Oil & Gas
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Southern North Sea Tight Gas

Strategy

Contents

1. Foreword 3
2. Executive summary 4
3. Strategy context 5
4. Tight gas ambition and implementation 6
5. Implementation programme and accountabilities 8
6. Communication and stakeholder engagement plan 13
7. Review and update of this strategy 14
8. Terminology 15

1. Foreword

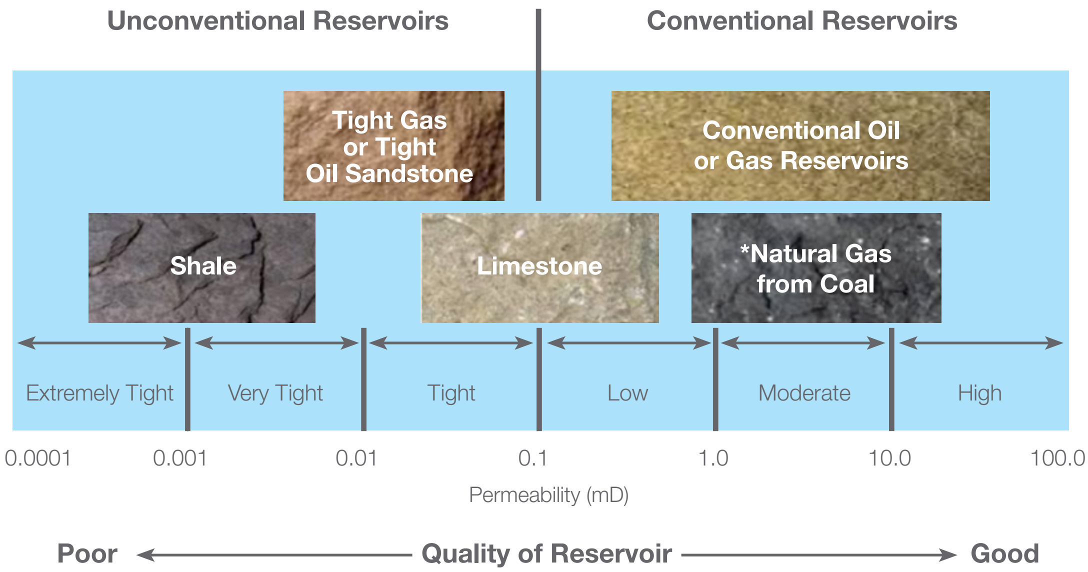
The term "tight gas" is an economic term commonly used to describe low permeability gas reservoirs that produce primarily dry gas. Production rates and recoverable reserves are typically uneconomic unless reservoir stimulation techniques are used to enhance recovery.

Permeability describes how easily gas can move through reservoir rock and is typically measured in Darcys or milliDarcys (mD). Reservoir rock with permeabilities of less that 0.1mD are often referred to as tight. The definition stems back to the US in the 1970s, where 'tight gas' reservoirs were defined for land well tax break purposes for reservoirs with an average permeability of 1mD or less.

Most reservoirs considered to be tight gas are sandstone or carbonate formations. Gas is stored within the rock pore space as well as a network of natural fractures. The gas is then produced via permeable paths which connect the pores and existing natural fractures. Other low permeability gas reservoirs include shale gas and coal bed methane.

In recent years technological advances have enabled successful Southern North Sea 'tight gas' offshore developments. A combination of horizontal drilling and reservoir stimulation technologies has been applied to exploit such reservoirs with average permeability values ranging from as low as 0.01mD but also more conventional reservoirs with permeabilities up to 1mD.

This document aims to build on these successes by providing a structure and framework to identify and disseminate best practice. The strategy also looks to promote further technological and collaborative opportunities which have the potential to unlock the remaining tight gas potential within the Southern North Sea.



2. Executive summary

The OGA estimates that there are some 3.8 trillion cubic feet (tcf) of remaining gas accessible within the Southern North Sea (SNS), inclusive of infill opportunities, undeveloped discoveries and prospects.

Tight gas reservoirs are often disregarded as both high cost and high risk. Licence holders tend to focus their resources on opportunities that are less complex, have lower development costs and higher recovery factors. The successful implementation of this Tight Gas Strategy represents an opportunity to unlock this remaining potential within the SNS.

Beyond the immediate benefits, the development of tight gas opportunities also has the ability to extend the economic life of the remaining infrastructure and thereafter stimulate field redevelopments, as well as marginal pools. Further tangible benefits may also be derived by the local supply chain through the stimulation of activity, as well as building local capability and expertise in tight gas.

The aim of this strategy is to help deliver tight gas developments across the SNS in support of the OGA's Maximising Economic Recovery strategy for the UK (MER UK) and furthermore the OGA's objectives and priorities within the Corporate Plan 2016-2021.

The current status and future potential of tight gas in the southern basin of the UK Continental Shelf (UKCS) is described in section 3. The OGA's ambition of supporting the delivery of 3.8 tcf of production from tight gas reservoirs in the Southern North Sea is described in section 4. Section 5 describes an eight-step programme intended to aid the delivery of tight gas projects, whilst section 6 provides an overview of the stakeholder communications required to deliver this strategy.

3. Strategy context

3.1 Where are we now and what are the opportunities?

The SNS is a mature offshore gas basin, with gas first produced in 1967. Over the last 50 years, a total volume in the region of 40 tcf has been produced. Today, the basin continues to produce circa 1.3 billion cubic feet/day and contains a significant number of producing gas fields with associated infrastructure, inclusive of offshore compression hubs, export pipelines and onshore terminals.

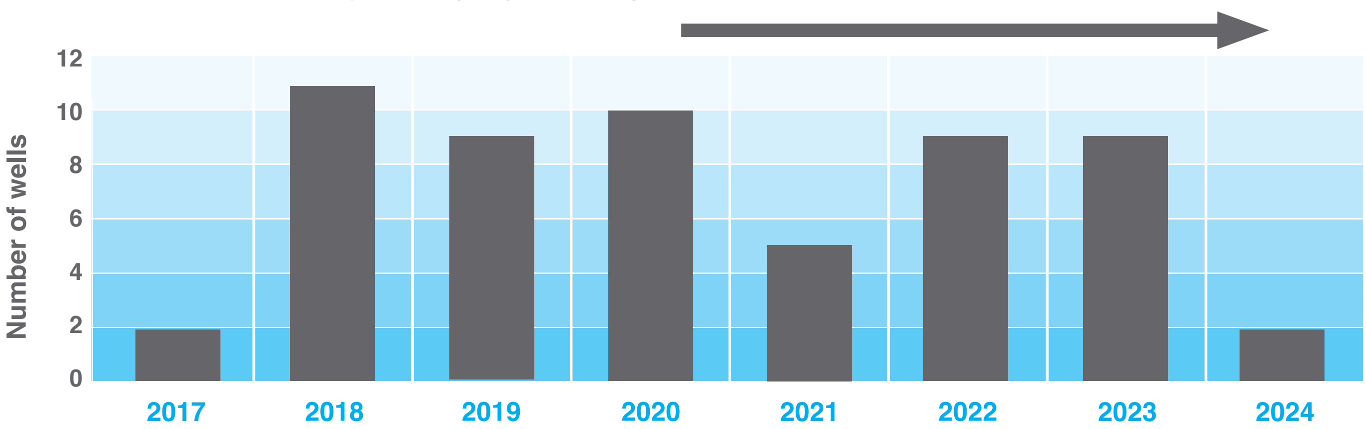
In 2015, Oil & Gas UK commissioned a Joint Industry Project (SNS Rejuvenation JIP). The purpose of this project was to develop a broad understanding of the remaining potential within the SNS and furthermore characterise this potential, including barriers to development.

One of the key findings from the project was to identify a substantial volume of tight gas remaining within existing producing gas producing fields, undeveloped discoveries and prospects. The project identified that at least 60% of undeveloped discoveries within the SNS and 50% of known prospects are considered to be tight gas accumulations.

Further to this, the OGA holds up to date figures on remaining volumes in producing fields, undeveloped discoveries and prospects, established through regular stewardship reviews with individual operators across the SNS. In total, the OGA conservatively estimates some 3.8 tcf of tight gas could be accessible from such opportunities.

The OGA also monitors activity levels across the SNS. Based on current gas price projections, drilling activity is projected to increase in the short to medium term, including development wells but also exploration and appraisal wells. Longer term, the OGA has more limited insight on activity levels, as operator and licence holder plans continue to evolve and mature.

SNS projected tight gas drilling activities (sanctioned and unsanctioned)



Includes infill and development wells, appraisal and exploration wells

Source: OGA

4. Tight gas ambition and implementation

4.1 The OGA's tight gas ambition

The OGA's ambition with regard to tight gas can be described as follows:

1. Drive the economic development of some 3.8 tcf from tight gas reservoirs across the SNS
2. Support existing tight gas projects and ensure readiness of future projects
3. Support collaboration to reduce both costs and risks by sharing knowledge and expertise
4. Identify and promote opportunities to undertake campaign activities across operators and drive economies of scale
5. Ensure appropriate technology is developed and deployed to support the economic recovery of tight gas, consistent with demand

The OGA's tight gas ambition will be implemented through an eight step programme, as described in section 5 of this document. Delivery will be through a combination of OGA and industry activities.

4.2 Relation with other OGA and industry led programmes of work

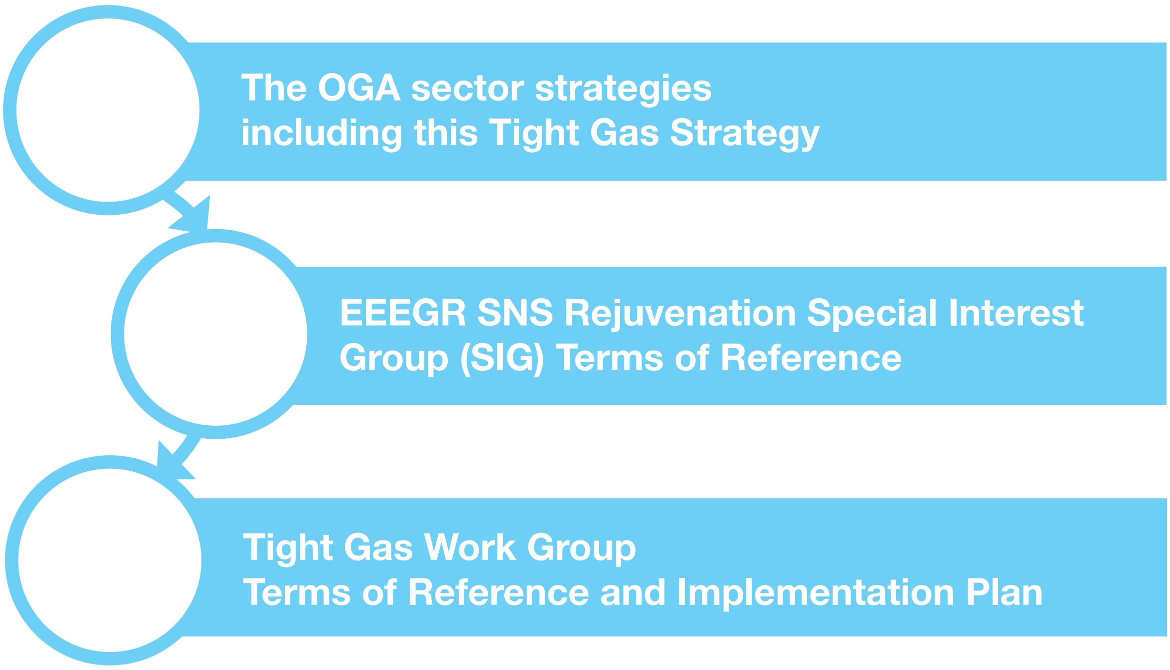
The success of this Tight Gas Strategy is dependent on a number of existing OGA sector strategies and initiatives as well as industry led initiatives. The primary interfaces are noted below:

1. **Asset Stewardship Strategy:** the OGA's stewardship expectations combined with the annual receipt of activity survey data from all UKCS operators provides the basis for the OGA's ability to interrogate and amalgamate an overall programme of tight gas opportunities across the SNS
2. **Technology Strategy:** the OGA's technology strategy provides an overall framework for the development and deployment of technology in support of the OGA's priorities. Technology strategy priorities include well cost reduction and the development of small / marginal pools
3. **MER UK Task Forces:** In total there are six task forces jointly chaired by the OGA and industry representatives. Each is intended to deliver the OGA's priorities for the UKCS and furthermore act as a vehicle for the delivery of the OGA's strategies

4.3 Tight Gas Strategy and the relationship with industry

The SNS Rejuvenation (Special Interest Group) commissioned through the East of England Energy Group (EEEGR) in conjunction with the OGA will be used as a vehicle through which a number of the priorities detailed in section 5 of this document will be implemented.

The SIG terms of reference covers a number of priority areas for the SNS, including the requirement to commission a Tight Gas Work Group. Where appropriate, the Tight Gas Work Group will develop a budget and work programme consistent with the priorities of this strategy. The SIG has accountability for monitoring delivery from the Tight Gas Work Group, including the provision of adequate resources and support.



5. Implementation programme and accountabilities

5.1 Eight step programme

The following eight step programme maps out a range of activities intended to deliver the OGA's tight gas ambition described in section 4.1. Accountabilities for delivering the various elements of this eight step programme are provided in the following section 5.2.

Programme 1 **Existing tight gas developments**	**Programme 2** **Future tight gas developments**
To promote integrated programmes of work and sharing of best practice amongst operators in the Southern North Sea who are progressing tight gas developments in the short term (next one to two years)	To promote integrated programmes of work and sharing of best practice amongst operators in the Southern North Sea who are progressing tight gas developments in the medium term (next three to five years)
Identify operator tight gas infill, development, appraisal and exploration drilling programmes in the near term	Identify operator tight gas infill, development, appraisal and exploration drilling programmes in the medium term
Promote and facilitate collaboration between operators with tight gas activities and programmes of work in the short term	Promote and facilitate collaboration between operators with tight gas activities and programmes of work in the medium term
Undertake post well evaluations of selected tight gas drilling programmes as a means to share and disseminate lessons learned and best practice	

Programme 3 **Workgroups and industry partnerships**	**Programme 4** **Technology development and deployment**
To establish and work alongside relevant industry workgroups and operators with a specific interest in promoting tight gas developments in the SNS	Through the co-ordinated feedback from industry partnerships and workgroups, identify technology development opportunities that may promote and unlock future tight gas opportunities
Establish and agree a Terms of Reference for a SNS Rejuvenation SIG in partnership with EEEGR	Through the EEEGR SIG, establish relevant business cases for specific technology needs in support of tight gas developments
Establish a Terms of Reference for a Tight Gas industry Work Group under the direction of the EEEGR SNS SIG	Through linkages with OGA's technology team, promote specific technology needs that may receive seed funding through the Technology Leadership Board (TLB) and Oil and Gas Technology Centre (OGTC)
Establish an action plan with clear and specific time bound priorities for the Tight Gas industry workgroup	

Programme 5 **Knowledge sharing and best practice**	**Programme 6** **Co-ordinating the supply chain**
To promote knowledge sharing and the dissemination of best practice amongst operators with an interest in tight gas developments	Ensure the supply chain is aligned with operator priorities and potential developments in the SNS such that capabilities are aligned with demand and costs minimised
Through EEEGR, run a programme of tight gas workshops, intended to promote knowledge transfer between relevant operators with an interest in tight gas developments	Through EEEGR, identify opportunities for collaboration and co-ordination of activities within the SNS
Through EEEGR, run a programme of tight gas hackathons, intended to promote technology transfer between operators and the supply chain	Through an awareness of operator activities and programmes of work, OGA to identify and promote opportunities for rig and logistics sharing
Develop and maintain a Tight Gas Best Practice document to be made available to industry through the OGA website	Through EEEGR, promote awareness of operator activities such that the supply chain may align capacity and capabilities with prospective work programmes

Programme 7 Creating value and improving economics	Programme 8 Communication and stakeholder plans
Reduce development risks and improve project economics for prospective tight gas developments	Raise the profile of tight gas opportunities within the SNS through a coordinated communication plan with relevant stakeholder engagement
Through linkages with the OGA's technology team well cost reduction initiative, establish new benchmark data for SNS drilling costs and extend through to reservoir stimulation operations	Monitor operator activities across the SNS through the OGA's stewardship reviews and industry surveys and identify future development opportunities which may benefit from this Tight Gas Strategy
Categorise tight gas development risks and use the Tight Gas Best Practice document as a means to communicate risk management strategies	Through the OGA communications and external affairs team, promote successes through relevant media channels Through the EEEGR team, promote successes via relevant media channels

5.2 Tight Gas Strategy accountabilities

The following table provides further detail on the required accountabilities required to deliver this Tight Gas Strategy. Accountabilities include internal OGA functions but, also, relevant licence holders and operators, the EEEGR SNS Rejuvenation SIG and, finally, the Tight Gas Work Group.

Role	Accountability	Tight Gas Strategy	Programme 1 **Existing Tight Gas Developments**	Programme 2 **Future Tight Gas Developments**	Programme 3 **Workgroups & Industry Partnerships**	Programme 4 **Technology Development & Deployment**	Programme 5 **Knowledge Sharing & Best Practice**	Programme 6 **Coordinating the Supply Chain**	Programme 7 **Creating Value & Improving Economics**	Programme 8 **Communication & Stakeholder Plans**
OGA Southern North Sea & East Irish Sea. Area Manager	Overall accountability for the SNS Tight Gas Strategy, ensuring appropriate OGA resource and priority is allocated to tight gas opportunities	A	I	I	I	I	I	I	I	I
OGA SNS & EIS Area Team	Stewardship of the licence holders and operators in the SNS, ensuring appropriate focus is applied to tight gas opportunities where relevant		A	A			I			I
OGA Technology Team	Unlocking tight gas developments across the SNS by identifying and promoting the development and deployment of technology and disseminating best practice				I	A	A		A	
OGA Communication and External Affairs Team	Publication of OGA tight gas documents and communication of tight gas success stories across the SNS									A
EEEGR Special Interest Group	Direction and co-ordination of the tight gas work group; hosting and the provision of resource and support for tight gas promotional events				A					A
EEEGR Tight Gas Work Group	Operator and supply chain work group with accountability for ensuring that tight gas priorities are consistent with the needs of industry; identification of focus areas for further development	I				A	A	A		
Licence holders and operators	Investment in tight gas opportunities and subsequent dissemination of lessons learned and best practice		A	A			I			

A Accountable for delivery of a programme element within the tight gas implementation plan

I To be kept informed of actions and activities resulting from a programme element

6. Communication and stakeholder engagement plan

Building on Programme 8 (detailed in section 5), tight gas communications will be agreed and delivered by both the OGA and EEEGR, in support of specific objectives and deliverables. Communications will be co-ordinated to ensure maximum impact as well as ensuring consistent messaging.

Key audiences for any communications associated with this Tight Gas Strategy and any subsequent deliverables include:

- Licence holders and operators with tight gas interests
- Oil & Gas UK Wells Forum
- MER UK Technology Leadership Board
- Oil and Gas Technology Centre
- Organisations with tight gas technology development capabilities
- Supply chain with tight gas deployment and delivery capabilities

7. Review and update of this strategy

Successful implementation of this Tight Gas Strategy requires on-going effort and a willingness to update and adjust direction, as progress is made, feedback is received and new insights are developed. Key activities include the following:

1. The OGA will monitor the status of the various licences and operator led activities which contribute to the overall estimated tight gas opportunity of 3.8 tcf across the SNS

2. The OGA will engage with SNS operators through Tier 2 and Tier 3 OGA's Asset Stewardship reviews and where relevant, will bring focus to any tight gas developments which have the potential to benefit from this strategy and its deliverables

3. The OGA will monitor the delivery of the eight step programme detailed in section 5, ensuring that the programme elements and specific deliverables are clearly communicated and understood

4. The OGA will support and monitor progress made by the SNS Rejuvenation SIG as well as the Tight Gas Work Group. Feedback will be sought and used as the basis for any subsequent adjustments to this strategy

5. Finally, the OGA will act as custodian of this strategy. As a minimum, this document will be subject to annual review, ensuring that it remains relevant and current

8. Terminology and linkages to OGA documents

bcf	Billion cubic feet
C&EA	Communications and External Affairs
EEEGR	East of England Energy Group
EIS	East Irish Sea
MER	Maximising Economic Recovery
OGA	Oil and Gas Authority
OGTC	Oil and Gas Technology Centre
SIG	Special Interest Group
SNS	Southern North Sea
tcf	Trillion cubic feet
TLB	Technology Leadership Board

Asset Stewardship Strategy - https://www.ogauthority.co.uk/media/2836/asset_stewardship_strategy_2016.pdf

Technology Strategy - https://www.ogauthority.co.uk/about-us/ambition-priorities/sector-strategies/

Acknowledgements

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1. SNS Tight Gas Workgroup comprising representation from the following organisations:

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- Premier Oil
- Shell UK
- Baker Hughes

2. Supporting organisations also include:

- East of England Energy Group
- Oil & Gas UK
- Exceed

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