



Oil & Gas  
Authority

# UK Oil and Gas Reserves and Resources

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as at end 2018

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# 1. Executive Summary

The Oil and Gas Authority (OGA) estimate of remaining UK Continental Shelf (UKCS) recoverable petroleum resources is in the range 10 to 20 billion barrels or more of oil equivalent (boe), including discovered and undiscovered petroleum resources:

## Key messages

- The UK's petroleum reserves remain at a significant level. The OGA's estimate for proven and probable (2P) UK reserves as at end 2018 is 5.5 billion boe, slightly higher than as at end 2017 despite a year's production. On the basis of current production projections<sup>1</sup>, this could sustain production from the UKCS for another 20 years or more.
- In 2018, 680 million boe (mmboe) were added to 2P reserves and about 600 mmboe were produced which equates to a reserve replacement ratio of 115%. 225 mmboe were matured by the granting of consent to new field developments, about 250 mmboe as a result of consent to field development plan addenda, and about 205 mmboe as a result of other infield activities, improved field performance and field-life extensions. The limited rate of replacement of proven and probable reserves by resource maturation from new field developments remains a key concern.
- The UK's contingent resource level is significant with a central estimate of discovered undeveloped resources of 7.5 billion boe. Much of this resource is in mature developed areas and under consideration for development. The maturation of contingent resources presents a significant opportunity for the continued development of the UK's petroleum resources. This will require substantial investment in both new field developments and incremental projects.
- In aggregate, UKCS petroleum reserves and discovered resources are both approximately 70% oil and 30% gas, when expressed in oil equivalent terms.
- Exploration success in 2018 delivered an addition of 239 million boe to the total of contingent resources<sup>2</sup>. A key part of exploration Stewardship is now to progress the many attractive opportunities within the prospective resource portfolio into drill-ready prospects, and into subsequent discoveries.
- The mean prospective resources in mapped leads and prospects are estimated as 4.1 billion boe. This is supplemented by an additional mean prospective resource of 11.2 billion boe estimated to reside in plays outside of mapped leads and prospects. These estimates when expressed in boe terms are unchanged since the end 2017 estimates.

<sup>1</sup> <https://www.ogauthority.co.uk/data-centre/data-downloads-and-publications/production-projections/>

<sup>2</sup> Note that this figure is subject to revision as a result of future appraisal activity

## 2. UK Reserves and Resources

The OGA estimate for remaining UK recoverable petroleum resources is in the range 10 to 20 boe, including discovered and undiscovered petroleum resources. A total of some 44.7 billion boe of oil and gas had been produced from the UKCS by the end of 2018.

The OGA's current central estimates as at the end of 2018 are summarised in Table 1 below (estimates as at the end of 2017 are in parentheses).

**Table 1: Oil and gas reserves and resources central estimates as at end 2018 (end 2017) in billion boe**

Reserves	2P
Reserves	5.5 (5.4)
Contingent resources	2C
Producing fields	2.3 (2.1)
Proposed new developments	1.9 (2.1)
Marginal discoveries	3.3 (3.3)
Prospective resources	Mean
Prospects and Leads	4.1 (4.1)
Plays	11.2 (11.2)

**Note:** The classification of reserves and resources is explained in Appendix B.

Ranges for these estimates are shown in sections 4 and 5.

Overall oil and gas reserves as at the end of 2018 showed a slight increase compared to end 2017. This is a result of production of 600 mmbbl in 2018 being offset by additions to the reserves base as a result of Field Development Plan ('FDP') approvals and reserves adjustments for producing fields.

The mean prospective resources in mapped leads and prospects are estimated as 4.1 billion boe. This is supplemented by an additional mean prospective resource of 11.2 billion boe estimated to reside in plays outside of mapped leads and prospects. These estimates when expressed in boe terms are unchanged since the end 2017 estimates, although revisions have been made to the estimated proportions of oil and gas (see section 5). Ultimately the Yet-to-Find potential of the UK Continental Shelf will be determined by activity levels. The ultimate volume that can be delivered will depend critically on how industry generates new targets, and the efficiency of resource progression from plays through to drill-ready prospects. The number of drill-ready prospects is equivalent to around 2 to 3 years-worth of drilling activity at current rates, and is unlikely to deliver industry's current Key Performance Indicator of discovering an additional resource of 200 million boe per year (as a five-year rolling average) through exploration.

Taking account of the range of possibilities for prospective resources, together with the range of discovered reserves and resources, the OGA's current estimate of remaining recoverable hydrocarbon resources from the UKCS remains in the range 10 to 20 billion boe.

**Note:** Definitions of terms, and an explanation of how the OGA categorisation compares to the Petroleum Resources Management System (PRMS) of the Society of Petroleum Engineers (SPE), are given in Appendix B. Reserves and resources for developed fields and fields where development projects are under discussion were compiled from data provided by operators – these data have not been audited by the OGA.

Proven, probable and possible reserves and resources for a large number of individual fields and discoveries have been aggregated to provide the totals shown. Note that figures for prospective (i.e. not yet discovered or "yet-to-find") resources are naturally subject to a higher degree of uncertainty than those for discovered resources. There will also be varying degrees of uncertainty in how much of the contingent resources will ultimately be developed.

**Summing the overall estimates of the four categories of resources (reserves, contingent resources, prospective resources associated with mapped features and play-level prospective resources) does not imply any particular levels of probability that those volumes will ultimately be produced.**

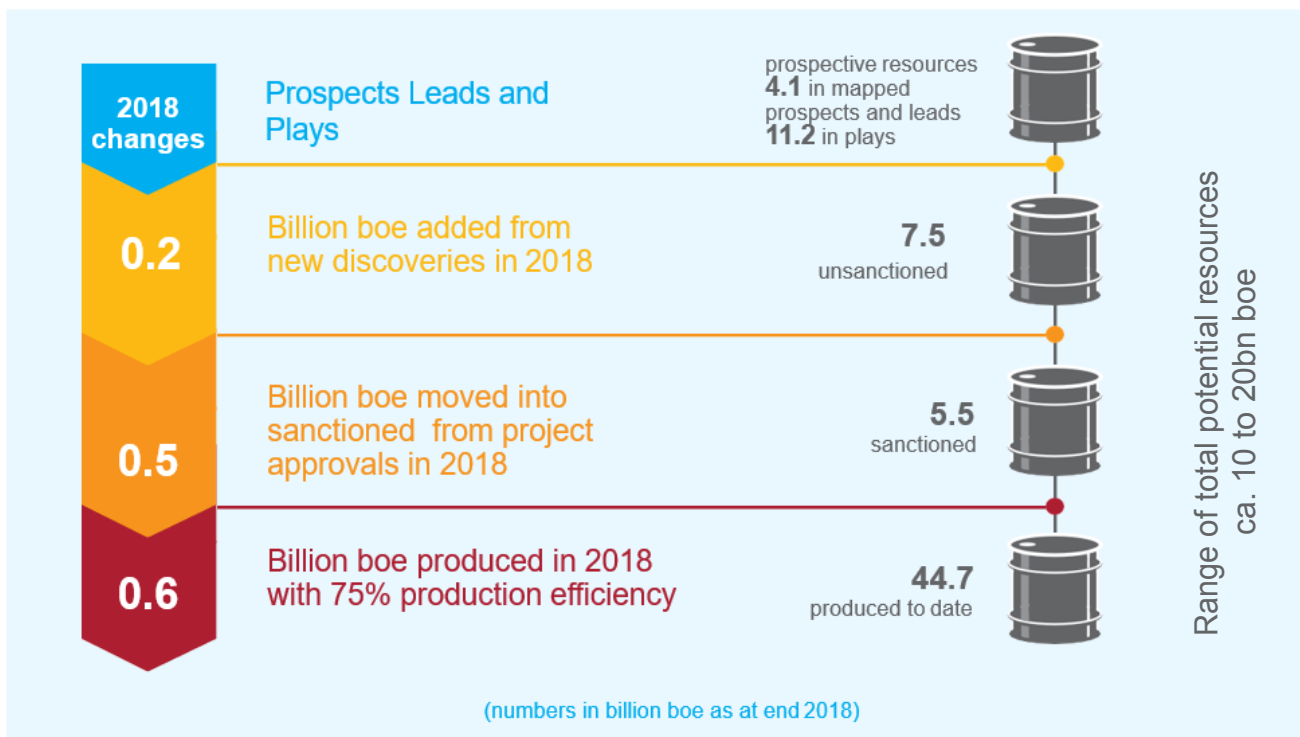
# 3. Oil and gas reserves and contingent resources progression

## 3.1 UKCS reserves and resources progression in 2018

Figure 1, below, illustrates the progression of resources and reserves between the major categories during 2018.

- Three new discoveries from exploration successes in 2018 added 239 mmbœ to the contingent resource base.
- Production during 2018 of 600 mmbœ resulted in an equivalent reduction in (remaining) reserves
- Nine new Field Development Plans (FDPs) consented to in 2018 resulted in a 225 million boe movement from contingent resources to reserves. (This includes one new discovery that received FDP consent in 2018 so the volumes immediately moved to reserves). Eleven FDP addenda (FDPAs) for incremental projects in producing fields resulted in a further 250 million boe moving from contingent resources to reserves

Figure 1: Reserves and Resources Progression

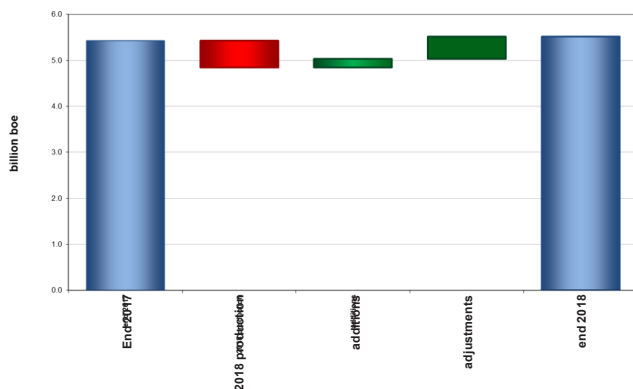


### 3.2 Reserves progression

Reserves rose from 5.4 billion boe as at end 2017 to 5.5 billion boe as at end 2018. This was a result of:

- Production during 2018 of 600 mmboe
- Nine new field developments consented to in 2018 resulted in 225 mmboe movement from contingent resources to reserves. (This includes one new discovery that received FDP consent in 2018 so the volumes immediately moved to reserves)
- Eleven FDP addenda for incremental projects in producing fields resulted in a further 250 million boe moving from contingent resources to reserves
- A net addition to the reserves estimates for producing fields of ca 205 mmboe (positive additions from other in-field activities, improved field performance and life of field extension (CoP deferral), but with offsetting downward revisions in other fields).

**Figure 2:**  
2P reserve changes from end 2017 to end 2018

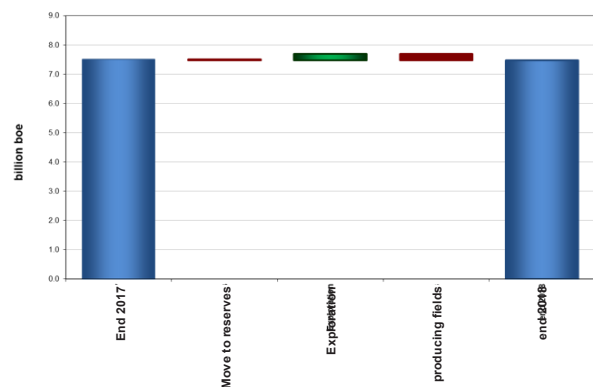


### 3.3 Contingent resources progression

The UK's contingent resources represents a significant opportunity to progress discovered resources to development. There was only a small change in the central estimate of total contingent resources during 2018, the overall estimate remaining at 7.5 billion boe. There were a number of changes within the contingent resources categories, as a result of:

- Three new discoveries from exploration successes in 2018 adding 239 mmboe to the contingent resource base
- Nine new field developments consented to in 2018 resulted in 225 mmboe movement from contingent resources to reserves. (This includes one new discovery that received FDP consent in 2018 so the volumes immediately moved to reserves)
- The sanction of a number of incremental projects in producing fields resulting in the movement of contingent resources to reserves
- A number of other adjustments made by operators resulting in an overall decrease in contingent resources in producing fields.

**Figure 3:**  
2C resource changes from end 2017 to end 2018



There have been some minor movements within the contingent resources categories not represented in Figure 3 above. Ca 200 mmboe has moved from contingent resources in marginal discoveries to the “proposed new developments” category as a result of development projects being progressed during 2018 for undeveloped discoveries.

### 3.4 Production and reserves replacement trends

#### Reserves replacement ratio

This provides an indication of how current production levels are being replenished through the maturation of contingent resources and exploration discoveries into reserves.

The underlying reserves replacement ratio in 2018 was 115%. A total of 475 mmboe of reserves were added as a result of nine Field Development Plans and 20 Field Development Plan addenda consents, while 205 mmboe were added as a result of other infield activities. This compares to production of around 600 mmboe in 2018. Replacement of proven and probable reserves by resources maturation remains a key concern: less than 35% of the reserves additions in 2018 came from approved new field developments.

Figure 4 below shows how 2P reserves and the reserves replacement ratio have changed over the last 20 years. It can be seen there is a large variation in the reserves replacement ratio from year to year, partly as a result of oil price fluctuations. The negative reserves replacement ratio in 2015 was a result of the OGA re-categorising certain types of project from reserves to contingent resources. Prior to 2015, DECC and its predecessors included in the reserves category projects that had not yet been sanctioned but were expected to be sanctioned in the near future. This is permitted under the SPE PRMS (the “Justified for Development” category), however the OGA now includes projects in the reserves category only where the project has been sanctioned by the participants and the OGA has issued a Development and Production Consent.

Figure 4: Oil and gas 2P reserves replacement

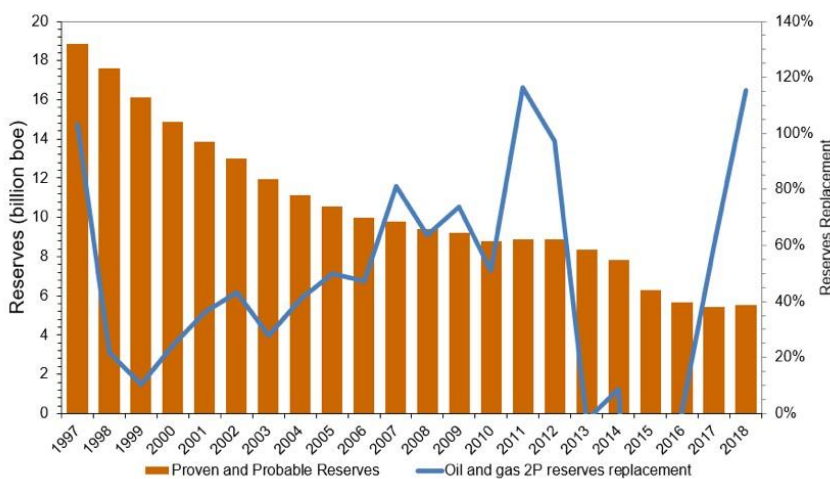
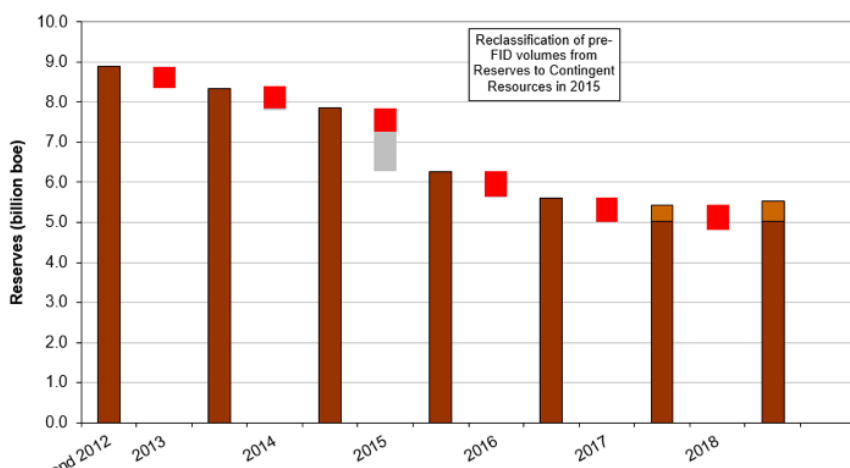


Figure 5 below shows how production and the central estimate of reserves have changed in the last 5 years. As can be seen, overall the UK reserves have decreased.

Figure 5: 2P reserves and production 2013 to 2018



### 3.5 Estimated Ultimate Recovery historic trends

Estimated Ultimate Recovery (EUR) is defined as production (to date) plus (remaining) reserves. Figures 6 and 7 shows how the EUR from the UKCS based on known reserves (proven, probable and possible) has evolved over time for oil and gas fields, respectively.

EUR increased significantly from 1970 to 1990, indicating that exploration success was adding to the contingent resource base and significant contingent resources were

being matured to reserves. However, in recent times the trend has reduced considerably and now is almost flat, because of low maturation of contingent resources to reserves and the low level of discoveries. It should be noted that the drops observed in EUR in 2015 are because of the change in the OGA's approach to defining reserves described earlier in this section.

Figure 6: Oil Estimated Ultimate Recovery vs time (to end 2018)

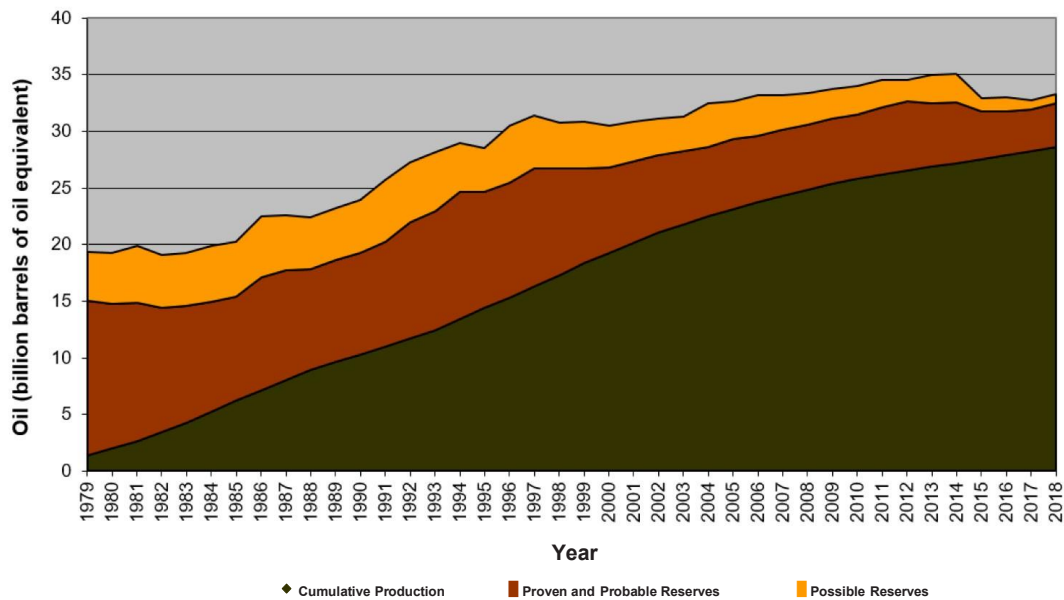
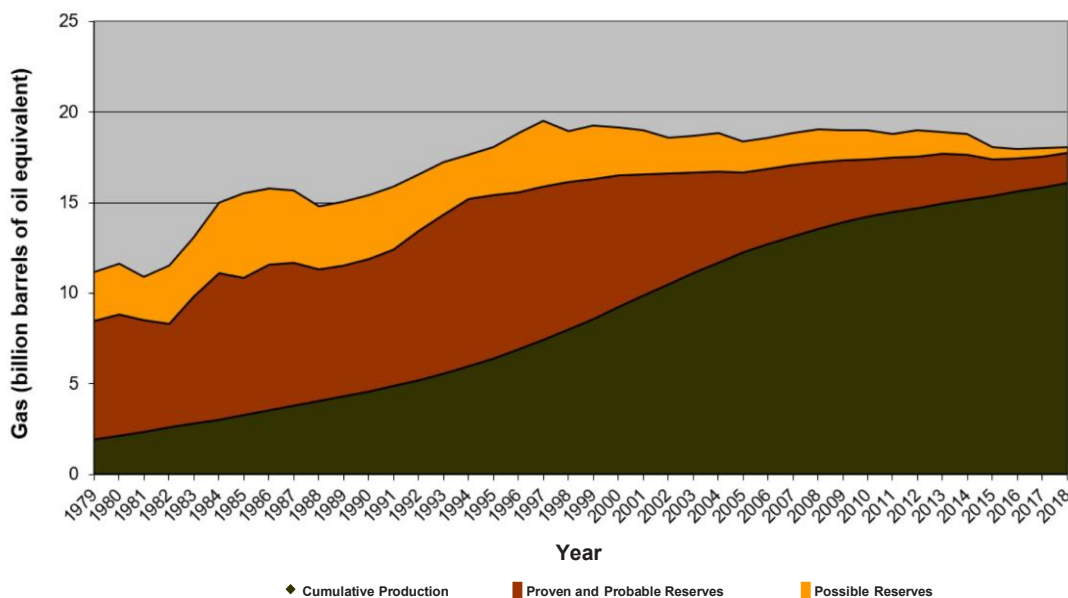


Figure 7: Gas Estimated Ultimate Recovery vs time (to end 2018)





## 4. Detailed breakout of oil and gas reserves and contingent resources

In this section, ranges for the estimates of oil and gas reserves and contingent resources are presented. The gas reserves and contingent resources for proposed new field developments are categorised according to whether they are “dry gas”, “gas from gas condensate fields”, or “associated gas from oil fields”. The oil and gas reserves and contingent resources are also split out by area (Northern North Sea (NNS), Central North Sea (CNS), Southern North Sea (SNS), Irish Sea (IS) and West of Shetland (WoS)).

### 4.1 Ranges for oil and gas reserves and contingent resources

Oil and gas reserves can be classed into three categories (proven, probable and possible, or 1P, 2P and 3P) depending on the level of confidence that they will eventually be produced (see Appendix B for definitions). Contingent resources can similarly be classed as 1C, 2C, 3C depending on confidence level.

The following tables indicate the split of petroleum liquids and gas reserves and resources and the 1P/2P/3P and 1C/2C/3C ranges according SPE PRMS definitions as given in Appendix B. Proven, probable and possible reserves and resources for a large number of individual fields and discoveries have been aggregated to provide the totals shown. Summing the overall estimates of the three categories of reserves and resources does not imply any particular levels of probability that those volumes will ultimately be produced. The ranges tabulated below should be considered as indicative of the various underlying uncertainties.

UK remaining reserves and contingent resources are both approximately 70% oil and 30% gas when expressed in oil equivalent terms. It should be noted that the split of oil and gas in the total production during 2018 approximately 60% oil and 40% gas.

**Table 2: Oil and gas reserves and resources as at end 2018 (2017) in billion boe**

<b>Reserves</b>	<b>1P</b>	<b>2P</b>	<b>3P</b>
Reserves	3.9 (3.6)	<b>5.5</b> <b>(5.4)</b>	6.7 (6.7)
<b>Contingent resources</b>	<b>1C</b>	<b>2C</b>	<b>3C</b>
Producing fields	1.6 (1.2)	<b>2.3</b> <b>(2.1)</b>	2.9 (2.3)
Proposed new developments	1.2 (1.5)	<b>1.9</b> <b>(2.1)</b>	2.6 (2.8)
Marginal discoveries	1.4 (1.4)	<b>3.3</b> <b>(3.3)</b>	6.3 (6.0)
<b>Total contingent resources</b>	4.2 (4.1)	<b>7.5</b> <b>(7.5)</b>	11.8 (11.2)

**Note:** The classification of reserves and resources is explained in Appendix B.

**Table 3: Oil reserves and resources as at end 2018 (2017) in billion boe**

Oil	1P	2P	3P
Oil Reserves	2.7 (2.5)	<b>3.8</b> <b>(3.8)</b>	4.7 (4.5)
Oil Contingent resources	1C	2C	3C
Producing fields	1.1 (0.8)	<b>1.5</b> <b>(1.4)</b>	1.9 (1.6)
Proposed new developments	1.1 (1.3)	<b>1.5</b> <b>(1.7)</b>	2.1 (2.3)
Marginal discoveries	0.8 (0.8)	<b>2.1</b> <b>(2.0)</b>	4.1 (4.0)
<b>Total contingent resources</b>	<b>3.0</b> <b>(2.9)</b>	<b>5.1</b> <b>(5.1)</b>	<b>8.1</b> <b>(8.0)</b>

**Table 4: Gas reserves and resources as at end 2018 (2017) in billion boe**

Gas	1P	2P	3P
Gas Reserves	1.1 (1.1)	<b>1.7</b> <b>(1.7)</b>	2.0 (2.1)
Gas Contingent resources	1C	2C	3C
Producing fields	0.4 (0.3)	<b>0.8</b> <b>(0.7)</b>	1.0 (0.9)
Proposed new developments	0.2 (0.2)	<b>0.3</b> <b>(0.4)</b>	0.5 (0.5)
Marginal discoveries	0.6 (0.6)	<b>1.2</b> <b>(1.2)</b>	2.1 (2.0)
<b>Total contingent resources</b>	<b>1.2</b> <b>(1.1)</b>	<b>2.3</b> <b>(2.3)</b>	<b>3.6</b> <b>(3.4)</b>

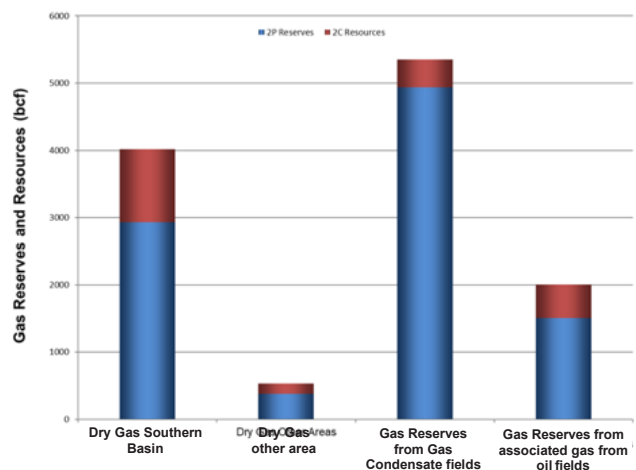
Due to rounding, subtotals may not exactly equal the sum or difference of the values entered elsewhere in the table.

Versions of the above tables in metric units (million tonnes of oil and billions cubic metres of gas) are presented in Appendix D.

## 4.2 Gas reserves distribution by type

Figure 8 indicates how UKCS gas reserves are distributed between dry gas fields (primarily located in the SNS), gas from gas condensate fields and associated gas from oil fields (both primarily located in the CNS, NNS and WoS).

The largest contribution to future gas production is expected to come from gas condensate fields. These fields tend to be produced at constant rates throughout the year (periods of planned and unplanned downtime apart), compared to dry gas fields where production rates can be higher during periods of peak demand (e.g. in winter) and lower during periods of low demand (e.g. in summer). Also, gas condensate fields need oil export infrastructure to convey their produced liquids to market. About 75% of the condensate gas reserves and resources lie in the CNS.

**Figure 8: Distribution of UKCS gas reserves and resources (central case)**

Tables 5 and 6 indicate the range of resources associated with gas reserves and contingent resources in proposed new developments.

**Table 5: Gas reserves by field type as at end 2018 (2017) in bcf**

Fields in production or under development	1P bcf	2P bcf	3P bcf
<b>Gas reserves from dry gas fields</b>			
Southern basin (i.e. SNS)	2172 (2004)	<b>2932</b> <b>(3024)</b>	3779 (3933)
Other areas	283 (273)	<b>380</b> <b>(478)</b>	466 (655)
<b>Gas reserves from gas condensate fields</b>	3336 (3321)	<b>4935</b> <b>(4955)</b>	5575 (6286)
<b>Gas reserves from associated gas from oil fields</b>	1115 (854)	<b>1506</b> <b>(1245)</b>	1738 (1488)

**Table 6: Gas contingent resources by field type as at end 2018 (2017) in bcf**

Fields where proposed development plans are under discussion	1P bcf	2P bcf	3P bcf
<b>Gas reserves from dry gas fields</b>			
Southern basin (i.e. SNS)	749 (605)	<b>1087</b> <b>(992)</b>	1514 (1420)
Other areas	2 (20)	<b>148</b> <b>(35)</b>	163 (188)
<b>Gas reserves from gas condensate fields</b>	56 (311)	<b>272</b> <b>(577)</b>	272 (784)
<b>Gas reserves from associated gas from oil fields</b>	267 (320)	<b>499</b> <b>(483)</b>	1738 (1488)

### 4.3 Petroleum resource distribution by geographic area

Figures 9 and 10 show the distribution of UK oil and gas reserves and contingent/discovered resources by area. Indicatively, most oil reserves are within the CNS and WoS areas with significant gas potential in the CNS.

Figure 9: Oil reserves and resources by area (2P/2C)

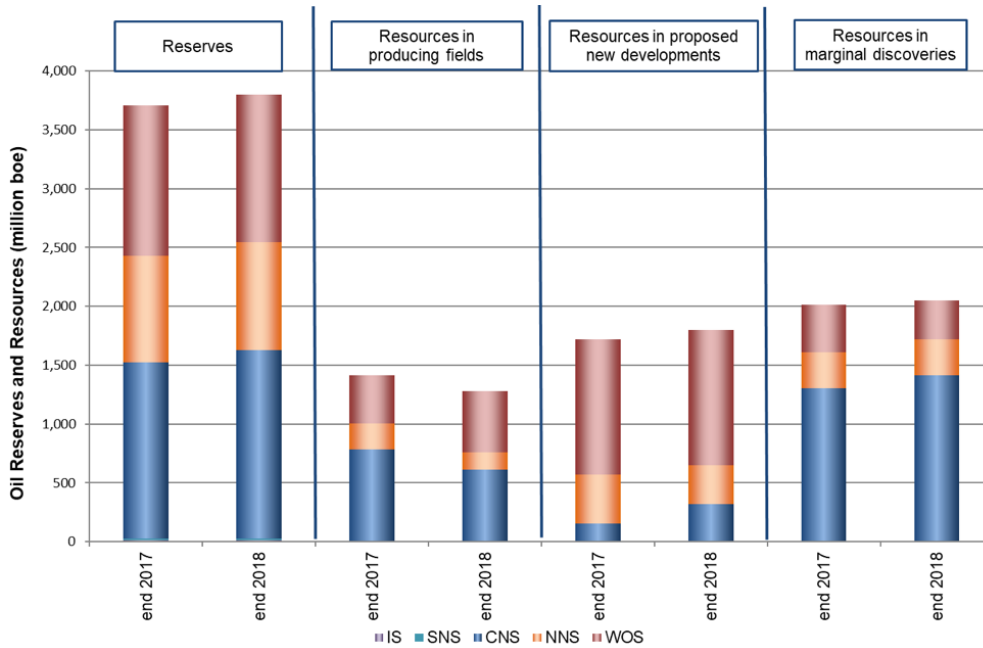
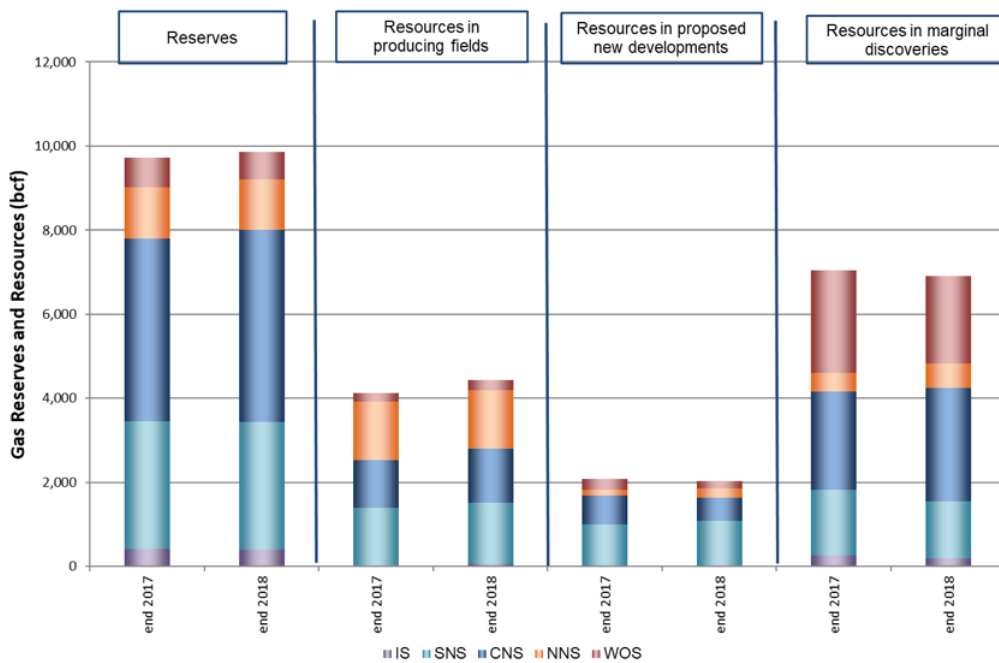


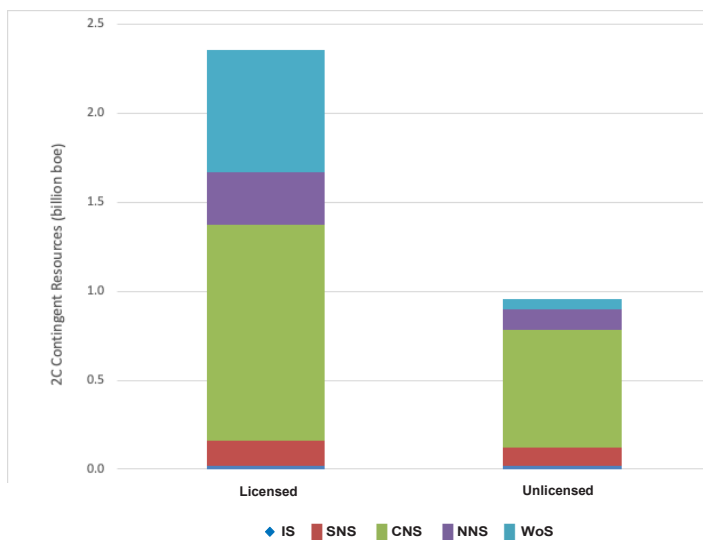
Figure 10: Gas reserves and resources by area (2P/2C)



#### 4.4 Contingent Resources by licence status

A significant resource potential remains in unlicensed acreage. A breakdown of contingent resources by area and licensed/unlicensed acreage is shown in Figure 11 below. This shows that over one quarter of the contingent resources in other discoveries (154 discoveries with 0.95 billion boe from a total of 3.3 billion boe) was on unlicensed acreage at the end of 2018. Some of this acreage was made available in the 31<sup>st</sup> Supplementary licensing round, the rest has been made available in the 32<sup>nd</sup> Round.

**Figure 11: Contingent resources (2C) in marginal discoveries on licensed and unlicensed acreage**



# 5. Prospective Resources (Yet-to-Find)

## 5.1 Summary

The overall Prospective Resource figures, when expressed in billions of boe, are unchanged from last years' estimates. The OGA estimates that the Mean Yet-to-Find Prospective Resources of leads and prospects in the inventory is 4.1 billion barrels of oil equivalent (Bboe). Within this inventory, a range of volume outcomes is possible, as illustrated in Table 5.1. However, within these oil equivalent volumes the proportion of gas and oil has been revised since last year – see table 5.2.

**Table 5.1: Prospective Resources Associated with Leads & Prospects, with Cut-Offs**

UKCS	P90	Mean	P10
<b>Total Prospective Resources (Bboe)</b>	<b>2.8</b>	<b>4.1</b>	<b>5.6</b>

All values calculated stochastically using the Monte Carlo method, with no dependencies. Volumes are risked recoverable prospective resources. 10 million boe unrisked volume cut-off (30 million boe unrisked West of Shetland) and 15% Geological Chance of Success (CoS) cut-off applied..

Leads and prospects included in table 5.1 meet a volume threshold of 10 million boe Mean Prospective Resources (or a 30 million boe mean volume cut-off West of Shetland) and have an estimated technical (geological) chance of success greater than 15%. These thresholds are consistent with drilling activity taking place under current market conditions. It is important to recognise that the final Prospective Resource that industry is able to deliver will depend on the interplay of a number of other factors which will vary spatially and temporally, including economics, infrastructure status, capital availability, technology development, social and environmental factors, and a host of other constraints and enablers.

The Prospective Resources available in the Lead and Prospect Inventory are potentially supplemented by an additional 11.2 Bboe of Mean Prospective Resources that are estimated in plays where the Industry has yet to map leads and prospects systematically, partly due to the need for improved geophysical datasets (see table 5.4). By their nature, these resources are more speculative, with greater risk, but also greater opportunities for value creation due to the impact of successful de-risking of chance factors that are shared among a collection of related leads and prospects (play risk).

It is important to recognise that these estimates reflect the current state of subsurface knowledge, limited by the extent of the work that could be performed by the OGA, and that the figures will be revised over time as work on the prospect inventory and play portfolio matures.

## 5.2 Methodology

During 2017/18, the OGA made substantial changes to the methodology (Figure 5.1) by which the UK's Yet-to-Find Prospective Resources are estimated, using industry best-practices and building upon the legacy inventory of leads and prospects inherited from the OGA's predecessor organisations, and maintained by the British Geological Survey (BGS).

The Yet-to-Find estimate now also includes Prospective Resources added through Play Analysis, building upon the OGA's recent regional geoscience initiatives and activities including the Government-Funded Seismic Programmes, the Regional Mapping Project (delivered by Lloyds Register), and post-doctoral research projects (delivered by Heriot-Watt University, the University of Aberdeen and the University of Durham).

A more detailed description of the methodology used is set out in the OGA's previous reserves and resources report.

### 5.3 Results

All volumes presented in this section (including tables and figures) are risked recoverable prospective resources. Onshore and unconventional hydrocarbon resources are not included in the assessment. Ultimately the Yet-to-Find potential of the UK Continental Shelf will be determined by activity levels. The ultimate volume that can be delivered will depend critically on how industry generates new targets, and the efficiency of resource progression from plays through to drill-ready prospects.

#### Lead and Prospect-Level Prospective Resources

The lead and prospect inventory held by the OGA currently contains almost 3500 features derived largely from operator evaluations, supplemented by in-house evaluations.

It would be reasonable to expect that only a subset of this resource base could be produced commercially, since ultimate recovery will be limited by a number of factors.

To model which leads and prospects the industry would consider to be viable targets from a geological perspective, the OGA used a simple set of cut-offs that are consistent with recent drilling activity and so capture features that may, if matured to a drill-ready status, be targeted under current market conditions. This is illustrated in Table 5.2 which shows the outcome of applying a 10 million boe volume cut-off (increased to 30 million boe West of Shetland) and a 15% geological chance of success cut-off. The feature count is now reduced to a figure that is more consistent with the UKCS's history of approximately 2,500 offshore exploration wells to date.

**Table 5.2: Prospective Resources Associated with Leads & Prospects, with Cut-Offs**

#### A) Lead & Prospect-level Prospective Resources by Basin (with cut-offs applied)

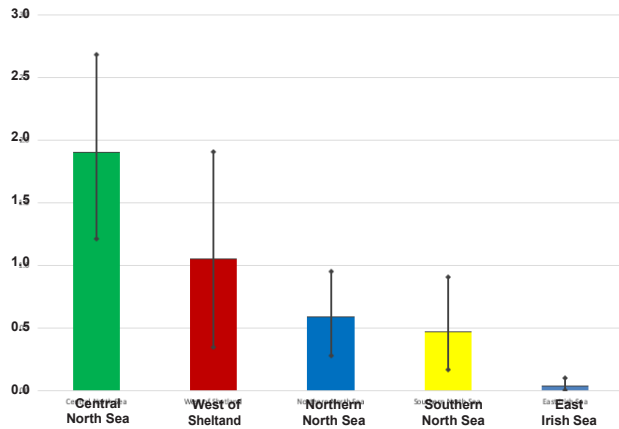
Basin	Oil Equivalent (billion boe)						%Gas	Feature Count
	P99	P90	P50	Mean	P10	P1		
West of Shetland	0.2	0.3	0.8	1.1	1.9	5.2	34%	46
Northern North Sea	0.2	0.3	0.5	0.6	1.0	2.1	20%	97
Central North Sea	0.9	1.2	1.7	1.9	2.7	5.4	27%	281
Southern North Sea	0.1	0.2	0.4	0.5	0.9	2.1	95%	58
East Irish Sea	0.00	0.00	0.01	0.04	0.1	0.6	92%	4
<b>Total Prospective Resources</b>	<b>0.2</b>	<b>0.3</b>	<b>0.8</b>	<b>4.1</b>	<b>5.6</b>	<b>9.4</b>	<b>37%</b>	<b>486</b>

#### B) Lead & Prospect-level Prospective Resources by Resource Category (with cut-offs applied)

Resource Category	Oil Equivalent (billion boe)						%Gas	Feature Count
	P99	P90	P50	Mean	P10	P1		
Leads	1.0	1.4	2.1	2.4	3.6	7.4	41%	260
Prospects	0.6	0.8	1.2	1.4	2.1	4.2	35%	191
Drill-ready Prospects	0.0	0.1	0.3	0.3	0.6	1.2	28%	35
<b>Total Prospective Resources</b>	<b>2.2</b>	<b>2.8</b>	<b>4.1</b>	<b>4.1</b>	<b>5.6</b>	<b>9.4</b>	<b>37%</b>	<b>486</b>

**Notes:** All totals calculated stochastically using Monte Carlo method, with no dependencies (i.e. totals are not calculated arithmetically). Volumes are risked recoverable prospective resources. \*10 million boe unrisked volume cut-off (30 million boe West of Shetland; unrisked) and 15% Geological Chance of Success (CoS) cut-off applied.

**Figure 12: Mean Prospective Resources associated with leads and prospects and P90-P10 ranges (with cut-offs applied)**



**Table 5.2.A** and figure 12 present prospective resources by basin with 15% Geological Chance of Success (CoS) and 10 million boe volume cut-offs applied (30 million boe West of Shetland). The volume cut-off is applied to the Mean Prospective Resource estimate for each feature.

**Table 5.2.B** shows the distribution of Prospective Resources by Resource Category with cut-offs applied. In order to progress towards drill-ready status, leads and prospects must mature successfully via technical work programmes. The number of drill-ready prospects is equivalent to around 2 to 3 years-worth of drilling activity at current rates, which is unlikely to meet industry's current Key Performance Indicator of discovering an additional 200 million boe of resource per year (as a five-year rolling average) through exploration.

In the above table, the oil equivalent volumes are unchanged from the end 2017 values. However, the proportion of gas and oil has been revised and is broadly consistent with existing fields and discoveries.

### Play-Level Prospective Resources

In 2017/2018, the OGA invested substantial effort in systematically estimating the prospective resources at a play level that lie outside of mapped leads and prospects, adopting industry best-practice methods. As at the lead and prospect level, risked prospective resources have been modelled stochastically to produce a range of volume estimates, which can be categorised in various ways, most simply at a basin level (Table 5.4). A high-level list of plays is appended to this report in Appendix C.

**Table 5.4: Play-Level Prospective Resources**

Basin	Oil Equivalent (billion boe)					
	P99	P90	P50	Mean	P10	P1
West of Shetland	2.0	3.1	4.6	4.7	6.3	7.8
Rockall Trough	0.0	0.3	2.1	2.5	5.1	8.6
Northern North Sea	0.2	0.4	0.8	0.9	1.7	2.7
Central North Sea	0.6	0.9	1.4	1.5	2.1	2.8
Mid North Sea High	0.0	0.1	0.5	0.5	1.1	1.6
Southern North Sea	0.2	0.4	0.8	0.8	1.2	1.6
East Irish Sea	0.0	0.0	0.0	0.0	0.1	0.3
SW Britain	0.0	0.0	0.2	0.3	0.6	1.0
<b>Total Prospective Resources</b>				<b>11.2</b>		

**Notes:** Play-Level Prospective Resources by Basin, no volume or Chance of Success (CoS) cut-offs applied, Total calculated using Monte Carlo with no dependencies. Volumes are risked recoverable prospective resources. Northern North Sea includes East Shetland Platform, SW Britain includes SW Approaches and Cardigan Bay. Mid North Sea High includes Forth Approaches Basin.



# APPENDICES

## Appendix A

### Data sources

The data for both developed fields and development projects under discussion were compiled from data provided by operators via the OGA's annual UKCS Stewardship Survey. The Survey also collected data on contingent resources in producing fields - these data were not collected prior to 2016.

The end 2018 survey covered:

- 316 producing fields
- 15 projects where an FDP had been approved but production had not yet started
- 33 other projects where FDPs were under discussion as at the end of 2018

Data for unsanctioned discoveries where no development project is under discussion (referred to as potential additional resources in previous Department of Energy and Climate Change reports) were not collected via the UKCS Stewardship Survey.

The OGA in-house data used for the UK Continental Shelf unsanctioned discoveries information pack<sup>3</sup> were updated to reflect the status as at end 2018. This now covers 386 undeveloped discoveries on both licensed and unlicensed acreage.

The methodology for deriving estimates for prospective resources is presented in Appendix C.

### Conversion factors:

The approach used to calculate barrels of oil equivalent is based upon the following (approximate) conversion factors:

- 1 tonne of crude oil = 7.5 barrels of oil equivalent
- 1 cubic metre of gas = 35.315 cubic feet of gas
- 1 cubic foot of gas = 1/5,800 barrels of oil equivalent

## Appendix B

### Comparison of OGA terminology with SPE PRMS

The OGA has sought to adjust its definitions and they are now more closely aligned with those recommended by the Petroleum Resources Management System (PRMS) of the Society of Petroleum Engineers (SPE). The full definitions associated with this classification system can be found in SPE PRMS 2018.<sup>4</sup>

The OGA now classifies reserves and resources into the following main categories: reserves, contingent resources and prospective resources, with further sub classes aligned with SPE PRMS as laid out in Figure 11.

**Figure 13: Comparison of OGA classifications with SPE PRMS**

### SPE PRMS

Total Petroleum Initially in place (PIIP)	Discovered PIP	Production	Project Maturity Sub-Classes	
		Commercial	Reserves	On production
			Sub-Commercial	Contingent Resources
	Justified for development			
	Unrecoverable	Development Pending		
		Development on Hold		
		Development Unclarified		
	Undiscovered	Prospective Resources	Prospect	
			Lead	
			Play	
		Unrecoverable		

### OGA classification

		Lower (1P)	Central (2P)	Upper (3P)	Data Source
Reserves	Fields in production or under development				UK Stewardship Survey
	Contingent resources in producing fields				
Contingent resources	Proposed new developments				
	Marginal Discoveries				OGA In house

		Lower	Mean	Upper	
Prospective Resources	Prospects				OGA in house
	Leads				
	Plays				

Source - SPE 2018

<sup>3</sup> <https://www.ogauthority.co.uk/media/2960/420297-small-pools-22.pdf>

<sup>4</sup> <https://www.spe.org/industry/reserves.php>

## Reserves

These are discovered, remaining volumes that are recoverable and commercial. They can be proven, probable or possible, depending on confidence level.

In the UKCS Stewardship Survey, operators were asked to provide reserves data in accordance with the following definitions for fields in production or under development (which are broadly in line with previous DECC guidance)

- **Proven (1P):** Reserves that, on the available evidence, are virtually certain to be technically and commercially producible, i.e. have a better than 90% chance of being produced
- **Probable (2P):** Reserves that are not yet proven, but which are estimated to have a better than 50% chance of being technically and commercially producible
- **Possible (3P):** Reserves that at present cannot be regarded as probable, but which are estimated to have a significant – more than 10% but less than 50% – chance of being technically and commercially producible

## Contingent resources

Contingent resources are those quantities of petroleum estimated to be potentially recoverable from known accumulations, but the applied project(s) are not yet considered mature enough for commercial development.

The “contingent resources in producing fields” represent discovered undeveloped resources in the field determined areas.

The “contingent resources in proposed new developments” represent discovered undeveloped potential in new field developments under consideration.

The “contingent resources in marginal discoveries” represent undeveloped discoveries where no development proposals are currently being proposed, in licensed and unlicensed areas.

### **In the UKCS Stewardship Survey, operators were asked to provide information on contingent resources in future planned developments:**

- In producing fields (including incremental projects)
- Where development plans are under discussion but have not yet been approved

### **Contingent resources in other discoveries:**

- The OGA assessed contingent resources in other discoveries based on in-house information compiled from a variety of sources

### **Resource confidence levels are defined as follows:**

- **1C:** Resource volumes that on the available evidence, are virtually certain to be technically producible, i.e. have a better than 90% chance of being producible
- **2C:** Resource volumes that are not yet 1C, but which are estimated to have a better than 50% chance of being technically producible
- **3C:** Resource volumes that at present cannot be regarded as 2C, but which are estimated to have a significant – more than 10% but less than 50% – chance of being technically producible

## Prospective resources

Undiscovered potentially recoverable resources in mapped leads and prospects that have not yet been drilled, plus those undiscovered potentially recoverable resources that are estimated to reside in plays for which there are few or no mapped features.

Prospective resource category definitions:

- A Lead is a trapping feature that is associated with a speculative volumetric and chance-of-success assessment, and requires additional seismic analysis/acquisition or other key data in order to progress to a prospect.
- A Prospect-Under-Evaluation is a robust trap that has been mapped with a higher degree of confidence using good quality seismic and other key data.
- A Drill-Ready-Prospect requires no further evaluation, and has an associated well location and plan.

## Appendix C

### Play Listings

#### Central North Sea & Moray Firth

- Eocene (Proven)
- Paleocene (Proven)
- Upper Cretaceous (Proven)
- Lower Cretaceous (Proven)
- Upper Jurassic (Proven)
- Middle Jurassic (Proven)
- Lower Jurassic (Proven)
- Triassic (Proven)
- Devonian (Proven)

Plays not included: Rotliegend, Carboniferous.

#### Forth Approaches Basin

- Carboniferous (Unproven)
- Rotliegend (Unproven)

Plays not included: Zechstein Dolomites.

#### Mid North Sea High

- Zechstein (Unproven)
- Rotliegend (Unproven)
- Carboniferous (Unproven)
- Devonian (Unproven)

#### Northern North Sea and East Shetland Platform

- Eocene (Proven)
- Upper Paleocene (Proven)
- Middle Jurassic (Proven)
- Lower Jurassic (Proven)
- Triassic (Proven)
- Devonian (Unproven)

Plays not included: Upper Jurassic interpreted as fully mapped therefore excluded. Upper & Lower Cretaceous excluded as these have been interpreted to be non-reservoir bearing intervals. Intervals younger than Eocene excluded due to biodegradation risk.

### West of Shetland (Faroe-Shetland Basin)

- Paleocene (Proven)
- Upper Cretaceous (UnProven)
- Lower Cretaceous (Proven)
- Jurassic (Proven)
- Triassic (Proven)

Plays not included: Fractured Basement.

### Rockall Trough

- Triassic (Unproven)
- Middle Jurassic (Unproven)
- Upper Jurassic (Unproven)
- Lower Cretaceous (Unproven)
- Paleocene (Partially Proven)

### Southern North Sea

- Triassic (Proven)
- Zechstein (Proven)
- Rotliegend (Proven)
- Carboniferous (Proven)

Plays not included: Intra-Carboniferous, Tight-Gas.

### South West Britain (including SW Approaches & Cardigan Bay)

- Triassic (Unproven)
- Middle Jurassic (Proven)
- Permian (Unproven)

Plays not included: Carboniferous.

## Appendix D

### Metic version of tables

**Table D3 Oil reserves and resources as at end 2018 in million tonnes**

Oil	1P	2P	3P
Oil Reserves	360	507	627
<b>Oil Contingent resources</b>	<b>1C</b>	<b>2C</b>	<b>3C</b>
Producing fields	147	200	253
Proposed new developments	147	200	280
Marginal discoveries	107	280	547
<b>Total contingent resources</b>	<b>400</b>	<b>680</b>	<b>1080</b>

**Table D4 Gas reserves and resources as at end 2018 in billion cubic metres**

Gas	1P	2P	3P
Gas Reserves	181	279	329
<b>Gas Contingent resources</b>	<b>1C</b>	<b>2C</b>	<b>3C</b>
Producing fields	66	131	164
Proposed new developments	33	49	82
Marginal discoveries	99	197	345
<b>Total contingent resources</b>	<b>197</b>	<b>378</b>	<b>591</b>

**Table D5 Gas reserves by field type  
as at end 2018 in billion cubic metres**

<b>Fields in production or under development</b>	<b>1P</b>	<b>2P</b>	<b>3P</b>
<b>Gas reserves from dry gas fields</b>			
Southern basin	62	83	107
Other areas	62	83	107
<b>Gas reserves from gas condensate fields</b>	<b>62</b>	<b>83</b>	<b>107</b>
<b>Gas reserves from associated gas from oil fields</b>	<b>32</b>	<b>43</b>	<b>49</b>

**Table D6 Gas contingent resources by field type as at end 2018 in billion cubic metres**

<b>Fields where proposed development plans are under discussion</b>	<b>1P</b>	<b>2P</b>	<b>3P</b>
<b>Gas resources from dry gas fields</b>			
<b>Southern basin</b>	<b>21</b>	<b>31</b>	<b>43</b>
Other areas	1	4	5
<b>Gas resources from gas condensate fields</b>	<b>4</b>	<b>8</b>	<b>8</b>
<b>Gas resources from associated gas from oil fields</b>	<b>8</b>	<b>14</b>	<b>24</b>

