# Oil and gas sector

## 7.1 Introduction

The oil and gas sector was responsible for 0.39 Mt (19%) of methane emissions in the UK in 2002,[63] making it the third largest methane-producing sector. Emissions are from two major sources – venting of methane from rigs and plants during maintenance and leakage from the gas pipeline network. Of these, the latter is by far the most important, accounting for 85% of methane emissions from this sector in 2001.[68] Importantly, venting from rigs is a point source and therefore capturable, whereas leakage from the pipeline network is a diffuse source of methane and therefore can only be reduced, not captured. This is reflected in the large uncertainties of emissions estimates from pipeline leakage (±40%).

Since 1990, the overall consumption of gas in the UK has nearly doubled, rising from 597 TWh to 1104 TWh in 2003[105] (Figure 18).

The increased throughput of gas since 1990 is mainly due to an increase in gas-fired power stations, rather than an increase in domestic and industrial usage, which have remained roughly constant. With the decline of nuclear power coupled with increased electricity demand, gas is likely to form an increasing contribution to UK electricity generation in the foreseeable future.

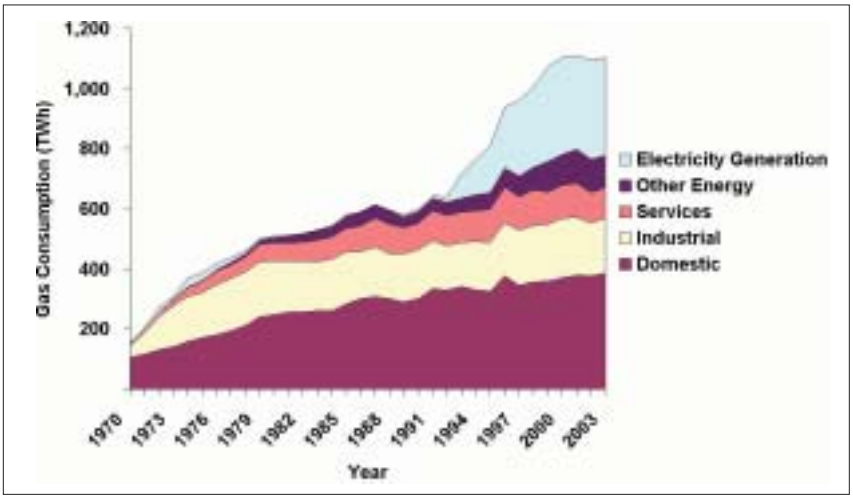


Figure 18: Gas consumption by sector, UK, 1970-2003

Source: DUKES 2004[105]

Therefore methane emissions associated with this sector are becoming progressively more significant.

## 7.2 Sources of methane

### Pipeline leakage

In 2003, it was estimated that 4.5 TWh of gas was lost through leakage.[105] Leakage from pipelines is difficult and costly to eliminate. Individual joints, flanges and seals along the distribution network leak frequently and, although not a major source of methane individually, are cumulatively significant over the whole 275,000 km pipe network.[62] Leakage is greater from traditional cast iron pipes than modern plastic versions.[132]

Most of the methane leakage, perhaps tens of tonnes per year, is from compressor seals in the boosters which are required every 60-100 miles along the pipe network to maintain pressure for transmission. Valve leakage can be very high in older installations.[132]

### Venting from rigs

Methane may be mined independently as natural gas or alongside oil and coal. In 1998, there were a record 204 offshore oil and gas fields in operation (Figure 19). Of these, 109 were producing oil, 79 gas and the rest condensate (a liquid condensed from natural gas).[133] In total, 127 million tonnes of oil and 103 Mt oil-equivalent of natural gas were mined in 2002.[105]

When oil is mined from a rig, it contains a mixture of oil, water and natural gas. This is separated on site by passing the mixture into large settlement tanks, where the three fractions separate by gravity. Gas is removed at the top and water from the bottom, leaving just the crude fraction. After repeating this process several times, the oil is of high purity and can be pumped along a pipeline to shore.

When the tanks need maintenance they must be made safe for human activity; methane is both explosive and a non-pungent asphyxiate. The

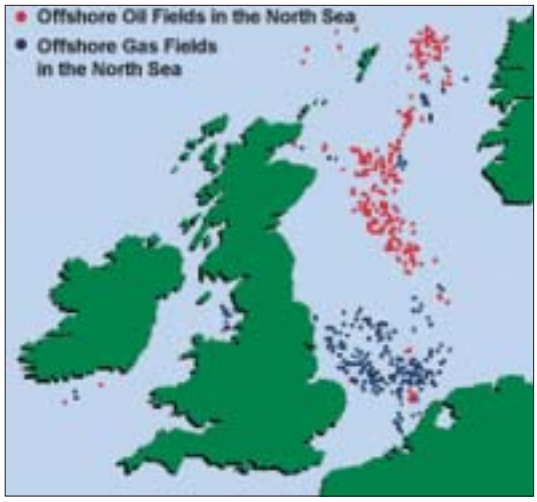


Figure 19: North Sea oil and gas fields

Source: UK Offshore Operators Association, 2002[133]

tanks are sealed off and flushed with water, then nitrogen, followed by air. The latter processes purge methane from the tanks, which were historically vented to the atmosphere. This resulted in significant methane emissions, especially due to the high operating pressure. Gas only rigs must also be purged of methane before work can recommence.[134]

## 7.3 Mitigating methane emissions

### Pipeline leakage

As a diffuse source of methane, capture is not an option. Mitigation of methane emissions from the pipeline network can be achieved simply by replacing old cast iron pipes with modern plastic piping. However, this is a laborious and costly process, involving labour-intensive construction work. Despite gains in operating efficiency to be made by minimising leaks, the relatively low cost of gas, especially compared to the cost of upgrades, means there is little economic incentive to do so. Even with the likely rise in gas prices over the coming years as the UK becomes more reliant on fossil fuel imports, fuel price alone is unlikely to encourage network investment.

### Venting from rigs

As a point source, capturing methane from rigs is more straightforward. By flaring instead of simply venting to the atmosphere, carbon dioxide is emitted in place of the more potent methane. This tends to be the most common method used to deal with the methane. Alternatively, all greenhouse gas emissions can be avoided by passing the aqueous and gaseous by-products from the tank back into the well during maintenance, thereby sequestering the greenhouse gases that would otherwise be emitted to the atmosphere. This methane does not remain sequestered: it is mined again when the rig is operational once more.[134]

## 7.4 Existing UK policies

In the UK, there are few policies or regulations in place that address natural gas leakage from pipes or even leakage monitoring. National Grid Transco operate the pipeline network and are responsible for its maintenance and attending to leaks. Transco spends an average of £600m per year on maintenance, of which £335m is spent on pipeline replacement. Transco is also mandated by the Health and Safety Executive to replace iron pipelines that lie within 30m of any property; a programme that will take place over 30 years. This, however, is a safety issue rather than active greenhouse gas abatement.

Leakage rates from the natural gas transmission and distribution network have improved as a result of a number of efforts: replacing old cast iron pipework, gas conditioning, pressure management and a mains and service replacement programme.[135, 136] Emissions have reduced by 14% (for the period 1990-2001)[135] against a target of 20% by 2000 (relative to 1992 levels).[136] In line with this, Transco revised its internal target to reduce leakage, in absolute terms, by 12.5% from 1990 levels by the year 2010, citing increased throughput as the reason for revision of the 20% target. It does, however, aim to overachieve this target by 7.5% by that date.[136]

Encouraged by the UK Emissions Trading Scheme (UK ETS), significant advances have been made in reducing methane emissions from oil and gas rigs. Companies such as Shell and BP have been able to trade carbon credits gained from capturing methane that would have otherwise been released into the atmosphere.

Both BP and Shell have also developed their own internal trading schemes in advance of both the UK and EU ETS. Pilot trading of greenhouse

*Carbon trading has encouraged the capture of methane emissions from oil and gas rigs*

gases was started by BP between its own sectors and installations in 1999, going company wide in 2000.[137] Internal trading allows companies to institutionalise the concept of a cost associated with environmentally damaging emissions, reinforce a culture of environmental accountability and develop trading skills to prepare for the emerging international marketplace. As a business practice it also allows a company to allocate capital to initiatives which have the greatest impact at lowest cost.[138]

## 7.5 Recommendations

### Pipeline leakage

Although leakage rates have reduced over the last ten years, methane emissions from gas pipelines are still significant and becoming more so with the growth in gas consumption. One of the major obstacles to achieving reductions in this area is the poor quality of data. Historically, pipeline leakage has been primarily a safety issue but with growing awareness about the environmental impact of methane emissions, quantification has become more important. Without a reliable baseline, there is uncertainty regarding the extent of the problem and no standard against which to evaluate any measures taken to mitigate emissions. Therefore, one of the first steps needs to be improved monitoring and data collection.

Regular, cost effective programmes for detecting, prioritising, and repairing leaks across all sectors of the gas industry – production, processing, transmission and distribution – are required. Monitoring equipment could be installed as part of the ongoing maintenance and upgrade of the gas pipeline network with a particular focus on boosters, since this is where the majority of leaks occur. This would enable more effective detection as well as more accurate quantification of gas leaks.

Although leakage represents a loss in revenue to the industry, the relatively low cost of gas means the economic incentive to achieve emissions reductions is weak. Safety tends to be the main concern at present. Minimisation of pipeline leakage is therefore more likely to be underpinned by environmental concerns and implemented through policy instruments rather than on an economic basis.

The industry would benefit from a focus on cost effective technologies and practices that improve operational efficiency and reduce emissions of methane. The USA's Natural Gas STAR Programme encourages the natural gas industry to reduce emissions through market-based activities that are both profitable for industry partners and beneficial to the environment.[139] This has introduced a range of best management practices to achieve emissions reductions at all stages of the gas production-distribution cycle. Opportunities and options to reduce leaks and venting from the largest sources were jointly identified by EPA and gas industry representatives and it is intended to reproduce these solutions across all sectors.

Trading could prove a strong driver towards

lower methane emissions provided additionality of the savings can be shown. Those reductions already required through legislation under the Health and Safety Executive would not qualify as additional and therefore could not be traded. Also, the lack of reliable data means there is a risk of introducing 'hot air' into the trading scheme where the gas industry could be rewarded for apparent reductions due to statistical error rather than 'real' savings. However, it is debatable as to whether the industry should be rewarded for carrying out repairs that should be done as a matter of course. It is Ofgem's responsibility to ensure the necessary investment in pipeline infrastructure is made and maintained in the long term. Direct legislation through, for example, mandatory standards for leakage, is required to secure further emissions reductions. Improved data would also help in monitoring and enforcing such targets.

**Venting from rigs**

Emissions trading has proved effective in encouraging methane capture from rigs. However, with the cessation of the UK ETS in 2006, the opportunity for trading methane will be lost, at least for two years until the EU ETS review. This results in a dilemma for the UK Government: to either legislate to encourage methane capture and underpin the savings already made or wait for two years until trading can recommence. Any legislation must ensure that methane reductions can still be classed as additional so as not to undermine the market for trading in the future.