Regulation's overall aim is to safeguard the security of gas supply in the European Union, and to enhance resilience to gas supply disruptions and exceptional climactic conditions. It sets supply and infrastructure standards to ensure that all necessary measures are being taken to ensure gas supply and infrastructure adequacy, and promotes regional co-operation as embodied by the Common Risk Assessments relevant to each Member State (in the case of the UK, these are the UK Risk Group Common Risk Assessment, and the Norway Risk Group Common Risk Assessment). The Regulation is based on the principle that measures (even in situations of tight supply) should be market based for as long as possible and stipulates that no Member State should take measures that impact negatively on another Member State's market.

1.3 This Preventive Action Plan (PAP) and the UK's accompanying Emergency Plan both incorporate the risks outlined in the National Risk Assessment, as well as a regional dimension based on the analysis and findings of the Common Risk Assessments.

1.4 This PAP is not a standalone document and shall be read in parallel with the National and Common Risk Assessments. It provides additional commentary on the measures being implemented to reduce risks to gas security, however it does not seek to unduly duplicate the details already set out in the Risk Assessment.

1.5 The accompanying Emergency plan has been produced as an evolution of an existing and well exercised plan and has been produced as a separate document. The Emergency Plan contains measures to be taken to remove or mitigate the impact of a gas supply disruption in accordance with the Regulation.

1.6 This is a national PAP for the UK and as such encompasses measures for both Great Britain and Northern Ireland. It also recognises specific initiatives underway between Northern Ireland and the Republic of Ireland and supports the development of regional co-operation measures and agreements.

General Information

1.7 The United Kingdom is a member of the North Sea gas supply risk groups:

- United Kingdom Risk Group: Belgium, Germany, Ireland, Luxembourg, Netherlands, United Kingdom;
- Norway Risk Group: Belgium, Germany, Ireland, Spain, France, Italy, Luxembourg, Netherlands, Denmark, Portugal, Sweden, United Kingdom.

1.8 The Department for Business, Energy and Industrial Strategy (BEIS) is the competent authority responsible for the preparation of this plan. In preparing the Preventative Action Plan, BEIS consult with the Northern Ireland Department for the Economy (DfE).

2. Description of the system

To avoid duplication, please refer to the relevant Common Risk Assessments for both the United Kingdom and Norway Risk Groups for further detail on the functioning of the gas systems of relevant member states of these Risk Groups. The Common Risk Assessments provide more detailed descriptions of gas consumption figures, peak demand, domestic production and national infrastructure for each member state. A brief summary of each Risk Group's gas system is presented below.

United Kingdom Risk Group

2.1 The United Kingdom Risk Group is made up of the following countries: Belgium, Germany, Ireland, Luxembourg, the Netherlands and the United Kingdom.

2.2 The natural gas systems of the members of the United Kingdom Risk Group are characterised by significant levels of interconnection, liquid markets and sufficient infrastructure that more than meets the region's needs. Further detail of the individual gas systems of the Member States of the United Kingdom Risk Group can be found in the Common Risk Assessment for the United Kingdom Risk Group.

2.3 The countries in the United Kingdom Risk Group represent a significant proportion of total European gas demand. In 2016, their combined annual consumption accounted for about 50% of total consumption in the EU-28. Germany and the UK were the countries with respectively the highest and the second highest natural gas demand in Europe in 2016.

2.4 Except for Belgium and Luxembourg, all Member States of the United Kingdom Risk Group have some level of domestic production, underpinning the resilience of the north-west European gas system. The United Kingdom and the Netherlands are the two largest natural gas producers in the European Union, producing approximately 416TWh (38 bcm) and 430TWh (44 bcm) respectively in 2017.

2.5 Although production from the United Kingdom Continental Shelf has, since 2014, increased year-on-year due to the development of new fields, increased production at some of the existing fields and production of cushion gas from the Rough storage facility as it is prepared for closure , production from the UKCS has generally been falling since the turn of the century, with production declining by around 8% a year between 2000 and 2013 .

2.6 Natural gas production in the Netherlands will decline rapidly over the next decade, due to the decision taken in 2018 to terminate production from the Groningen gas field by 2030. The shutdown in Groningen production is expected to reduce national Dutch production by an average of 19% per year in the period 2018-2021. Further detail regarding the planned shutdown of Groningen is set out in Chapter 4 of the UK Risk Group Common Risk Assessment.

2.7 Projected data for 2018-2020 indicates that the total storage deliverability in the United Kingdom Risk Group is 10,212 GWh/day. The breakdown of this figure can be found in the Annex to the UK Risk Group Common Risk Assessment, alongside a breakdown of total production capacity (projected to be 3,538 GWh/day in 2020) and the maximum technical LNG facility capacity (projected to be 2,405 GWh/day from 2018-2020).

Norway Risk Group

[Placeholder – France to provide summary. Requested January 2019]

United Kingdom

2.8 This section draws on the key points made in the description of the system in Section 3 of the National Risk Assessment. To avoid duplication, the detail has been omitted but can be found in the NRA as supplementary information.

2.9 The UK has one of the largest and most liquid gas markets in Europe. In 2016, UK consumption was the second largest in Europe, just behind Germany. High levels of liquidity at the UK's hub, the National Balancing Point (NBP), are evidenced by the level of trades there: alongside the Netherlands the UK dominates gas trade in Europe, with both countries covering more than 80% of hub-traded volumes.

Gas Demand

2.10 Natural gas provides the main source for heating homes and businesses in Great Britain (GB). It is also a major primary energy source for industry and electricity generation as well as being a feedstock for some industrial applications. In 2017 natural gas accounted for nearly 39% of all the UK's primary fuel consumption.

2.11 Gas demand has fallen by more than a fifth compared with 2000. Over this period, significant reductions in gas used for power generation had been notable until the reduction in coal-powered generation in 2016 that led to increased use of gas that year; however, gas for power generation fell in 2017, reflecting the longer-term trend.

2.12 Gas demand in 2017 was about 3% lower than in 2016 at 79.5bcm. The principal cause was a reduction in final gas consumption caused by generally warmer temperatures, which resulted in a reduction in demand for gas for space heating and power generation. Domestic sector consumption was down 4.6% compared to 2016. Demand for natural gas from the industrial sector in 2017 increased by 3.2% compared to 2016, with a marked 8.4% increase in gas used in the chemicals sector.

2.13 The peak winter day demand for 2017/18 was 418mcm on the 1st March, which was the highest level for 7 years and 47mcm lower than the record winter peak day demand in January 2010. Further detail of the UK gas network's response to this high demand can be found in Case Study 3 of Chapter 6 in the National Risk Assessment.

Gas Supply

2.14 The UK has a wide range of gas supplies and sources. This includes significant levels of domestic gas production, access via pipelines to Norwegian gas production, interconnection with the Continent through the IUK and BBL pipelines and some of the largest and most modern LNG infrastructure in Europe. The figures below are taken from the UK NRA. Figure 2.1 outlines the sources of UK gas in 2015-2017 and Figure 2.2 shows the composition of total supplies for winter 2017/2018 compared to the previous two winters.

Figure 2.1: Annual sources of UK gas 2015-2017

Source	2015 (bcm)	2016 (bcm)	2017 (bcm)
Total Pipelines	32	38	40
Belgium	0.20	1.39	2.65
Netherlands	3.33	4.40	1.87
Norway	28.10	31.71	35.89
Total LNG	14	11	7
Algeria	0.44	0.43	0.33
Belgium	-	0.10	-
Egypt	-	0.01	-
Nigeria	0.04	0.04	0.07
Norway	0.06	0.24	0.14
Qatar	12.93	10.05	6.18
Trinidad & Tobago	0.46	0.11	0.20
Dominican Republic	-	-	0.06
Peru	-	-	0.14
Russia	-	-	0.09
United States	-	-	0.15
Total imports	46	49	47
UK Production	36	37	38
Total exports	14	10	11
Gas available at terminals	68	76	74

Figure 2.2: Gas supplies for winter 2017/18 and previous years

	2015/16		2016/17		2017/18	
	bcm	%	bcm	%	bcm	%
UKCS	17.8	36%	19.9	38%	19.7	36%
Norway	18.0	36%	21.6	42%	21.0	39%
BBL	3.0	6%	2.7	5%	3.1	6%
IUK	<0.1	0%	2.5	5%	4.7	9%
LNG	6.4	13%	1.9	4%	1.8	3%
Storage	4.1	8%	3.3	6%	3.8	7%
Total	49.4		52.0		54.1	

Source: National Grid 2018 Winter Review and Consultation

UK Continental Shelf (UKCS) Production

2.15 Domestic UKCS production (also referred to as North Sea gas) is a key source of gas for the UK, accounting for about 36% of gas supplies in winter 2017/18. Although production from the United Kingdom Continental Shelf (UKCS) has, since 2014, increased year-on-year due to the development of new fields, increased production at some of the existing fields and extraction of cushion gas from the Rough storage facility as it is prepared for closure , production from the UKCS has generally been falling since the turn of the century, with production declining by around 8% a year between 2000 and 2013. Despite this, the UK is along with the Netherlands one of the two major gas-producing nations within the EU.

Import infrastructure

2.16 Currently the UK has a total import capacity of about 149bcm/year, split into three near-equal sources: the continent (43bcm/year), Norway (56bcm/year) and LNG (49bcm/year). Figure 3.5 below, shows the range of facilities that currently make up the UK's import infrastructure. A table detailing exiting GB import infrastructure can be found in section 3.3 of the UK's National Risk Assessment.

Interconnectors

2.17 The UK currently has four interconnectors with other EU Member States:

- Interconnector UK (IUK), which flows gas in both directions between Bacton and Zeebrugge in Belgium;
- The BBL pipeline, which flows gas in one direction from Balgzand in the Netherlands to Bacton in England;
- The Moffat interconnectors (IC1 and IC2), which flow gas in one direction from Moffat in Scotland to Ireland;
- The South-North Pipeline (SNP) which can flow gas in one direction from Gormanston in Ireland to Northern Ireland if required. SNP gas flows across the interconnector have been for specific operational and maintenance purposes by the Transmission System Operator. Northern Ireland currently receives all its gas via the Scotland to Northern Ireland Pipeline (SNIP).

2.18 One of the UK's interconnectors, IUK, has bi-directional flow enabled. The remaining three were exempted from the mandatory bi-directional requirements. These exemptions were renewed in September 2018. Section 4 of the United Kingdom National Risk Assessment contains more detail on these exemptions.

Liquefied Natural Gas (LNG)

2.19 The UK is connected to global gas markets through three LNG import terminals. The UK currently has the infrastructure capacity to import around 49bcm/y of LNG through: Milford Haven (South Hook and Dragon, 21bcm/y and 8bcm/y respectively) and Isle of Grain (20bcm/y). This means the UK has the second largest LNG infrastructure in Europe, behind Spain.

2.20 These terminals connect the UK to any LNG producing country, although historically the majority of UK LNG has come from Qatar (around 84% of total UK LNG imports in 2017), the world's largest LNG producer. Send-out from LNG terminals was lower in winter 2017/18 with respect to the previous three winters.

Gas storage

2.21 GB storage does not operate as a "strategic reserve" of gas – providing a large volume of gas to be used in case of an emergency but otherwise not utilised. Instead, the value of storage lies in its ability to operate flexibly in response to relatively short-term price signals and ultimately reduce price volatility.

2.22 The total storage space provided by UK storage sites is 1.44bcm, providing approximately 120.8 mcm/d in maximum delivery. A table of existing storage sites can be found below in figure.2.3.

Figure 2.3 Existing storage sites.

Site	Operator / Developer	Location	Space (bcm)	Approximate max delivery (mcm/d)
Aldborough	SSE/Statoil	East Yorkshire	0.3	40
Hatfield Moor	Scottish Power	South Yorkshire	0.07	1.8
Holford	E.ON	Cheshire	0.2	22
Hornsea	SSE	East Yorkshire	0.3	18
Humbly Grove	Humbly Grove Energy	Hampshire	0.3	7
Hill Top Farm	EDF Energy	Cheshire	0.05	12
Stublach	Storenergy	Cheshire	0.2	15
		Total	1.42	115.8

Source: National Grid, Gas Ten Year Statement 2017

3. Summary of the risk assessment

United Kingdom Common Risk Assessment

3.1 The Common Risk Assessment (CRA) for the United Kingdom Risk Group demonstrates the strength of the security of supply situation in the Member States of the group. The region's extensive infrastructure is more than sufficient to meet the region's needs even during periods of high demand.

3.2 The region's N-1 result is well in excess of 100%. The region is capable of achieving up to an N-3 result under the formula. For the Risk Group to fail the infrastructure standard test, around a third of the region's existing gas infrastructure capacity would have to be lost simultaneously.

3.3 The UK CRA analysed ENTSOG Scenario no. 13 in which disruption to the largest offshore production infrastructure from the UK (the Forties Pipeline System) demonstrated the resilience and interconnectivity of the UK and North-West European gas system. Analysis showed that whilst security was unthreatened, gas prices increased to attract the additional gas supplies needed.

3.4 The Case Study at section 5 of the CRA examines the events of December 2017 when a controlled shutdown of the Forties Pipeline System coincided with an explosion at the Baumgarten gas pipeline hub in Austria. Despite these co-incident events, at no time was North-West European gas security threatened

3.5 The CRA also explored the disruption of multiple infrastructure at a time of high demand (February/March 2018). This case study similarly demonstrated the resilience of the North-West European gas system, whereby the loss of significant pieces of gas infrastructure tested the UK Risk Group's ability to respond to a system stress scenario. Whilst the calculation of the N-1 standard is a theoretical exercise, with the United Kingdom Risk Group able to achieve up to at least an N-3 standard, the events of February/March 2018 may be considered as a real-life test of the principles underlying the standard, i.e. the loss of significant (albeit not necessarily the largest) pieces of gas infrastructure within the region

3.6 When assessing the long-term resilience of the region, the long-term decline in the contribution made by indigenous production was taken into account. This reduction must be viewed in the context of a forecast long-term reduction in the demand for natural gas.

3.7 The resilience of the north-west European gas network is supported by indigenous production, pipeline and LNG imports and storage, and underpinned by a mature and liquid gas market which has demonstrated its ability to deliver even during the most extreme combination of infrastructure failure and increased demand.

Norway Risk Group Common Risk Assessment

3.8 The Common Risk Assessment for the Norway Risk Group demonstrates that gas supply infrastructure is resilient to all but the most unlikely combinations of supply shocks in the region.

3.9 Only 5% of the gas produced in Norway is consumed in the country. The vast majority is exported, predominantly to neighbouring countries in the North Sea area via subsea pipelines to Western Europe.

3.10 Norwegian gas supplies can be considered to be reliable for the foreseeable future, based on the analysis set out in the CRA. However, the predicted decline in Norwegian production must be monitored and taken into account when considering the security of gas supply to the region. The level of this production decline will depend on discoveries being made and developed, as well as improved recovery projects being implemented on existing fields.

3.11 The N-1 test for the region provided results that were well above 100% in all projections, meaning that the region's other entry capacities are proven to be sufficient to cover demand in a 1-in-20 scenario, should there be a major disruption to Norwegian gas infrastructure.

3.12 Section 4 of the CRA discusses ENTSOG simulations of disruption to three significant pieces of Norwegian gas infrastructure (Langeled pipeline to the UK, EUROPIPE II to continental Europe, and Emden Station). It concludes that other means of supply are resilient enough to compensate the disruption in all three simulations. These other means are the reorganisation of flows from Norway, additional withdrawal from storage, and additional send-out from LNG terminals.

United Kingdom National Risk Assessment

3.13 In October 2018, in line with the Regulation, the UK Government carried out an updated assessment of the risks affecting the security of gas supply in the UK. The National Risk Assessment (NRA) was based on a number of common elements as set out in the Regulation, including assessment of the Infrastructure Standard and Supply Standard, a description of the national gas system and gas market, and a review of three case studies.

3.14 The NRA identified and assessed the impact of a supply shock equivalent to the loss of the largest single piece of gas supply infrastructure (the 100km Felindre pipeline connecting the two liquified national gas (LNG) terminals located at Milford Haven to the National Transmission System (NTS)) over the course a day, week, month and entire winter under both average and severe demand conditions.

3.15 The NRA also included a series of three case studies to assess the UK's ability to respond to situations of supply shocks and constraints. These were: the disruption of the Forties pipeline system; the late winter cold snap in February/March 2018; and disruption from geopolitical events concerning Russian gas supplies. Further detail of all three case studies can be found in Section 6 of the NRA.

3.16 The N-1 calculation as completed in the NRA resulted in a value of 120% (Appendix I) thereby meeting the Infrastructure Standard. As part of National Grid's Future Energy Scenarios analysis, under all scenarios the N-1 margin is expected to improve or stay approximately at today's level until 2035 (Appendix II).

3.17 With regard to the supply standard, the demand modelling set out in the Risk Assessment demonstrates that the UK achieves the requirements to ensure gas supply to protected customers in a range of scenarios. The risk analysis with no supply disruption showed that non-storage supply is sufficient to meet demand from protected customers for all durations. In the risk analysis that introduced the largest possible single supply disruption, protected demand was met by a combination of non-storage supply and non-storage supply upside in all scenarios.

3.18 This analysis is supported by numerous reports and analysis including biannual summer and winter outlook reports as published by GB's Transmission System Operator (TSO). In practice, the UK achieves the requirements of the Supply Standard through sharp commercial incentives, shippers/suppliers, specifically the 'cash-out' regime to provide sufficient gas to meet the needs of all their firm customers on any gas day and under any weather conditions or other circumstances.

3.19 Despite the downward trend in UKCS production, the UK Government has taken extensive measures to support commercial extraction of existing reserves and to encourage exploration. The UK Government has assessed the changing supply and demand patterns which are likely to be seen over the coming years in its 2017 Strategic Assessment. It concludes that, even with the decline in indigenous production, the UK is well placed to attract sufficient gas supplies from a variety of sources to meet demand.

3.20 In summary, the NRA found that the UK gas market is resilient to all but the most unlikely combination of high demand and supply disruption, and that protected demand is met in all considered circumstances. The UK Government continues to monitor risks to gas security of supply and will continue working to improve resilience. In the medium to long term, there may be further challenges.

3.21 Gas demand from the electricity generation sector is expected to increase as gas fired plants replace coal fired power plants, which will progressively close due to the requirements of the Industrial Emissions Directives and the UK Government's plan to end unabated coal-fired power generation by 2025. Flexible gas fired generation is also likely to be necessary to provide marginal electricity balancing as more intermittent renewable energy sources are installed. This is an area which will continue to be monitored and, if appropriate, mitigating steps will be identified and implemented to manage any potential impact.

4. Infrastructure Standard

4.1 The N-1 standard has been calculated for the United Kingdom in the National Risk Assessment, and for both the United Kingdom Risk Group and the Norway Risk Group in their respective Common Risk Assessments. In all three calculations, the results were well in excess of 100%. This section highlights the N-1 scores for all three, whilst supplementary detail can be found in the respective Risk Assessments.

Regional Level

United Kingdom Risk Group

4.2 For the purposes of calculation, disruption of the largest infrastructure of the group has been assessed:

- Disruption of Felindre pipeline connecting the South Hook and Dragon LNG terminals to the UK National Transmission System with a capacity of 892GWh/d;
- Disruption of Mallnow interconnection point between Germany and Poland with a capacity of 932GWh/d;
- Disruption of Emden EPT entry point from Norway to the continent with a capacity of 989 GWh/d.

4.3 The region's N-1 result is well in excess of 100%. The region is capable of achieving up to an N-3 result under the formula. For the UK Risk Group region to fail the N-1 test, around a third of existing gas infrastructure capacity would have to be lost.

Norway Risk Group

4.4 The Norway Risk Group calculation considered the disruption of the two largest pieces of infrastructure:

- Disruption of Emden station (from Norway to the continent) with a capacity of 989 GWh/d.
- Disruption of Langeled pipeline (from Norway to the United Kingdom) with a capacity of 770 GWh/d.

4.5 The region's N-1 results are well above 100%, demonstrating that in the case of disruption to key infrastructure capacity the region would remain resilient in a 1-in-20 demand scenario.

National Level

N-1 Calculation

4.6 For the National Risk Assessment, BEIS (as Competent Authority for the Regulation) asked National Grid Gas (as System Operator) to calculate the N-1 figures as of August 2017.

4.7 The assessment is based on a failure of the 100km Felindre pipeline connecting the South Hook and Dragon LNG terminals at Milford Haven to the gas National Transmission System (NTS). The failure of this pipeline represents the failure of the UK's single largest gas infrastructure and it would lead to the loss of an estimated 81mcm/d of capacity.

4.8 The National N-1 score was 120% at peak, demonstrating the UK's ability to ensure security of supply in a 1-in-20 demand scenario.

Bi-directional Capacity

4.9 There are four interconnectors between the UK and other Member States. One of these is enabled for bi-directional flow: the IUK Interconnector between the UK and Belgium.

4.10 The remaining three interconnectors where an exemption has been granted in accordance with Article 5(4) are as follows:

- BBL: The Netherlands has historically been a net gas producer with little-to-no market demand to import gas from the UK in the short term. However, following recent market developments, the interconnector decided to invest to enable bi-directional flows. This exemption has been granted for the maximum duration of 4 years in accordance with Annex III of the Regulation.

- Moffat IC1/IC2: Ireland continues to be heavily reliant on the GB market for its gas and as such, any gas deficit within GB would similarly impact Ireland. Indigenous production from the Corrib gas field is expected to decline steadily in the future and currently there is no potential for sustained gas flows from Ireland to the GB market. An interim exemption has been granted until 31st May 2019 due to the ongoing preparation of a full feasibility study (as required by Article 5(5) of the Regulation), which is expected to be submitted by the end of April 2019.

- South North Pipeline: Gas can flow from Ireland to Northern Ireland via the South North Pipeline. Reverse flow from North to South would provide another supply route into the Republic of Ireland, but this would be the same gas that had already come through IC1 and IC2, which flow directly to Ireland from GB (as these interconnectors also spur off to supply 100% of Northern Irish gas). There is currently therefore no demand for gas to flow through SNP from Northern Ireland to Ireland. This exemption has been granted for the maximum duration of 4 years in accordance with Annex III of the Regulation.

5. Compliance with the supply standard

UK Regional Supply Standard

5.1 Under Article 6 (Supply Standard) of the Regulation, Competent Authorities shall require that the natural gas undertakings64, which it identifies, take measures to ensure gas supply to the protected customers in the following cases:

- Extreme temperatures during a 7-day peak period occurring with a statistical probability of once in 20 years;
- Any period of 30 days of exceptionally high gas demand, occurring with a statistical probability of once in 20 years;
- For a period of 30 days in the case of disruption of the single largest gas infrastructure under average winter conditions.

Definition of Protected Customers

5.2 The UK Risk Assessment definitions of protected customers is as follows:

Household customers;

- Small and medium-sized enterprises connected to a gas distribution network; and,
- Essential social services where loss of gas supplies could endanger health (as long as these customers and small and medium-sized enterprises do not exceed 20% of final use of gas).

Gas Volumes Required by Protected Customers

5.3 Figure 5.1 provides a breakdown of the volumes of gas required by Protected Customers under 1-in-20 Peak Day conditions.

Figure 5.1 Protected customer gas demands

1-in-20 peak demand (mcm/d)	United Kingdom (Great Britain + Northern Ireland)
Protected Customers' Demand	321
Other Loads	134
Total peak demand	455

Source: National Grid

Compliance with the Supply Standard

5.4 The United Kingdom can fulfil the supply standard on a national basis. Further information on this can be found in section 4 of the UK's 2018 National Risk Assessment and in Appendix III of this Preventative Action Plan.

6. Preventive Measures

6.1 The National Risk Assessment makes it possible to identify key areas for development in order to improve resilience within the gas sector. Whilst it demonstrates that the UK's security of supply position is strong, the UK Government is not complacent and continues to work to reduce any security of supply risks and has arrived at five key proportionate risk reduction measures for the security of gas supply that effectively form the preventive actions in this plan.

6.2 The UK has a liberalised, competitive energy market, which operates within a strategic framework set out by the Government. This approach ensures that commercial incentives combine with efficient processes to mitigate and manage the risks of any interruption. A more comprehensive description of this framework is provided in Section 7. Additionally, the UK has arrived at four proportionate risk reduction measures for the security of gas supply based on the analysis of the Risk Assessments are as follows:

- Gas Demand Side Response (DSR) Methodology
- MER UK Strategy
- The Capacity Market
- Regular systematic assessments of risk to the GB Gas System

6.3 It should be noted that the UK Government sees monitoring the market, risk assessment and the application of risk reduction measures as a continual activity and may implement other measures as necessary to ensure security of supply.

Gas Demand Side Response (DSR) Methodology

6.4 The conclusions of Ofgem's Gas Significant Code Review (SCR) placed an obligation on National Grid to develop a centralised demand side response mechanism to encourage greater demand-side participation from industrial and commercial users. National Grid's proposed DSR methodology was approved by Ofgem and implemented on 1st October 2016.

6.5 This service allows large gas consumers to offer, via a centralised platform, to reduce the amount of gas they use during times of system stress in exchange for a payment. This platform was deployed for the first time after the issuing of the Gas Deficit Warning in March 2018, however no DSR offers were placed on the centralised platform and no involuntary demand-side measures were taken by National Grid because of the market-based response seen after the Gas Deficit Warning was issued.

Maximising Economic Recovery (MER) UK Strategy

6.6 On 18 March 2016 the MER (Maximising Economic Recovery) UK Strategy came into force. It sets out a Central Obligation alongside Supporting Obligations and Required Actions and Behaviours to ensure the Central Obligation is effectively delivered.

6.7 The Central Obligation sets out that relevant persons must, in the exercise of their relevant functions, take the steps necessary to secure that the maximum value of economically recoverable petroleum is recovered from the strata beneath relevant UK waters

6.8 The relevant persons detailed in this obligation are the Oil and Gas Authority, petroleum licence holders, operators appointed under those licences, the owners of upstream petroleum infrastructure, and those planning and carrying out the commission of upstream petroleum infrastructure.

6.9 The Oil and Gas Authority (OGA) became a Government Company in October 2016, following Parliamentary approval for the Energy Act 2016. This equipped the OGA with additional powers to maximise economic recovery of oil and gas from beneath UK waters. The OGA is working with industry and co-operating with its counterparts in neighbouring North Sea countries to maximise economic recovery of the UK Continental Shelf.

The Capacity Market

6.10 The Capacity Market is a market-wide mechanism open to all providers of power generation that are able to supply reliable capacity, including demand side response and storage (except for providers in receipt of support from other policy measures) in order to avoid over-compensation and deliver value for money.

6.11 Gas plants are expected to play an important role in the Capacity Market because they have the potential to provide reliable capacity. The Capacity Market provides an upfront payment, which will make investment in new gas plant less risky and help deliver the investment in gas plant needed to ensure security of electricity supply. It includes financial penalties for non-delivery of electricity at times of system stress, so will also strengthen incentives for the provision of resilient gas supply chains and sufficient storage.

6.12 The Capacity Market is currently in a standstill period, following the judgment of the General Court of the Court of Justice of the European Union in Case T-793/14. This standstill period prevents the UK Government from making capacity payments under existing agreements until re-approval. The Commission has confirmed that it will be conducting an investigation into the original State aid notification for the Capacity Market, and the UK government is working with the Commission to ensure they have everything necessary to re-consider the case for approval of the CM scheme as quickly as possible.

Regular Systematic Assessments of Risk to the GB Gas System.

6.13 The Government has a process of regular, systematic assessments to examine the risks to the gas system over the longer term and the level of security we can expect it to deliver.

6.14 In the UK National Risk Assessment on the Security of Gas Supply; the UK government is able to discharge the duty set in EU Regulation to assess the security of gas supply in a range of scenarios.

6.15 The UK Government believes that the gas market is robust against a range of adverse events; but it cannot rule out the risk of supply shortfalls in extreme circumstances, nor the risk of a significant rise in wholesale gas prices to balance the market during times of system stress.

6.16 In all circumstances the UK's gas infrastructure must be sufficient to:

- Meet 'peak' demand, including significant capacity and deliverability to ensure the gas we have can be accessed with minimal delay.
- Ensure the safe and efficient transportation of gas from domestic production, storage facilities, and import points to consumers across the country.
- Provide access to the most competitively priced gas supplies.

6.17 The below reports published since 2016 provide the UK Government with a diverse range of bespoke gas security considerations to protect the UK gas market:

- Statutory Security of Supply Report 2016 and 2017: an annual requirement of UK law which provides an assessment of the availability of secure, affordable electricity, gas and oil for meeting the needs of consumers. The 2018 Statutory Security of Supply Report is being prepared and will be laid in November this year.
- Gas security of supply: strategic assessment and review3: BEIS' evaluation of the long-term security of gas, combining conclusions from assessments from the Government, the Regulator, the System Operator and the private sector supported by detailed analysis from external consultants, Cambridge Economic Policy Associates (CEPA).
- CEPA Report of Gas Security of Supply: undertaken to study the impact of shocks to GB gas supplies under different demand scenarios and their impact on security of supply in Great Britain for 2016-2035.
- National Grid Future Energy Scenarios: produced to indicate plausible scenarios for the future of energy, from today out to 2050.
- National Grid Winter Outlook: provided annually with the security of supply outlook for the coming winter.
- National Grid Summer Outlook: provided annually to gas market participants with the security of supply outlook for the coming summer.
- Northern Ireland Gas Capacity Statement8: produced to assess the ability of the Northern Irish gas transmission network to deliver gas over a number of potential scenarios within the next ten years.

7. Other measures and obligations

Market-based Approach

7.1 The UK's market-based approach sets out the obligations on natural gas undertakings. A fundamental part of this approach is a liberalised, competitive energy market providing strong commercial incentives. These combine with efficient processes to ensure effective risk mitigation measures.

7.2 The key elements of this overall approach are:

- The maximisation of economic production from indigenous resources;
- A well-functioning commodity market that delivers a high quality, reliable and competitive service to consumers;
- A well-functioning capital market that works with the Government to provide necessary levels of investment in energy infrastructure;
- An enabling regulatory framework that is set by the Government, in areas where the market acting alone might not achieve adequate levels of security; and
- Strong and diverse markets that are promoted both within the EU and internationally.

Roles and Responsibilities

7.3 The roles and responsibilities of the key market participants are set out below:

- The respective Government departments – BEIS in Great Britain and DfE in Northern Ireland have a strategic role in ensuring that the overall policy framework is clear, safeguarding security of supply, supporting the necessary investment in energy infrastructure and promoting energy efficiency.
- The regulators – Ofgem in Great Britain and the Utility Regulator in Northern Ireland (UREGNI) – work within the framework set by the Government and are responsible, with the Government, for protecting the interests of both current and future consumers, including the security of energy supplies. Both regulatory authorities have a role in ensuring that licensed companies carry out their responsibilities with respect to protecting customers.
- Energy companies are responsible for delivering energy infrastructure and ensuring sources of energy are available to meet demand in a competitive market. To enable competition there is legal separation between the transportation of gas and the shippers and suppliers that take ownership of the gas once it enters the network.

Legislation

7.4 There are three main pieces of legislation that provide the GB framework under which the current gas emergency arrangements are set. These are: the Energy Act of 1976 (the Energy Act); the Gas Act of 1986 (the Gas Act); and, the Gas Safety (Management) Regulations of 1996 (the GS(M)R). Northern Ireland has similar legislation as described in 7.17 –7.22.

- The Energy Act 1976 sets out the permanent and reserve powers resting with the UK Government for energy conservation and control. These provide the Secretary of State with the vires to regulate or prohibit the production, supply, acquisition or use of natural gas, including in an emergency.
- The Gas Act 1986 (as amended) is the fundamental legislation underlying the UK gas market, providing for the regulation of gas shipping, transport, and supply. It prohibits the shipping, transport, or supply of gas without a licence, unless an exemption has been granted by the Secretary of State. It also sets out the basic regulatory framework establishing Ofgem as the gas regulator and provides authority for the Secretary of State to require the promotion of energy efficiency. The Act has been subject to frequent changes to make sure it keeps pace with the evolving energy policy environment.
- The GS(M)R is the legislation which sets out the requirement for a network which has more than one gas transporter to have a Network Emergency Coordinator (NEC). The GS(M)R requires parties across the gas industry to cooperate with the NEC and each other (this duty is not specifically limited to preventing or minimising a gas supply emergency). The GS(M)R also places a duty on gas conveyors and the NEC to hold a safety case accepted by the Health & Safety Executive (HSE) and makes it an offence not to conform to an accepted safety case. The NEC safety case sets out the role and responsibilities of the NEC in the event of an emergency. This includes particulars of the procedures that the NEC has established to monitor the situation throughout a supply emergency and for coordinating actions across affected parts of the gas network. It also sets out the stages of a gas deficit emergency (GDE) that the NEC may declare in order to minimise the risk or impact of a supply emergency. Appropriately, these are described more fully in the National Emergency Plan (NEP).

Gas Licences

7.5 All persons licensed by Ofgem are required to comply with the conditions of their licences. The licences for the gas industry are categorised into transporter, shipper, supplier and interconnector licences. The licence conditions are separated into standard licence conditions which apply to all licensees, special licence conditions which are conditions specific to each individual licensee (e.g. National Grid Gas) and standard special conditions of licences which apply to a class of licensees. Licences for gas producers are issued by BEIS. Storage and LNG operators are regulated by Ofgem but the regulatory requirements with which they have to comply are set out in the Gas Act, rather than in licences.

7.6 There is a licence condition for transmission system operators to plan the system to meet the 1-in-20 peak aggregate daily demand, including but not limited to, within day gas flow variations on that day. The condition states that the 1-in-20 peak demand level should be calculated to include the load reduction through interruption or for contractual reasons and

requires that historic data from at least the 50 previous years should be used when identifying the 1-in-20 peak day.

Incentives to supply sufficient gas

7.7 Gas shippers are incentivised to balance their gas supplies and demands through imbalance or 'cash-out' charges set out in the Uniform Network Code (UNC):

- 'Short' shippers — those that have not put as much gas onto the system as their customers are taking off — are required to pay the System Marginal Buy Price for the volume of gas for which they are short.
- 'Long' shippers — those that have put more gas onto the system than their customers are taking off — are paid the System Marginal Sell Price for any additional gas they flow onto the system.

7.8 Therefore, in most circumstances long shippers would be paid less than they would have received from selling their excess gas in the market. Similarly, short shippers would usually be charged more than they would have likely paid for buying the gas in the market. Hence, there is an economic incentive for shippers to try to keep their supply and demand in balance.

7.9 The level of cash-out will generally reflect system tightness, so that cash-out will rise when supplies are scarce relative to demand. It is these short-term cash-out prices that incentivise shippers to balance their positions and invest in sources of flexibility to allow them to hedge against higher imbalance charges in the future. In addition, the TSO can, as Residual System Balancer, through its balancing actions move the cash-out prices to drive the balance.

7.10 Cash-out is in line with the European security of supply objectives in Article 6(2) of Regulation 2017/1938 as it is a market-based measure which does not distort competition nor hamper the internal market in gas.

7.11 In particular, we believe that cash-out has a positive impact on the security of supply of both the UK and neighbouring Member States. Cash-out is designed to prevent supply deficit within Great Britain which, if it occurred, is likely to impact negatively on the flows of gas to the island of Ireland, and Belgium. Furthermore, cash-out allows prices to rise to attract new sources of gas in a period of supply tightness and this is fundamentally important in attracting LNG to Europe in a global market.

Transparency

7.12 National Grid widely publishes a range of data items on its website and is required to take a co-operative and co-ordinated approach with other TSOs through its activities within ENTSOG and the European Transparency Platform. National Grid publishes all the required data items stipulated in the third energy package within the obligated timescales. The National Grid website provides access to Operational Data to all relevant industry stakeholders, with the aim to reduce market uncertainty, reinforce equal access to information, and increase information transparency, facilitating efficiency in the capacity and energy markets whilst providing equitable and timely access to its operational and market information.

Maintenance

7.13 To ensure a high level of safety and reliability in operation, it is essential that a system of inspection and maintenance exists for assets associated with the gas transmission and distribution network.

7.14 In accordance with each network's Safety Case, maintenance activities shall comply at all times with any statutory or legislative requirements, in order to meet legal obligations. The main legislative drivers are the Pressure Systems Safety Regulation 2000 (PSSR), the Pipeline Safety Regulations 1996 (PSR), the Equipment and Protective System Intended for Use in Potentially Explosive Atmospheres Regulations 1996 and the Electricity at Work Regulations 1989.

7.15 Maintenance, operational practices and procedures adopted by the networks are designed to optimise performance. This approach maximises overall reliability and reduces the risk of failure. It also produces minimal overall operating cost by increasing the useful life of pipelines and plant.

7.16 It is network policy to continually review operational and maintenance procedures and practices to ensure they remain valid. This review is based upon historic evidence from the existing strategy, the development of new maintenance techniques and operational feedback. This process is audited periodically.

Legislation, Licences and Codes: Northern Ireland

7.17 For Northern Ireland, similar legislation mirrors that which is in force in GB. The relevant legislation is set out below.

7.18 The main piece of legislation with respect to emergency arrangements is the Gas Safety (Management) Regulations (Northern Ireland) 1997 (GS(M)R(NI)). The responsibility for enforcing GS(M)R(NI) rests with the Health and Safety Executive Northern Ireland (HSENI).

7.19 GS(M)R(NI) requires anyone conveying gas to have a safety case accepted by the HSENI. The legislation envisages two types of safety cases: one to be submitted by those conveying gas and one by the Northern Ireland Network Emergency Coordinator (NINEC), currently Phoenix Natural Gas Ltd. The NINEC and the lead TSOs (PTL and GNI(UK)) play the key roles when co-ordinating the response to an emergency.

7.20 The NINEC safety case must demonstrate the arrangements that the holder has established to coordinate the actions to be taken to prevent an emergency from occurring and actions to be taken during an emergency. The safety case of those conveying gas should include arrangements to cooperate with the NINEC, others conveying gas, and gas suppliers in the event of a gas emergency. There is also a requirement that arrangements are regularly tested.

7.21 The Energy (Northern Ireland) Order 2003 sets out the principal objective and duties of DfE and UREGNI with regards to the protection of consumers. Both DfE and UREGNI must carry out their gas functions having regard to the need to ensure a high level of protection of the interests of consumers of gas and to secure a diverse, viable and environmentally sustainable long-term energy supply.

7.22 UREGNI may grant a licence to convey, supply and store gas under the Gas (Northern Ireland) Order 1996. The relevant licences contain conditions with respect to emergency arrangements and also to establish a network code which covers the steps to be taken by TSOs and shippers in the event of an emergency on the transportation system.

Shale Gas

7.23 The Oil & Gas Exploration and Production Team works closely with regulators and industry to encourage the development of a safe and environmentally sound shale industry in the UK, ensuring that robust regulations are in place to safeguard public safety and protect the environment. Having given careful consideration to the evidence submitted and after scrutiny from the department, on 24 July 2018 BEIS Ministers granted the first Hydraulic Fracturing Consent for shale gas extraction to shale gas operator Cuadrilla Bowland Limited. The development of a successful UK shale gas industry has the potential to improve investment prospects for the production sector in the longer-term. Given we do not yet know how much shale gas can be technically or economically extracted; the UK does not assume any contribution from UK-produced shale gas in its assessment of gas security of supply.

8. Infrastructure Projects

8.1 In addition to the market-based approach set out by the UK Government, other preventive measures are also in place in the way of diversifying gas routes and sources of supply.

8.2 The UK already has a large and diverse capacity to import gas from a wide range of import routes and sources. UK based shippers have access to: domestic production from the UK Continental Shelf; pipeline imports from Norway, Belgium and the Netherlands; and LNG imports from global markets through any of the three LNG regasification terminals.

8.3 As the proportion of gas from the UKCS has declined, the market has provided strong, diverse import infrastructure. There are various proposals by commercial operators to expand this capacity further.

8.4 Gas shippers are incentivised to secure diverse supplies through the cash-out arrangements, which charges shippers for every unit of imbalance between their customers' demand from, and their input into, the National Transmission System.

8.5 Meanwhile, the Government builds and maintains strong relationships with key producing countries.

Proposed Infrastructure Projects

8.6 Figure 8.1 below shows the list of proposed new LNG infrastructure projects as outlined in National Grid's 2017 Gas Ten Year Statement. It should be noted that there is no guarantee that the proposed projects will go on to be operational.

Project	Operator/ Developer	Type	Location	Start-up	Capacity (bcm/yr)	Status
Isle of Grain 4	National Grid	LNG	Kent	~	~	Open season
Norsea LNG	ConocoPhillips	LNG	Teesside	~	~	Planning granted, no FID. Currently on hold
Port Meridian	Port Meridian Energy	LNG	Barrow, Cumbria	~	5	Open season
Amlwch	Halite Energy	LNG	Anglesey	~	~30	Approved

Source: National Grid Gas Ten Year Statement 2017

8.7 Figure 8.2 [next page] below shows the list of proposed new storage infrastructure projects as outlined in National Grid's 2017 Gas Ten Year Statement. It should be noted that there is no guarantee that the proposed projects will go on to be operational and that the list is not meant to be exhaustive.

Figure 8.2: Proposed new UK storage infrastructure

Project	Operator/Developer	Location	Space (bcm)	Status
Gateway	Stag Energy	Offshore Morecambe Bay	1.5	Planning granted, no FID
Deborah	Eni	Offshore Bacton	4.6	Planning granted, no FID
Islandmagee	Infrastrata	County Antrim, Northern Ireland	0.5	Planning granted, no FID
King Street	King Street Energy	Cheshire	0.3	Planning granted, no FID
Preesall	Halite Energy	Lancashire	0.6	Planning granted, no FID
Saltfleetby	Wingaz	Lincolnshire	0.8	Planning granted, no FID
Whitehill	E.ON	East Yorkshire	0.4	Planning granted, no FID
		Total	**8.7**	

Source: National Grid Gas Ten Year Statement

9. Public service obligations related to the security of supply

9.1 Under the requirements of the 3rd Energy Package, notifications of any PSOs for security of gas supply need to be given to the European Commission, together with their possible effect on national and international competition. The UK has no public service obligations related to security of supply.

10. Stakeholder consultations

10.1 The Gas Safety (Management) Regulations 1996 (GS(M)R) requires the Transmission System Operator (TSO) and the Gas Distribution Network Operators (GDNs) to establish adequate arrangements for dealing with supply emergencies. GS(M)R defines a supply emergency as an emergency endangering persons and arising from a loss of pressure in a network or any part thereof.

10.2 GS(M)R requires the NEC to prepare a safety case. The NEC's safety case describes the arrangements established for co-ordinating the actions of relevant industry participants, including the GDN Operators, to prevent a supply emergency occurring or to minimise the safety consequences where one develops.

10.3 The TSO and the GDN Operators are also required under GS(M)R to prepare safety cases for their own networks. These safety cases describe the arrangements established by the TSO or the GDN Operators to manage a network gas supply emergency (NGSE) or local gas supply emergency (LGSE) and should be consistent with the arrangements within the NEC safety case.

10.4 The NEC arranges for the preparation of the Procedure for Network Gas Supply Emergency. The purpose of this procedure is to provide a measured, appropriate and co-ordinated response to an NGSE in accordance with the requirements of the NEC safety case. The procedure describes the causes and classifications of an NGSE, the arrangements the TSO has in place for managing the NGSE, the possible stages of an NGSE and the actions that could form part of the strategy for resolving the emergency. The procedure is made available to all industry participants via publication on the National Grid website.

10.5 The TSO and the GDN Operators have also prepared detailed procedures describing the arrangements they have in place for managing an NGSE. Other industry participants are expected to establish and maintain procedures for responding to gas supply emergencies in accordance with their statutory or regulatory obligations and these procedures should align with the Procedure for Network Gas Supply Emergency and in turn the NEC Safety Case.

10.6 In addition, the GDN Operators have prepared Procedures for Managing a Local Gas Supply Emergency. The purpose of this procedure is to provide a measured, appropriate and co-ordinated response to a LGSE in accordance with the requirements of the GDN Operator's safety case.

10.7 The emergency procedures are reviewed on a regular basis and are subject to periodic testing to ensure they remain suitable for use during an NGSE and/or LGSE and support NGGT and the GDN Operators in meeting their statutory safety obligations including GS(M)R.

10.8 The NEC runs annual cross-industry/HMG exercise to test the emergency arrangements in place to manage an NGSE as part of its safety case obligations. Following the exercises, the NEC prepares a report providing the results of these exercises and identifying recommendations to improve the emergency arrangements which will be made available to all industry participants by the HSE. The NEC's conclusions of the 2017 'Exercise Yield' are that the industry successfully demonstrated that it is able to effectively respond to an NGSE . The NEC is currently preparing its report into the outcomes of the 2018 'Exercise Zeus'.

11. Regional Dimension

UK Regional Risk Group

11.1 The North-West European gas system, comprising the six countries of the United Kingdom Risk Group, namely Belgium, Germany, Ireland, Luxembourg, the Netherlands and the United Kingdom, has a strong gas security of supply position characterised by extensive and resilient infrastructure, and significant levels of interconnection coupled with indigenous gas production. This strength of infrastructure is enhanced by a mature and liquid gas market which has demonstrated an ability to deliver even during the most extreme combination of infrastructure failure and increased demand.

11.2 The N-1 standard has been calculated for the entire United Kingdom Risk Group, using the formula prescribed in Annex II of the Regulation:

$$N-1\,[\%] = \frac{EP_m + P_m + S_m + LNG_m - I_m}{D_{max} - D_{eff}} \times 100,\ N-1 \geq 100\ \%$$

Where: N-1 Formula

- EPm - technical capacity of entry points, other than production
- Pm - maximal technical production capacity
- Sm - maximal technical storage deliverability
- LNGm - maximal technical LNG facility capacity
- Im - technical capacity of the single largest gas infrastructure
- Dmax - total daily gas demand
- Deff - demand-side measures

11.3 For EPm, interconnection between Member States within the United Kingdom Risk Group has not been assessed. The appendix to this report outlines the parameters used in the calculation of the N-1 standard. For the purposes of calculation, disruption of the largest infrastructure of the group has been assessed:

- Disruption of Felindre pipeline connecting the South Hook and Dragon LNG terminals to the UK National Transmission System with a capacity of 892GWh/d;
- Disruption of Mallnow interconnection point between Germany and Poland with a capacity of 932GWh/d;
- Disruption of Emden EPT entry point from Norway to the continent with a capacity of 989 GWh/d.

Technical capacity largest gas infrastructure (Im)			Historical Data			Projected Data		
			2015	2016	2017	2018	2019	2020
			GWh/d	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d
UK	LNG Terminals	Felindre	946	946	957	892	892	892
DE	Poland IP	Mallnow	931	932	932	932	932	932
DE/NL	Norway Pipeline	Emden EPT	989	989	989	989	989	989

N-1 for region	Historical Data			Projected Data		
	2015	2016	2017	2018	2019	2020
Felindre	149%	148%	141%	144%	143%	142%
Emden	149%	147%	141%	143%	142%	141%
Mallnow	149%	148%	141%	143%	142%	141%

N-2	Historical Data			Projected Data		
	2015	2016	2017	2018	2019	2020
Felindre + Emden	143%	141%	135%	137%	136%	135%
Felindre + Mallnow	143%	142%	135%	138%	137%	136%
Emden + Mallnow	143%	141%	135%	137%	136%	135%

N-3	Historical Data			Projected Data		
	2015	2016	2017	2018	2019	2020
Felindre + Emden + Mallnow	137%	135%	129%	132%	130%	130%

Source: Common Risk Assessment on Security of Gas Supply (EU Reg 2017/1938) UK Risk Group

11.4 As demonstrated above, the region's N-1 result is well in excess of 100%. The region is capable of achieving up to an N-3 result under the formula. For the UK Risk Group region to fail the N-1 test, around a third of existing gas infrastructure capacity would have to be lost.

11.5 Given its role in supporting security of supply across the Northwest Europe Gas System, the bi-directional flow capacity of interconnectors is shown in the table below:

[See next page for table]

Interconnection points with bi-directional capacity		Capacity (GWh/d)	Description of arrangements
Eynatten	BE > DE	542	
Eynatten	DE > BE	556	
IUK	BE > UK	814	
IUK	UK > BE	605	
Cluster Emden-Oude Statenzijl H	NL > DE	504	
Cluster Emden-Oude Statenzijl H	DE > NL	1847	
Zelzate	NL > BE	393	
Zelzate	BE > NL	393	
Oude Statenzijl H Gasunie	NL > DE	64	
Oude Statenzijl H Gasunie	DE > NL	36	
Oude Statenzijl H OGE	NL > DE	71	
Oude Statenzijl H OGE	DE > NL	162	
Interconnection points with reverse flow capacity (e.g. interruptible capacity) and bidirectional flow exemptions			Description of arrangements
Hilvarenbeek / Poppel	NL > BE	642	
Hilvarenbeek / Poppel	BE > NL		Backhaul Capacity and Backhaul Level 1
Oude Statenzijl L (GTG-Nord, GUD)	NL > DE	252	
Oude Statenzijl L (GTG-Nord, GUD)	DE > NL		Backhaul Capacity and Backhaul Level 1
Zevenaar	NL > DE	456	

Zevenaar	DE > NL		Backhaul Capacity and Backhaul Level 1
Winterswijk	NL > DE	179	
Winterswijk	DE > NL		Backhaul Capacity and Backhaul Level 1
Tegelen	NL > DE	5	
Tegelen	DE > NL		Backhaul Capacity and Backhaul Level 1
Cluster Limburg (Gravenvoeren, Bocholtz Tenp, Bocholtz Vetschau)	NL > DE	858	
Cluster Limburg (Gravenvoeren, Bocholtz Tenp, Bocholtz Vetschau)	DE > NL		Backhaul Capacity and Backhaul Level 1
Zandvliet H (Fluxys)	NL > BE	47	
Zandvliet H (Fluxys)	BE > NL		Backhaul Capacity and Backhaul Level 1
Vlieghuis-Kalle	NL > DE	72	
Vlieghuis-Kalle	DE > NL		Backhaul Capacity and Backhaul Level 1
Moffat IC1/IC2	UK > IE	330	
Moffat IC1/IC2	IE > IE		Virtual reverse flow. Physical Flow Exemption
BBL	NL > UK	494	
BBL	UK > NL		Virtual reverse flow. Physical

			Flow Exemption
Remich	DE > LU	39	
Remich	LU > DE		Exemption
Bras/Pétange	BE > LU	48.8	
Bras/Pétange	LU > BE		Exemption
South North Pipeline	IE > UK	66	
South North Pipeline	UK > IE		Exemption

The methodology for the N-1 calculation concerning the disruption of Felindre pipeline may be found in the tables of Appendix IV.

Mechanisms developed for cooperation

11.7 The United Kingdom Risk Group comprises the United Kingdom, Belgium, Germany, Ireland, Luxembourg, the Netherlands. The group operates on a consultative basis: the UK holds the pen on drafting the implementation of regional aspects of the Regulation, with all decisions made in consultation with members of the Risk Group. Regular group meetings held via teleconference and in person at the Gas Coordination Group are supported by email discussions and, where appropriate, bilateral communication.

11.8 In the event of a national gas system emergency, the emergency measures set out in National Emergency Plans (NEPs) demonstrate how the Risk Group has adopted a collaborative approach to handling NGSE, where applicable

11.9 The UK National Preventive Action Plan (PAP) for gas has been developed alongside this revision of the NEP and the regional cooperation mechanisms and agreements relating to managing emergencies across Northern Ireland and the Republic of Ireland.

11.10 The United Kingdom and Ireland have carried out a Joint Risk Assessment identify and assessing regional risks. This is contained at Chapter 6 of the UKRG Common Risk Assessment and provides details on the mechanisms developed for communication, including intergovernmental agreements, transportation arrangements and load shedding protocols.

11.11 The United Kingdom and Ireland have carried out a Joint Risk Assessment identify and assessing regional risks. This is contained at Chapter 6 of the UKRG Common Risk Assessment and provides details on the mechanisms developed for communication, including intergovernmental agreements, transportation arrangements and load shedding protocols.

Solidarity

11.13 Pursuant to Article 13 of Regulation 2017/1938, the Member States of the United Kingdom Risk Group are currently in the process of developing arrangements for Solidarity measures with interconnected Member States.

11.14 These measures are designed to facilitate gas sharing in the event of an extreme emergency situation where the interconnected Member States request solidarity gas. Further information on solidarity arrangements are set out in Member States' Emergency Plans.

Preventative Action Measures

Political risks associated with the UKRG

11.15 UKCS offshore production infrastructure is directly connected to Great Britain and Netherlands transmission networks. The Netherlands' production infrastructure is directly connected to the Netherlands transmission network. There are no third countries through which gas transits within the UKRG; there is, therefore, no need for preventative measures concerning transit of third countries.

UK risks associated with the UKRG

11.16 The production of natural gas from the United Kingdom Continental Shelf (UKCS), has declined since the turn of the millennium, although a small increase due to new fields was seen in 2015 and 2016. Despite this, the UK, along with the Netherlands, remains one of the two major gas producing nations within the EU.

11.17 UK oil and gas production is expected to start to fall again in the years ahead, though production estimates are subject to uncertainty. There are a wide range of possible outcomes because the future rate of production is dependent on a number of different factors including the level of investment and the success of further exploration.

11.18 The Oil and Gas Authority (OGA) is working to maximise the economic recovery of hydrocarbons from the UKCS. It aims to foster an environment that stimulates exploration activity leading to the discovery of new oil and gas reserves. In recent years the OGA has made available large amounts of exploration data, including new government-funded seismic data, data on wells, prospects, geological mapping and lessons learned. This has helped generate new interest in UKCS oil and gas acreage.

11.19 Most issues are addressed and resolved through the stewardship process. Asset stewardship is crucial to maximising economic recovery from the UKCS and to delivering greater value overall. Effective stewardship means that asset owners consistently do the right things to identify and then exploit opportunities and that assets are in the hands of those with the right behaviours and capabilities to achieve MER UK.

11.20 The OGA has worked closely with operators, licence holders and other interested parties to develop Area Plans across the oil and gas life cycle that integrate exploration, development, production, operations and decommissioning to maximise economic recovery – for example, through the optimum use of infrastructure to extend the life of hubs. The OGA has reaffirmed its focus on the importance of collaboration and urged industry to increase the pace at which licensees develop a culture of collaboration internally and externally within existing joint venture partnerships and beyond.

11.21 Working with industry, government and the research community, the OGA is committed to overcoming current constraints on technology innovation and commercialisation. The OGA works closely with industry and government, including BEIS, HM Treasury and other key

government departments, providing expertise and evidence where appropriate. The OGA also works with a range of other stakeholders including the Scottish Government. Recent years have seen many positive examples of collaboration between companies leading to solutions to long-running issues. As part of its Asset Stewardship Strategy, the OGA expects that operators have technology plans which identify actions and timelines to access and/or develop the critical technologies needed for their assets.

Netherlands risks associated with the UKRG

11.25 For many years, total annual production in the Netherlands was about 80bcm. This has already decreased in the past year and will continue to decrease in the coming years due to production limitations set on the Groningen field and lower production levels of the small fields.

11.26 As a result of earthquakes related to gas production in Groningen, the volume allowed to be produced has been restricted in the past few years. In 2018, the Netherlands decided to reduce production from Groningen as fast as possible to 12bcm and then continue to 0bcm, i.e. to terminate production from the Groningen field. Since 2013, gas production from Groningen has fallen 54bcm to 23.98bcm in 2017 and will continue to fall. In addition, reduced production from Dutch small fields will further constrain natural gas production in the Netherlands.

11.27 On the 8th of January 2018, a gas production-induced earthquake occurred at Zeerijp. Following the advice of the State Supervision of the Mines, the Dutch Minister has decided to reduce production from Groningen as fast as possible to 12bcm and then continue to 0bcm, i.e. to terminate production from the Groningen field.

11.28 To achieve this, GTS will invest in a new nitrogen plant at Zuidbroek which can, starting gas year 2022-2023, produce up to 7bcm of pseudo L-gas in a cold year. In addition, GTS will purchase additional nitrogen which can produce 1 to 1.5bcm of pseudo L-gas from gas year 2020-2021. Furthermore, industrial clients will be converted between gas year 2019-2020 and gas year 2022-2023 from L-gas to H-gas. Possibilities to accelerate the market conversion in Germany, Belgium and France will also be investigated.

11.29 the meantime, production from the Groningen field will never be more than is required from a security of supply perspective. This means that the blending stations of GTS will produce baseload (on average, 85% of blending stations Ommen and Wieringermeer); the Groningen field combined with other sources (storage facilities) will cover the rest of the market.

11.30 In addition to these volume-reducing measures, the Minister also decided to close the production clusters in the Loppersum region. This decision will reduce the capacity of the Groningen field by approximately 25%. This will have the following impact on Dutch production capacity:

Germany

11.32 In 2017, Germany produced 7.9bcm of natural gas with a calorific value of 9.77kWh/m3 which is classified as L-Gas. Production in 2017 decreased by 8.6% compared to 2016, with the forecast production continuing to decline due to the depletion of existing reserves.

11.33 Despite this, there are many import routes to supply the German market known as "diversification of supply routes" and the German gas infrastructure network is well suited to meeting the demands for transportation of gas within Germany.

11.35 In addition, the relevant companies are already acting to prevent the decline in the availability of L-gas negatively affecting security of supply. German L-gas producers, who are the affected network operators and storage system operators have set up a joint working group to develop a plan for the coordinated conversion from L-gas to H-gas. This conversion plan is included in the national network development plan as an input parameter.

Ireland

11.36 The Kinsale Heads storage facility is now in blowdown mode and is therefore classed as production until its expected final closure in 2020. The gas security of Ireland is however ensured by the new Corrib gas field which commenced production during the 2015/16 gas year and supplied 62% of gas demand in Ireland in 2016/17. The Moffat Entry Point accounted for 31% of the overall requirement with the remaining 5% supplied from production gas from an off-shore gas field at the Inch entry point.

11.37 The Corrib gas field would be expected to supply approximately 27.7% of ROI peak day gas demand in 2018/19 in the event of a 1-in-50 winter peak day, with Inch accounting for around 2.3%. The Moffat Entry Point would be expected to meet nearly 69.9% and 78% of ROI demand and Gas Networks Ireland system demands respectively in 2018/19, in such circumstances. Moffat is anticipated to meet 89.5% and 92.2% of ROI and Gas Networks Ireland system peak day demands respectively in 2026/27.

Connection with Member States outside of the risk group

Germany

11.38 Germany has an extensive transmission system. The network of the transmission system operators is connected to the systems of neighbouring countries via a large number (>25) of cross-border interconnection points. This transport infrastructure is essential for Germany's natural gas market, situated as it is in the centre of Europe and functioning as an important trading hub for the continent. In the southern part there are significant import points on the borders of the Czech Republic and Austria. The major export points are on the borders to France, Switzerland and Austria. The transmission system is thus used for both transit and supply services.

11.39 In the past, gas consumed in the northern part of the supply area in Schleswig-Holstein and Hamburg largely came from Danish reserves. For some years now, Denmark has been stepping up preparations for supply from German imports via the Ellund station. The Nord Stream and Baltic Sea Pipeline Link (OPAL) pipelines were put into operation at the end of 2011. The OPAL can transport up to 35 bcm of natural gas a year from Nord Stream. This means that Nord Stream and the OPAL, together with pipelines in the Czech Republic (Gazelle), ensure supply volumes for the Waidhaus import point and strengthen the security of supply for Germany, France and the Czech Republic.

Netherlands

11.40 In the Netherlands there is a total of 135,000 km of gas pipelines. There are 8 Local Distribution Companies for gas in the Netherlands, of which there are 7 operating gas transmission grids for L-gas and 1 for H-gas.

11.41 On the Maasvlakte in Rotterdam, Gate terminal has built the first LNG import terminal in the Netherlands. The terminal currently has a throughput capacity of 12bcm per annum and consists of three storage tanks, two jetties and a process area where LNG will be re-gassified. Annual throughput capacity can be increased to 16bcm in the future. The terminal dovetails with Dutch and European energy policies, built on the pillars of strategic diversification of LNG supplies, sustainability, safety and environmental awareness.

Non-Market Preventative Measures

11.42 The countries within the United Kingdom Risk Group adopt a market-based approach to guaranteeing security of supply, although a number of countries do adopt measures which they consider to be necessary to guarantee security of supply. The Preventative Action Plan focuses on those measures which proceed the declaration of an NGSE in Member States; as such, no measures relating to stages of an emergency are discussed here.

Conclusions

The UK gas market is resilient to all but the most unlikely combination of high demand and supply disruption. The UK Government continues to work closely with its stakeholders on additional projects to improve resilience within the sector and prevent disruption.

The UK Government welcomes the Regulation's requirement that this national PAP is continuously reviewed and published at regular intervals.

The UK Government continues to work closely with its stakeholders and supports the consultations routinely executed by industry.

The relevant publications by National Grid as System Operator are:

- "The Winter Outlook Report": Published annually following stakeholder consultation. This provides information to market participants on the supply and demand situation for the coming winter;
- "Future Energy Scenarios": National Grid's annual publication setting out a range of potential pathways for future gas and electricity demand to 2050; and
- "Ten Year Statement": Published annually - a rolling ten-year forecast of gas transportation system usage and likely system developments that can be used by companies which are contemplating connecting to the system, or entering into transport arrangements, to identify and evaluate opportunities.

In Northern Ireland the Utility Regulator publishes the Gas Capacity Statement which provides an assessment of the ability of the transmission network to meet forecast demands on the network over a ten-year period.

Information is also consolidated annually in the Statutory Security of Supply Report, which is published by BEIS and produced jointly with the economic regulator (Ofgem) with input from National Grid. That report provides analysis on security of supply risks and drivers, and scenarios to help inform the market.

Appendix I – N-1 Calculation

The N-1 formula, as described in Annex II of the Regulation, is as follows:

$$N-1\ [\%] = \frac{EP_m + P_m + S_m + LNG_m - I_m}{D_{max} - D_{eff}} \times 100,\ N-1 \geq 100\ \%$$

Where:

EPm - technical capacity of entry points, other than production
Pm - maximal technical production capacity
Sm - maximal technical storage deliverability
LNGm - maximal technical capacity of LNG facilities
Im - technical capacity of the single largest gas infrastructure
Dmax - total daily gas demand
Deff - demand-side measures

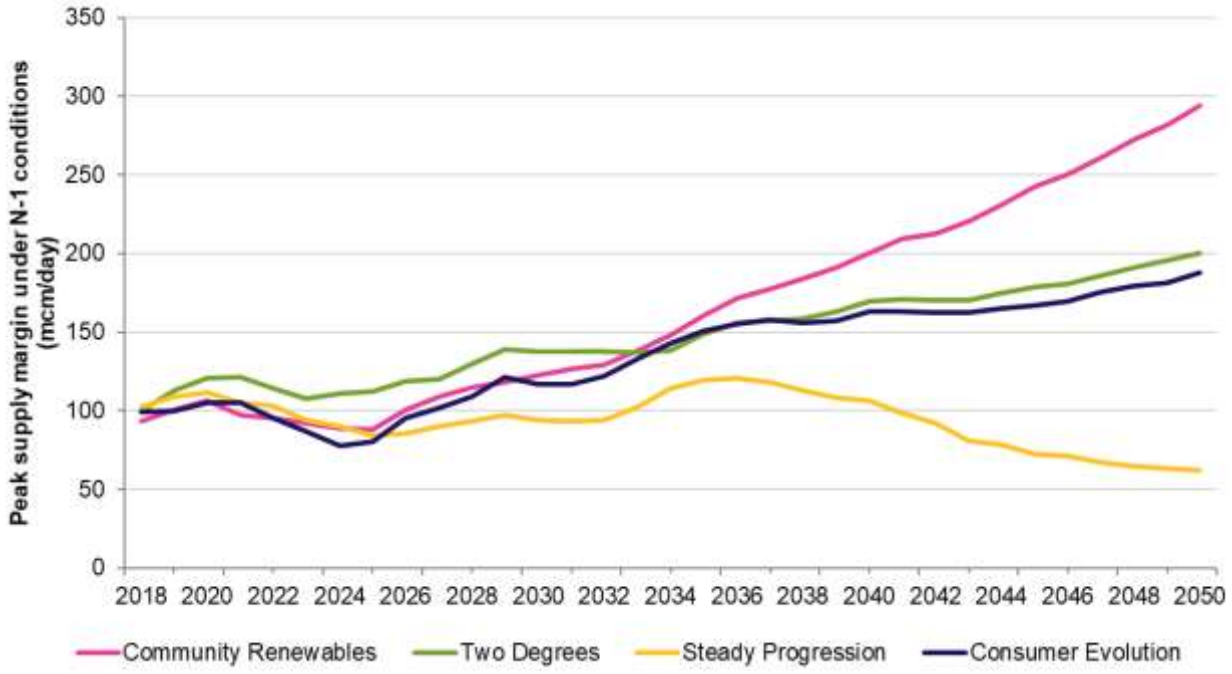
N-1 Calculation for the UK

2018	Capacity (mcm/d)	Notes
Main Infrastructure (Im)	81	Felindre pipeline to reflect the combined capacity of both Milford Haven LNG terminals
Max imports (EPm)	272	Include entry points other than production with: Belgium: IUK (77.8mcm/d) the Netherlands: BBL (47.4mcm/d) and Norway: Langeled (76 mcm/d), Vesterled (41mcm/d) and FLAGS – Tampen and Gjoa (30mcm/d)
Max domestic production (Pm)	123	Total indigenous production from the UK sectors of both the North Seas and Irish Sea along with gas produced onshore
Max Storage (Sm)	116	The technical capacity of UK storage
LNG (LNGm)	140	Includes South Hook (60mcm/d), Dragon (21mcm/d) and Isle of Grain (59mcm/d)
Max Demand (Dmax)	475	Diversified 1-in-20 peak day demand from FES 2018 ‘Steady Progression’ scenario (highest gas demand case). It includes exports to Ireland.

At peak: N-1 = (272 + 123 + 116 +140 - 81) / 475 = 120%

Appendix II – Projected N-1 Calculations

As part of the Future Energy Scenarios analysis, National Grid provided a projected annual N-1 margin calculation until 2050 as shown below.



Source: National Grid

Appendix III – Meeting the Supply Standard

UK ‘protected customers’ gas volumes are split into the following definitions as per Article 2 of the Regulation:

- Household customers;
- Small and medium-sized enterprises connected to a gas distribution network;
- Essential social services where loss of gas supplies could endanger health (as long as these customers and small medium enterprises do not exceed 20% of final use gas).

The table shows that the volume of Small and Medium Enterprises (SMEs) and essential social services does not exceed the Regulation’s limit of 20% final demand under the following scenarios:

- 1-in-20 peak day demand;
- Day 7 under 1-in-50 weather conditions;
- Day 30 under 1-in-50 conditions;
- Day 30 under average winter conditions.

The demand volumes have been estimated for winter 2017/18.

	Day 1 1-in-20 conditions	Day 7 1-in-50 conditions	Day 30 1-in-50 conditions	Day 30 Average Winter Conditions
Households (mcm/d)	242	223	188	159
SMEs (mcm/d)	74	73	62	54
Essential Social Services (mcm/d)	3	3	3	3
Total Demand (mcm/d)	502	407	355	318
% SME and Social Services	15.3	18.7	18.3	17.9

Source: National Grid

Appendix IV – Regional Dimension

This appendix reports the breakdown of the parameters used to compute the N-1 score for the United Kingdom Risk Group.

EPm: Technical capacity of entry points

Technical capacity of entry points (EPm)			Historical Data			Projected Data		
			2015	2016	2017	2018	2019	2020
			GWh/d	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d
BE	Norway	ZPT (Zeepipe)	515	515	515	515	515	515
BE	France	Alveringem	0	271	271	271	271	271
DE	Denmark	Ellund	37	91	33	33	33	33
DE	Austria	Oberkappel	133	160	160	160	160	160
DE	Austria	Überackern 2	230	230	230	230	230	230
DE	Austria	Überackern	54	61	61	61	61	61
DE	Czech Republic	Deutschneudorf	198	198	198	198	198	198
DE	Czech Republic	Brandov-Stegal (Olbernhau)	9	5	0	0	0	0
DE	Czech Republic	Waidhaus	904	907	907	907	907	907
DE	Norway	Dornum	774	721	721	721	721	721
DE/NL	Norway	Emden EPT	989	989	989	989	989	989
DE	Poland	Mallnow	931	932	932	932	932	932
DE	Poland	Kamminke/Gubin/Lasow	0.0	0.1	0.1	0.1	0.1	0.1

DE	Russia	Greifswald	618	618	618	618	618	618
UK	Norway	Langeled	770	770	770	836	836	836
UK	Norway	Vesterled	396	396	396	451	451	451
UK	Norway	FLAGS	275	275	275	330	330	330
Total			6,833	7,140	7,076	7,252	7,252	7,252

Source: Common Risk Assessment on Security of Gas Supply (EU Reg 2017/1938) – UK Risk Group

Pm: Maximum technical production capacity

Maximum technical production capacity (Pm)	Historical Data			Projected Data		
	2015	2016	2017	2018	2019	2020
	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d
BE	0	0	0	0	0	0
DE	301	301	301	301	301	301
IE	0	104	104	110	94	92
LU	0	0	0	0	0	0
NL	2,994	2,218	2,156	2,144	1,959	1,818
UK	1,111	1,232	1,319	1,355	1,349	1,327
Total	4,406	3,854	3,879	3,910	3,702	3,538

Source: Common Risk Assessment on Security of Gas Supply (EU Reg 2017/1938) – UK Risk Group

Sm: Maximum technical storage deliverability

Maximum technical storage availability (Sm)	Historical Data			Projected Data		
	2015	2016	2017	2018	2019	2020
	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d
BE	170	170	170	170	170	170
DE	4,600	4,600	4,600	4,600	4,600	4,600
IE	33	33	33	0	0	0
LU	0	0	0	0	0	0
NL	4,180	4,180	4,163	4,163	4,163	4,163
UK	1,650	1,606	1,231	1,279	1,279	1,279
Total	10,632	10,588	10,197	10,212	10,212	10,212

Source: Common Risk Assessment on Security of Gas Supply (EU Reg 2017/1938) – UK Risk Group

LNGm: Maximum technical LNG facility capacity

Maximum technical LNG facility capacity (LNGm)	Historical Data			Projected Data		
	2015	2016	2017	2018	2019	2020
	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d
BE: Zeebrugge LNG Terminal	461	461	461	461	461	461
NL: Gate	399	399	399	399	399	399
UK: South Hook	649	649	660	663	663	663
UK: Dragon	297	297	297	229	229	229
UK: Isle of Grain	649	649	649	653	653	653
Total	2,455	2,455	2,466	2,405	2,405	2,405

Source: Common Risk Assessment on Security of Gas Supply (EU Reg 2017/1938) – UK Risk Group

Dmax: 1-in-20 gas demand

1 in 20 gas demand (Dmax)	Historical Data			Projected Data		
	2015	2016	2017	2018	2019	2020
	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d
BE	1,307	1,303	1,357	1,466	1,478	1,490
DE	5,460	5,460	5,460	5,460	5,460	5,460
IE	207	221	206	277	281	288
LU	6	6	5	5	5	5
NL (1-in-50 demand)	3,729	3,648	3,678	3,692	3,678	3,664
UK	4,970	5,013	5,343	5,039	5,008	4991
Total	15,680	15,651	16,048	15,940	15,910	15,898

Source: Common Risk Assessment on Security of Gas Supply (EU Reg 2017/1938) – UK Risk Group

Assessed Margin	Historical Data			Projected Data		
	2015	2016	2017	2018	2019	2020
	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d	GWh/d
Technical capacity of entry points (EPm)	6,833	7,410	7,076	7,252	7,252	7,252
Maximal technical production capacity (Pm)	4,406	3,854	3,879	3,910	3,702	3,538
Maximal technical storage deliverability (Sm)	10,632	10,588	10,197	10,212	10,212	10,212
Maximal technical LNG facility capacity (LNGm)	2,455	2,455	2,466	2,405	2,405	2,405
Total peak supply	24,326	24,037	23,618	23,779	23,571	23,407
1 in 20 gas demand (Dmax)	15,680	15,651	16,048	15,940	15,910	15,898
Margin	8,646	8,386	7,570	7,839	7,662	7,509
Margin (%)	36%	35%	32%	33%	33%	32%

Source: Common Risk Assessment on Security of Gas Supply (EU Reg 2017/1938) – UK Risk Group

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