

# Unconventional gas and fracking

## Friends of the Earth Scotland Policy Briefing

March 2013

### Summary

The industry likes to talk about unconventional gas as the answer to our energy needs: plentiful, cheap and clean. It is increasingly apparent however that not only are there are inherent environmental and health risks associated with onshore coalbed methane and shale gas extraction, but that unconventional gas is certainly not going to be a game changer for energy supply in Europe. The recoverable resource is small, extraction is expensive and climate emissions are likely to be much higher than North Sea gas. Far from being plentiful, cheap and clean, the reality is that unconventional gas in Scotland can only ever be **scarce, expensive and dirty**.

In Scotland the industry is moving rapidly from infancy to commercial extraction. DECC's plans for tendering a vast area of Scotland for exploration are currently on hold due to an inadequate Strategic Environmental Assessment process. Friends of the Earth Scotland is very concerned that developments are rolling out ahead of a proper review of the full lifecycle impacts and adequacy of the planning and environmental regulatory framework to deal with the new techniques used to extract onshore coalbed methane and shale gas. What is more, it is clear that extracting and burning this gas will seriously jeopardise our ability to meet climate targets.

It is very welcome that unconventional gas does not form part of the Scottish Government's energy generation strategy. However we consider that an outright ban, or at the least, a moratorium on any further unconventional gas extraction, at least until the key issues highlighted in this briefing have been resolved, is necessary to safeguard communities and the environment.

### Unconventional gas & fracking

The UK has significant reserves of unconventional gas trapped inside shale rock and coal seams, however there is considerable uncertainty as to how much of the resource is recoverable.<sup>1</sup> In Scotland, the largest onshore unconventional gas reserves are coalbed methane found across the central belt, Fife and Scottish Borders, with some shale deposits in the Forth Valley.

Hydraulic fracturing, or 'fracking', is a controversial technique often used to exploit unconventional sources of gas, such as shale gas and coal bed methane. It is an expensive process that is only economically viable when the price of fossil fuels are high. It involves drilling up to several kilometres deep and pumping gallons of water, proppants<sup>2</sup> and toxic chemicals under high pressure into the borehole to open up fractures and ease the flow of gas for extraction.

### Environmental risks

There has been a great deal of focus in the media on the impacts of shale gas extraction and fracking, and there is a tendency to use these terms interchangeably, as shale gas drilling always involves fracking.

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<sup>1</sup> The British Geological Survey estimate the UK's recoverable shale gas reserve at 150 billion cubic meters (bcm) or 1.5 years current consumption, and coalbed methane resource at 2,900 bcm, emphasising that there is considerable uncertainty as to how much of that resource is recoverable.

<sup>2</sup> To hold open the fractures. Proppants can be sand treated with resin, glass, ceramics or bauxite

Coalbed methane extraction does not always involve fracking – at least not in the early years of an operation. But as gas flow starts to decline after a few years, wells are often fracked to increase productivity. In Australia where coalbed methane (known as coal seam gas) is more developed, the industry estimates that up to 40% of wells end up being fracked.<sup>3</sup>

However, there are serious environmental problems associated with coalbed methane extraction regardless of whether fracking takes place. The chemicals used in drilling muds can be just as toxic as those used in fracking fluids, and the same risks of spillages, leakages and mobilisation of naturally occurring chemicals and radioactive substances apply. In fact, because coalbed methane is significantly shallower than shale gas certain risks, such as groundwater contamination, are increased.

Key environmental risks of unconventional gas extraction include:

- **Climate change**

Energy companies are keen to promote unconventional gas as ‘natural gas’, claiming that it is cleaner than conventional fossil fuels. However, unconventional gas extraction is considerably more energy intensive than conventional gas extraction, and the added risk of methane – a highly potent greenhouse gas – leakage means it is far from being a clean source of energy.

Using a very conservative estimate of well-to-burner emissions from unconventional gas, the International Energy Agency’s ‘Golden Age of Gas’ scenario puts global emissions on a trajectory for 3.5° warming.<sup>4</sup> Research from the USA indicates that gas obtained through fracking could have a bigger total greenhouse gas footprint than coal.<sup>5</sup> One recent study from Australia found almost half the wells in coal seam gas fields to be leaking,<sup>6</sup> and another found that methane was leaking at around 3.5 times the level expected.<sup>7</sup>

- **Renewables**

Independent research demonstrates that Scotland could meet all our electricity needs from renewable sources and phase out fossil fuel generation by 2030.<sup>8</sup> The renewables industry in Scotland is a valuable growth area, with over 11,000 jobs in 2011-12.<sup>9</sup> However, the IEA and other leading commentators suggest a dash for unconventional gas could prove a serious distraction from badly needed investment in clean renewable energy and energy efficiency, and see us locked into expensive, carbon-intensive infrastructure for years to come.

- **Water environment**

To extract coalbed methane the developers must de-water the seam by drilling vertically and horizontally (for up to 1km) and pumping out vast quantities of water that has been in contact with coal for centuries. Waste water from coalbed methane developments is extremely salty, and has been found to contain not only harmful chemicals from the drilling fluids used by operators, but also naturally occurring and highly toxic BTEX (benzene, toluene, ethylbenzene and xylenes) chemicals amongst which are known carcinogens, and naturally occurring radioactive materials. Vast quantities of contaminated water must be treated and disposed of. Evidence is emerging from Australia that existing treatments are not capable of removing all the toxins found in CBM

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<sup>3</sup> [Australian National Greenhouse Accounts, Coal Seam Gas Estimation and Reporting of Greenhouse Gas Emissions 2012, http://www.climatechange.gov.au/climate-change/emissions/~media/climate-change/emissions/factsheets/NGA-FactSheet-7-CoalSeamGas-20120430-PDF.pdf](http://www.climatechange.gov.au/climate-change/emissions/~media/climate-change/emissions/factsheets/NGA-FactSheet-7-CoalSeamGas-20120430-PDF.pdf)

<sup>4</sup> International Energy Agency, Are We Entering a Golden Age of Gas? 2011 <http://www.worldenergyoutlook.org/goldenageofgas/>

<sup>5</sup> Howarth and Ingraffea, Methane and the greenhouse-gas footprint of natural gas from shale formations, Cornell University 2010 <http://frackfreescotland.files.wordpress.com/2012/09/howarth-et-al-2011.pdf>, and, Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al. 2012 <http://frackfreescotland.files.wordpress.com/2012/09/howarth-et-al-response-to-cathles-2012.pdf>

<sup>6</sup> Queensland Government Investigation Report 2010, Leakage testing of coal seam gas wells in the Tara ‘rural residential estates’ vicinity [http://mines.industry.qld.gov.au/assets/petroleum-pdf/tara\\_leaking\\_well\\_investigation\\_report.pdf](http://mines.industry.qld.gov.au/assets/petroleum-pdf/tara_leaking_well_investigation_report.pdf)

<sup>7</sup> [http://www.scu.edu.au/news/media.php?item\\_id=6041&action=show\\_item](http://www.scu.edu.au/news/media.php?item_id=6041&action=show_item)

<sup>8</sup> Power of Scotland Secured, 2010, <http://www.foe-scotland.org.uk/power-secured>

<sup>9</sup> <http://www.scottishrenewables.com/scottish-renewable-energy-statistics-glance/>

wastewater.<sup>10</sup> Extracting water from coal seams can also lead to the serious depletion of ground water.<sup>11</sup>

- **Human and animal health**

Researchers in the USA looked at the impacts of gas drilling on human and animal health, and warned that the gas boom was an uncontrolled health experiment on an enormous scale.<sup>12</sup> The study uses animals exposed to fracking and drilling fluids as sentinels to predict the possible impacts on human health. The authors also make a plea for badly needed research on the likelihood and impact of these chemicals entering the food chain via animal products.

Communities living near gas fields in Australia complain of respiratory problems, rashes and irritated eyes.<sup>13</sup> But the long-term human health impacts could be much more serious: research from the USA found that gas operations were leaking highly toxic and carcinogenic benzene into the air.<sup>14</sup>

- **Soil contamination and livestock**

Spillages and leakages of drilling and fracking fluids can lead to death of and reproductive problems in livestock, and the contamination of agricultural land. In one case 17 cows died within an hour of the release of fracking fluid from a drilling rig into the adjacent pasture. In another, where goats were exposed to leaked fluids from a faulty tank valve they suffered reproductive problems for two years.<sup>15</sup> BTEX chemicals – naturally occurring in coal seams and shale, and mobilised by the drilling process – are notorious soil contaminants.

Concerns about the impact of soil and water contamination on farming have been a key factor in the discussion of bans and moratoria on fracking in Europe and around the world, particularly in France and the famous wine producing Rioja region in Spain.

- **Earthquakes**

A 2011 report commissioned by Caudrilla following earth tremors measuring 1.5 and 2.3 on the Richter scale at their shale site in Bowland, Lancashire confirmed that fracking was the likely cause.<sup>16</sup> Probably the most important risk associated with earth tremors of this low magnitude is that of damage to the borehole casing, leading to increased risks of fugitive methane emissions and leakages of fracking fluid and wastewater.

However scientists have recently linked a 2011 earthquake in Oklahoma measuring 5.7 on the Richter scale, which injured 2 people and destroyed 14 homes, to hydraulic fracturing processes.<sup>17</sup> Researchers from University of Oklahoma, Columbia University and the US Geological Survey found that wastewater (from nearby conventional oil wells) injected into the rocks for disposal was the likely cause of the earthquake, and point to the consequences for the unconventional gas industry which relies on injection of fluid into rocks as part of the hydraulic fracturing process. The US Geological Survey have linked a significant increase in seismic activity in central USA to the injection of wastewater into rocks: between 1970-2000 there were an average of 21 earthquakes a year; this increased to 50 in 2009, 87 in 2010 and 134 in 2011.<sup>18</sup>

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<sup>10</sup> National Toxics Network submission to New South Wales Inquiry into Coal Seam Gas, September 2011, <http://www.ntn.org.au/wp/wp-content/uploads/2011/11/NTN-submission-to-the-NSW-Inquiry-Into-Coal-Seam-Gas3.pdf>

<sup>11</sup> "The drawdown of ground water heads within coal seam gas aquifers is a necessary process and an unavoidable impact associated with the de-pressurisation of the coal" Groundwater (Deep Aquifer Modeling) for Santos GLNG Project – Environmental Impact Statement, 31/3/2009

<sup>12</sup> Bamberger and Oswald, Impacts of Gas Drilling on Human and Animal Health, 2012, *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy* <http://baywood.metapress.com/link.asp?id=661442p346j5387t>

<sup>13</sup> <http://www.smh.com.au/national/health/doctors-raise-alarm-over-toxic-coal-seam-gas-leaks-20121116-29hbp.html>

<sup>14</sup> <http://frackfreescotland.files.wordpress.com/2012/10/nature-vol-482-feb-2012-air-sampling-reveals-high-emissions-from-gas-field.pdf>

<sup>15</sup> Bamberger & Oswald

<sup>16</sup> <http://www.cuadrillaresources.com/about-us/communication-claims-support/geomechanical-study/>

<sup>17</sup> Keranan et al, 2013 <http://geology.gsapubs.org/content/early/2013/03/26/G34045.1.abstract?cited-by=yes&legid=geology;G34045.1v1>

<sup>18</sup> [http://www2.seismosoc.org/FMPro?-db=Abstract\\_Submission\\_12&-sortfield=PresDay&-sortorder=ascending&-sortfield=Special+Session+Name+Calc&-sortorder=ascending&-sortfield=PresTimeSort&-sortorder=ascending&-](http://www2.seismosoc.org/FMPro?-db=Abstract_Submission_12&-sortfield=PresDay&-sortorder=ascending&-sortfield=Special+Session+Name+Calc&-sortorder=ascending&-sortfield=PresTimeSort&-sortorder=ascending&-)

- **Cumulative impact**

Like any industrial development, coalbed methane and shale projects have numerous local environmental and community impacts such as noise from drilling, site traffic and landscape impacts. Moreover, each coalbed methane and shale development requires tens or even hundreds of wells, so the cumulative local environmental and landscape impacts for each project can be very significant. It also means that the likelihood of something going wrong – such as a well blow out or chemical spillage – is considerably greater.

## **Economic impacts**

It is not yet clear whether unconventional gas extraction is actually economically viable. Deutsche Bank has warned that shale gas is not a game changer in Europe,<sup>19</sup> and Scottish and Southern Energy have echoed this view in relation to Scotland.<sup>20</sup> Evidence is emerging from the USA to suggest that the industry has vastly overestimated reserves and could be the next sub-prime bubble waiting to burst.<sup>21</sup> It is clear however that unconventional gas extraction in Scotland will not lead to cheap energy bills: Dart Energy's sales agreement with SSE is linked to prevailing market prices.<sup>22</sup> Further, the industry is unlikely to create any great number of jobs in Scotland. Dart only estimate a maximum of 20 jobs in total for their potentially vast Airth project.

Any economic benefits of unconventional gas extraction are likely to be significantly outweighed by the numerous dis-benefits. In the USA householders living near gas drilling sites are seeing impacts on their property prices, and ripples are already being felt in Scotland, with house builders Cala and Persimmon objecting to Dart Energy's coalbed methane plans at Letham Moss near Airth because of its proximity to their developments. Network Rail have objected to the same development for fear of the risk of explosions from the gas pipelines. Fracking is known to cause earth tremors that – while unlikely to be felt by people – risks disrupting fragile equipment such as in data centres. These combine with the potential economic impacts of soil contamination on agriculture and tourism, the placing of hundreds of well-heads in the countryside, and the cost of human health impacts.

- **Dart Energy**

Dart Energy is the leading unconventional gas developer in Scotland, and its Airth coalbed methane project is the most advanced in its global portfolio. The company has seen its share prices plummet over the last 6 months following legal disputes with communities over its Fullerton Bay project in New South Wales, and in April 2013 announced suspension of all Australian activities, and cuts of 70% of its global workforce.<sup>23</sup> This followed the introduction of a state-wide ban on coal seam gas extraction within 2km of residential areas,<sup>24</sup> and a new low in share prices, which dropped to 6 Australian cents on 2 April.<sup>25</sup> We are concerned for the company's financial resilience in the face of any spillages or leaks at its Scottish sites.

We are also concerned with Dart Energy's public inconsistency over plans to frack for shale gas in central Scotland. The company consistently talks up shale prospects within Petroleum Exploration and Development License 133 – which also contains the Airth coalbed methane project – to shareholders, whilst telling the local community and journalists that it has no plans to frack or exploit shale.<sup>26</sup>

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<sup>19</sup> Deutsche Bank 2011 [http://www.shalegas-europe.eu/en/docs/Deutsche\\_Bank\\_Report.pdf](http://www.shalegas-europe.eu/en/docs/Deutsche_Bank_Report.pdf)

<sup>20</sup> <http://news.sse.com/listing/2013/03/blog-is-shale-gas-a-%27game-changer%27-for-the-uk-market/>

<sup>21</sup> [http://www.huffingtonpost.co.uk/dr-nafeez-mosaddeq-ahmed/the-frack-farce\\_b\\_2299554.html](http://www.huffingtonpost.co.uk/dr-nafeez-mosaddeq-ahmed/the-frack-farce_b_2299554.html) and <http://shalebubble.org/drill-baby-drill/>

<sup>22</sup> <http://www.dartenergy.com.au/content/Document/Expanded-Gas-Sales-Agreement-for-UK-CBM.pdf>

<sup>23</sup> <http://clients.weblink.com.au/clients/dartenergy/article.asp?asx=DTE&view=2728430>

<sup>24</sup> [http://www.resources.nsw.gov.au/\\_data/assets/pdf\\_file/0008/458018/TOUGH-NEW-RULES-FOR-COAL-SEAM-GAS-ACTIVITY.pdf](http://www.resources.nsw.gov.au/_data/assets/pdf_file/0008/458018/TOUGH-NEW-RULES-FOR-COAL-SEAM-GAS-ACTIVITY.pdf)

<sup>25</sup> <http://www.asx.com.au/asx/research/companyInfo.do?by=asxCode&asxCode=dte>

<sup>26</sup> See Dart Energy's annual and quarterly report at

[http://www.dartenergy.com.au/page/Investor\\_Relations/Annual\\_Reports/](http://www.dartenergy.com.au/page/Investor_Relations/Annual_Reports/) and Sunday Herald report at

<http://www.heraldsotland.com/news/environment/revealed-secret-scots-fracking-plans.20661744>

**FoES Position**

We are extremely concerned that this industry is being allowed to roll out ahead of a thorough review of the environmental and health impacts, and of the adequacy of the regulatory and planning framework to deal with these risks.

We are also clear that even if it was safe to extract this gas (and it is increasingly clear that it is not) it isn't safe to burn it in. Investing in unconventional gas now will lock us into to dangerously high greenhouse gas emissions and make it extremely difficult to meet our world leading, legally binding carbon reduction targets in 2050.

Friends of the Earth Scotland is calling on the Scottish and UK Governments to suspend all ongoing unconventional gas activities, and put in place a moratorium on any new projects, until these problems are fully addressed.

The industry is in its infancy in Scotland, so now is the time to act. Dart Energy's Airth CBM project is their flagship European development, and one of the most advanced unconventional gas project in the UK. The people of Airth and the surrounding area are understandably concerned about the prospect of being guinea pigs for this uncertain industry. Scotland does not need unconventional gas and Scotland's climate policy cannot afford it. Decisive action by the Scottish Parliament and Government could ensure that we do not needlessly go down a route that will wreck our climate commitments, and blight communities and our countryside for many years to come.

**For more information contact:**

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## **Appendix 1: What is happening in Scotland?**

There are currently a number of areas in Scotland licensed for onshore oil and gas exploration and development. Dart Energy operated 4 licenses and Reach Coal Seam Gas operate 1.

### **Airth**

The most advanced unconventional gas development is at Letham Moss, near Airth, where Dart Energy is using horizontal and vertical drilling techniques (but not currently fracking) to extract coalbed methane. This pilot project is Dart's most advanced European venture, and produced its first electricity from the site earlier this year. Still at the testing stage, the project already has 16 wells drilled.

In September 2012 Dart submitted planning applications to Falkirk and Stirling Councils for 22 new wells at 14 sites, a waste water treatment facility and a network of pipelines to take the development to its commercial production phase. However, this phase of the project will access 10 - 20% of the resource in the license area which Dart plan to exploit in coming years.<sup>27</sup> Simple maths indicates that the immediate area could see a further 100 wells in the coming years if Dart's plans go ahead.

In March 2013 Falkirk and Stirling Council requested a second 2-month extension, until 7 May to decide the application.

This license area covers 329km<sup>2</sup> and also contains shale deposits which Dart, under the terms of their license from DECC, are obliged to explore.

### **Canonbie**

The second most advanced project is at a Canonbie, in Dumfries and Galloway near the Scottish border, and is also operated by Dart Energy (who bought out Greenpark Energy's license in early 2012). Again, while still in the testing stage, over 19 wells have been drilled. The company has permission from SEPA to frack for coalbed methane at this development, however the development appears to have stalled, possibly as Dart focuses attention on its Letham Moss project.

This development has highlighted a worrying loophole whereby companies exploiting coalbed methane can apply to SEPA for permission to frack after planning permission has been granted for CBM meaning that there is no opportunity for the local authority or community to be properly consulted on the use of the technique in their area.

### **Midland Valley**

Dart Energy also have 2 licenses in Fife areas both of which are in the very early stage of exploration. In one of these license areas Dart has drilled an exploratory well and are obtaining seismic data to assess potential.

Reach Coal Seam Gas have a license that covers a large area mainly in Lanarkshire. This license is also in the early stages of exploration with one exploratory well drilled.

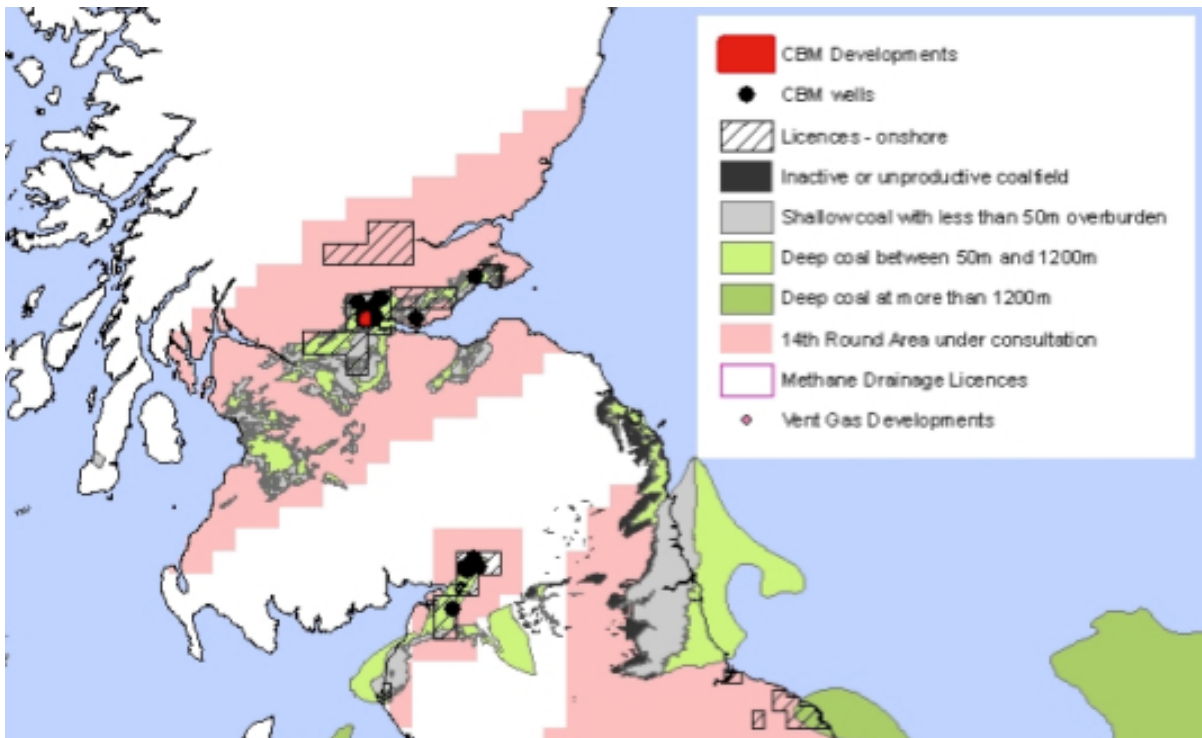
### **Rest of Scotland**

The UK Department for Energy and Climate Change (DECC)'s plans for tendering the 14<sup>th</sup> round of onshore licensing are currently on hold due to an inadequate Strategic Environmental Assessment process. However, the area for which they conducted the SEA covered a vast swathe of central Scotland, will be potentially be put out to tender for gas and oil exploration (see area in pink on map).

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<sup>27</sup> <http://www.naturalgaseurope.com/dart-announces-first-cbm-electricity>





## Appendix 2: Moratoriums and bans around the world

A number of countries and states already have moratoria or bans in place including:

- France: First country to ban March 2011
- Denmark: Moratorium at least until the end of 2013.
- Germany: Moratorium in Northrhine-Westphalia
- Bulgaria: Ban since January 2012
- Romania: Moratorium announced May 2012
- Czech Republic: Moratorium in May 2012 considering outright ban
- Spain: La Rioja region is currently considering implementing a ban on fracking
- Quebec: Moratorium pending environmental review
- Vermont: Banned in May 2012
- New South Wales: Ban on any coal seam gas activity within 2km of residential areas, Feb 2013.<sup>28</sup>
- Ireland: 2-year moratorium in March 2013

<sup>28</sup> [http://www.resources.nsw.gov.au/\\_data/assets/pdf\\_file/0008/458018/TOUGH-NEW-RULES-FOR-COAL-SEAM-GAS-ACTIVITY.pdf](http://www.resources.nsw.gov.au/_data/assets/pdf_file/0008/458018/TOUGH-NEW-RULES-FOR-COAL-SEAM-GAS-ACTIVITY.pdf)