



**Friends of
the Earth
Scotland**

**Friends of the Earth Scotland
Statement of Case in Planning Permission Appeal PPA-240-2032**

COAL BED METHANE PRODUCTION, INCLUDING DRILLING, WELL SITE ESTABLISHMENT AT 14 LOCATIONS AND ASSOCIATED INFRASTRUCTURE AT LETHAM MOSS, FALKIRK FK2 8RT Falkirk (P-12-0521-FUL) and Stirling (12/00576/FUL)

1. Introduction

- 1.1 This statement is submitted on behalf of Friends of the Earth (FoE) Scotland; FoE Falkirk; FoE Stirling; and supported by Transition Stirling.
- 1.2 Friends of the Earth Scotland is an independent Scottish charity with a network of thousands of supporters, and active local groups across Scotland. FoE Stirling and FoE Falkirk are semi-autonomous local groups of FoE Scotland. We are part of Friends of the Earth International, the largest grassroots environmental network in the world, uniting over 2 million supporters, 76 national member groups, and some 5,000 local activist groups - covering every continent. We campaign for environmental justice: no less than a decent environment for all; no more than a fair share of the Earth's resources.
- 1.3 *'UG exploitation and production may have unavoidable environmental impacts. Some risks result if the technology is not used adequately, but others will occur despite proper use of technology. UG production has the potential to generate considerable GHG emissions, can strain water resources, result in water contamination, may have negative impacts on public health (through air and soil contaminants; noise pollution), on biodiversity (through land clearance), food supply (through competition for land and water resources), as well as on soil (pollution, crusting).'* UNEP Global Environmental Alert System 2012¹
- 1.4 Dart Energy's application for commercial coalbed methane at Letham Moss is the most advanced project of its kind, not just in Scotland, but in the UK. There is a growing body of evidence from countries where the industry is more developed that the environmental and health risks associated with onshore unconventional gas extraction, including coalbed methane, are inherent and impossible to eliminate.
- 1.5 Friends of the Earth Scotland is concerned that the industry in Scotland is moving from infancy to commercial extraction ahead of a proper review of the full lifecycle environmental and health impacts and adequacy of the regulatory framework to deal with the new techniques used to extract onshore coalbed methane and shale gas in the Scottish context.

¹ UNEP Global Environmental Alert System 2012, Can we safely squeeze the rocks? http://www.unep.org/pdf/UNEP-GEAS_NOV_2012.pdf

- 1.6 What is more, it is argued that extracting and burning this gas will seriously jeopardise Scotland's ability to meet legally binding targets under the Climate Change(Scotland) Act 2009.
- 1.7 There are significant research gaps in relation to the impacts of these techniques and conflicting results between some existing studies. Some studies do not clearly differentiate between results from shale gas fields and CBM fields, or between CBM fields / wells where fracking has been used or not, for example by examining the health impacts of drilling and fracking chemicals as one.
- 1.8 However, the precautionary principle requires that lack of scientific certainty must not be used as a reason for not preventing potential harm to the environment: *"In order to protect the environment, the precautionary approach shall be widely applied by States ... Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."* (1992 Rio Declaration on Environment and Development).
- 1.9 We consider that there is a sufficient body of indicative evidence of environmental and health impacts (much of which is referred to below) to support an outright rejection of Dart Energy's application on the basis of the precautionary principle amongst other considerations. Therefore we call on the DPEA to refuse Dart Energy's application.

2. Application background

- 2.1 The current appeal relates to an application for commercial coalbed methane extraction at Letham Moss, Airth. The application crosses local authority boundaries with 11 new well sites, water outflow pipe and further drilling at 2 existing well sites in the Falkirk area; and 3 new well sites plus a gas delivery and water treatment facility in the Stirling area. The application constitutes a major development and requires an EIA under Schedule 2 of the Environmental Impact Regulations (Scotland) 2011. Falkirk Council took a lead in determining the application, and both Councils now deem the application to have been refused.
- 2.2 Dart Energy submitted a pre-application notice on 26 April 2012 to Falkirk and Stirling Councils, held 5 community exhibitions that summer and submitted the planning application on 7 September of the same year. On 20 December 2012 Falkirk Council requested an extension to decide the application until 7 May 2013. On 4 January 2013 Dart agreed to an extension of 7 March 2013. On 1 March 2013 Falkirk Council returned to Dart to again request an extension until 7 May 2013, which Dart agreed to. On 14 March 2013 Falkirk Council commissioned environmental consultants AMEC to undertake a peer review of the environmental statement. Dart wrote to Falkirk Council on 3 April 2013 expressing concern at the timescale for determining the application. On 3 May 2013 Falkirk Council requested a further extension until 7 July 2013, to which Dart responded agreeing an extension until 31 May. On 20 May 2013 AMEC's initial review of the Environmental Statement and questions relating to it were sent to the applicant, and on 5 June 2013 Dart appealed to Scottish Ministers on the grounds of non-determination, enclosing a response to AMEC's review.
- 2.3 This current application is the latest in a number of related applications in the Letham Moss / Airth area and broader Petroleum Exploration and Development License ('PEDL') 133 area, which covers 330km² around the mouth of the Firth of Forth.
- 2.4 Australian Securities Exchange registered, Singapore headquartered Dart Energy bought out Stirling based Composite Energy (formerly Coal Bed Methane Ltd, formerly the Hillfarm Coal Company Ltd) in 2011, and inherited PEDL 133, 161 and 163. Composite Energy and its predecessors had already drilled 15 wells in the Airth area, and Dart drilled a further 1

following the takeover. Two existing well sites operated by Dart Energy are within the current application boundary. Together with the proposed 9 production and 5 surface to in seam (SIS) wells, the development could produce in the region of 10 to 15 billion cubic feet (bcf) of coalbed methane gas over the 25-30 year planned lifespan of the wells.

- 2.5 Dart Energy entered a 5-year gas sales agreement with Scottish and Southern Energy (SSE), which owns and operates the local gas grid infrastructure, in August 2011. The agreement was expanded in March 2012 to allow for the delivery of incremental volumes of gas up to a maximum of around 60 bcf, a figure which comes close to possible reserves² in PEDL 133, although the deal has no minimum delivery requirement.
- 2.6 We note that the method of extraction proposed by the applicant is de-pressuring the coal seams by de-watering, rather than the controversial hydraulic fracturing (or 'fracking') technique commonly used in unconventional gas operations.³ It is our understanding that hydraulic fracturing is often used on coalbed methane wells as gas flow starts to decline. We note that the most of key environmental impacts associated with coalbed methane extraction occur whether or not hydraulic fracturing is employed.⁴ However, while the Joint Statement of Common Understanding between the appellant and Councils includes a proposed planning condition restricting the techniques to be employed under this application to de-watering, this does not rule out future applications to vary planning permission or for additional wells within the license area where hydraulic fracturing could be employed.
- 2.7 Airth is understood to be Dart Energy's global flagship project, and the most advanced unconventional gas development in the UK. If the application goes ahead, Dart indicate the site will be in operation over the next 25-30 years.
- 2.8 FoE Scotland wish to present evidence climate change and climate change policy. In addition to leading the witnesses set out in Appendix 1, FoE Scotland would intend to lead Concerned Communities of Falkirk (CCoF) witnesses in the area of climate change and public health. FoE Scotland also wish to cross-examine the other parties' witnesses on national and local policy (including planning policy), public health, but do not intend to lead evidence on those matters.

3. Climate change

- 3.1 Climate change is the greatest threat humankind has ever faced. The Intergovernmental Panel on Climate Change has reported with greater certainty and scientific consensus than ever before that "warming of the climate system is unequivocal" and that "human influence has been the dominant cause of the observed warming since the mid-20th century".⁵ Global warming of 2°C or more will cause devastating impacts, including an increase in extreme weather events, sea level rises, and the destruction of livelihoods of communities and even

² Net CBM '3P' reserves in PEDL 133 are 72 bcf http://www.dartgas.com/page/Europe/United_Kingdom/PEDL133/. See http://www.spe.org/industry/docs/PRMS_Guidelines_Nov2011.pdf for definitions of oil and reserves.

³ In Australia where coalbed methane (known there as coalseam gas) is more developed, the industry estimates that up to 40% of wells will end up being fracked. 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>

⁴ A key difference in environmental impacts where hydraulic fracturing is employed is regarding increased strain on water resources due to the use of large volumes of water injected into coal seams during the process.

⁵ IPCC Fifth Assessment Report: Climate Change 2013 Working Group I Report "The Physical Science Basis" http://www.climatechange2013.org/images/uploads/WGI_AR5_SPM_brochure.pdf

entire countries.⁶ The world's nations agreed in the Copenhagen Accord to keep climate change below 2°C in order to prevent dangerous interference with the climate system.⁷

- 3.2 The primary human driver of climate change is the combustion of fossil fuels, and contrary to Dart's assertion that this application is for a "clean fuel source", coalbed methane is a fossil fuel and burning it will contribute to climate change. Analysis by the Carbon Tracker Initiative⁸, an NGO which aims to improve the transparency of embedded carbon in equity markets, shows that in order to have a reasonable chance of staying below 2°C warming, 80% of the world's proven fossil fuel reserves must not be burned unabated.⁹
- 3.3 Using a conservative estimate of additional emissions, the International Energy Agency's (IEA) 'Golden Age of Gas' scenario – which assumes increased exploitation of global unconventional gas reserves – puts global emissions on a trajectory for 3.5°C warming.¹⁰ The IEA admits "*we are not saying that it will be a golden age for humanity - we are saying it will be a golden age for gas.*"¹¹
- 3.4 Moreover, the impact of 'fugitive emissions' through leakage, in addition to flaring and venting has led scientists to argue that the climate impact of unconventional gas is greater than that of conventional natural gas, and some to suggest it could be as bad as coal. Methane is a much more powerful greenhouse gas than carbon dioxide, with a global warming impact 86 times that of carbon dioxide over 20 years, and 34 over 100 years, according to the latest IPCC report.¹² The important point with methane gas is that while it has a relatively short lifespan, its potency in the short term make necessary overall greenhouse gas emissions reduction targets harder to meet.
- 3.5 As with conventional oil and gas operations, leaks can occur at wellheads, pumps, pipelines and associated gas treatment infrastructure. Evidence from around the world indicates that a certain amount of leakage via these routes is practically inherent to the industry, and in theory, these sources of leakage can be identified and mitigated through monitoring and industry best practice to a greater or lesser extent. However, one of the key areas considered to be outstanding by Falkirk and Stirling Council's following AMEC's review of the application is the issue of methane migration leading to fugitive emissions through high permeability strata, faults and old coal mine working.¹³ The work of Professor David Smythe in reviewing this application¹⁴ supports this concern, sheds serious doubt on the applicants understanding of the geology of the development area, and position that fugitive emissions are unlikely to occur, further noting the inherent difficulties with identifying, monitoring and mitigating against such leaks.
- 3.6 Researchers from Princeton University and the Environmental Defence Fund calculate that if fugitive emissions are below about 3.2% of total well production then natural gas has a lower

⁶ IPCC Fourth Assessment Report: Climate Change 2007 Working Group II Report

"Impacts, Adaptation and Vulnerability" http://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html

⁷ UNFCCC Copenhagen Accord, Dec 2009 <http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf>

⁸ <http://www.carbontracker.org/team/about-us>

⁹ Carbon Tracker Initiative 'Unburnable Carbon – Are the world's financial markets carrying a carbon bubble?' 2011 <http://www.carbontracker.org/wp-content/uploads/downloads/2011/07/Unburnable-Carbon-Full-rev2.pdf>

¹⁰ International Energy Agency, Are We Entering a Golden Age of Gas? 2011

<http://www.worldenergyoutlook.org/goldenageofgas/>

¹¹ BBC, Campaigners' anger over agency's shale gas report 29th May 2012

¹² IPCC Working Group 1, Fifth Assessment Report, 2013. 20 and 100 years are commonly used timescales for calculating the carbon dioxide equivalent of other greenhouse gases.

¹³ Joint Statement of Common Understanding between Falkirk Council and Stirling Council (of the first part) and Dart Energy (Forth Valley) Limited (of the second part) regarding the matters on which the parties are agreed in relation to the appealed applications for planning permission to construct a coal bed methane ("CBM") production facility at Letham Moss and Powdrake Farm near Falkirk, 17 December 2013

¹⁴ Smythe, D Dart Energy coalbed methane proposed development at Letham: Review of additional information supplied in support of the hydrogeological assessment, August 2013

climate impact than coal.¹⁵ The US EPA estimates that fugitive emissions are below this, but recent US monitoring suggests that fugitive emissions could be over 4% and up to 9% in some cases,¹⁶ wiping out any climate advantages. One recent Australian study found that coal seam gas might be nearly as high carbon as coal or electricity generation, with a leakage rate up to 4.38%.¹⁷ A Queensland Government study found almost half the wells in coal seam gas fields in the Tara region to be leaking.¹⁸

Carbon budgets and unburnable carbon

- 3.7 Our evidence will consider the dangers of climate change. It will also consider the stringency of Scotland's and the UK's current regulations (carbon budgets) which do not align with global commitments to avoiding 2 degrees warming.
- 3.8 It will also consider how global availability of hydrocarbons relates to carbon budgets (i.e. identify unburnable carbon) and on this basis suggest that expanding hydrocarbon reserves is counterproductive.
- 3.9 We will also lead evidence on the use of arguments support the industry. These arguments include that natural gas: [1] has lower emissions than coal; [2] offers the prospect of low-carbon energy and that [3] is a transition fuel to a low-carbon future.
- 3.10 We will also lead evidence on coal bed methane produced in the UK and its carbon footprint considering other forms of energy including conventional gas and imported LNG.
- 3.11 We will lead evidence that coal bed methane is a high-carbon energy source and that each tonne of gas produces nearly three tonnes of CO₂. We will lead evidence as to the science of global warming, the maths of emissions to date and against the background of the Copenhagen pledge to limit temperature increases to below a 2°C rise, and the implications of this for the consideration of this application.

Climate change law

- 3.12 The Scottish Government and Parliament have recognised the urgency of tackling climate change, and the historic responsibility of developed nations to drastically curb greenhouse gas emissions, in the Climate Change (Scotland) Act 2009, which introduced annual legally binding targets requiring a reduction of around 1.5MtCO₂ a year.¹⁹
- 3.13 By comparison, the deal to supply SSE from the proposed development would increase emissions by 4.5MtCO_{2e} including fugitive emissions from the site.²⁰ If all Dart Energy's

¹⁵ Alvarez, Pacala et al, Feb 2012 Greater focus needed on methane leakage from natural gas infrastructure, <http://www.pnas.org/content/109/17/6435.full>

¹⁶ Nature, 2nd January 2013 'Methane leaks erode green credentials of natural gas' <http://www.nature.com/news/methane-leaks-erode-green-credentials-of-natural-gas-1.12123>, Howarth and Ingraffea, Methane and the greenhouse-gas footprint of natural gas from shale formations, Cornell University <http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf>, & Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al. 2012 http://www.eeb.cornell.edu/howarth/Howarthetal2012_Final.pdf

¹⁷ Hardisty, P. E., Clark, T. S., Hynes, R. G., 2012. 'Life Cycle Greenhouse Gas Emissions from Electricity Generation: A Comparative Analysis of Australian Energy Sources.' *Energies* 5, 872897

¹⁸ 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

¹⁹ Climate Change (Scotland) Act 2009 section 3. The Act does not set out the level of each annual target, but the overall target equates to roughly 3% a year <http://www.legislation.gov.uk/asp/2009/12/section/3>

²⁰ Calculations assume a conservative leakage rate of 4.5% based on real world observations as per quoted in paragraph 3.6 rather than industry inventories, and using the IPCC's latest calculations of global warming potential expressed over

CBM and shale gas assets in the PEDL133 licence area were burnt they would create at least 42MtCO_{2e} – more than Scotland's *total* carbon target in 2020.

- 3.14 We will lead evidence on the Climate Change (Scotland) Act 2009 and the duties it imposes on public bodies, both in relation to climate targets and sustainability. We will lead evidence as to why the planning decision-making in relation to CBM is caught by the duties because of the climate impacts of CBM. This may include to refuse planning permission on climate grounds.
- 3.15 We will also lead evidence on the guidance on the duties and the three-pronged nature of the sustainable development principle, encompassing social, economic and environmental aspects.

4. Public health

- 4.1 Drilling for coalbed methane carries the risk of mobilising naturally occurring chemicals and leaving introduced chemicals behind deep underground from where they can migrate into and contaminate soil, water and air. Indicative research from Southern Cross University suggests that de-pressurisation of coal seams through de-watering and hydraulic fracturing can permanently alter soil structures and increase pollutant pathways for naturally occurring, drilling and fracking chemicals into soil and water systems.²¹ The authors of a study from Cornell University warn that the gas boom is an uncontrolled health experiment on an enormous scale and make a plea for badly needed research on the likelihood and impact of these chemicals entering the food chain via animal products.²²
- 4.2 We note that while there is a lack of peer reviewed studies into the health impacts of unconventional gas extraction and specifically regarding coalbed methane extraction, indicative findings point to potentially very serious public health impacts for communities living in and near gas fields. While studies often fail to distinguish between the impacts of drilling and fracking chemicals on human health, a recent peer reviewed study found that non-methane hydrocarbon emissions from unconventional gas sites were higher during drilling stages than during fracking stages²³, hence key public health concerns apply to coalbed methane operations whether or not they are fracked.
- 4.3 The following polycyclic aromatic hydrocarbons (PAHs) – naturally occurring in coal – were detected in air samples taken at a fixed sampling station near a natural gas well pad that used a closed loop system in Colorado.²⁴ Sixteen directional wells were drilled and fracked during the study period, however samples of PAHs were highest during drilling stages. The health effects of exposure to these chemicals can include impact on: skin, eye and sensory organ; respiratory system; gastrointestinal; brain and nervous system; immune system; kidney function; cardiovascular and blood; cancer, tumorigenesis; genotoxic; endocrine system; liver and metabolic. The same study also detected a large number of volatile

100 years. Delivery of the maximum volume under the gas sales deal with SSE would require additional field development.

²¹ Santos and Maher, Southern Cross University, Fugitive emissions from coal seam gas <http://www.scu.edu.au/coastal-biogeochemistry/index.php/70/>; Tait, Santos et al, Southern Cross University 2013 Enrichment of Radon and Carbon Dioxide in the Open Atmosphere of an Australian Coal Seam Gas Field <http://pubs.acs.org/doi/full/10.1021/es304538g>

²² 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>

²³ Colburn et al, An Exploratory Study of Air Quality near Natural Gas Operations, 2012

<http://endocrinedisruption.org/assets/media/documents/HERA12-137NGAirQualityManuscriptforwebwithfigures.pdf>

²⁴ Ibid

organic compounds including high levels of methane and methylene chloride.

Table 3. PAHs detected in air samples in western Colorado from October, 2010 to March, 2011.

Chemical name	CAS #	<i>n</i> Detects	% Detects	Mean pptv	Range pptv	Std	<i>n</i> Spikes
						Dev pptv	
naphthalene	91-20-3	21	100	3.01	0.81-6.08	1.44	4
phenanthrene	85-01-8	16	76	0.36	0.21-0.61	0.14	4
fluorene	86-73-7	11	52	0.20	0.15-0.32	0.06	2
indeno(1,2,3-cd)pyrene	193-39-5	8	38	0.18	0.09-0.49	0.13	1
benzo(g,h,i)perylene	191-24-2	7	33	0.22	0.09-0.45	0.13	1
dibenzo(a,h)anthracene	53-70-3	7	33	0.20	0.11-0.51	0.15	1
benzo(a)pyrene	50-32-8	5	24	0.21	0.13-0.36	0.09	1
benzo(b)fluoranthene	205-99-2	5	24	0.20	0.13-0.26	0.05	1
benzo(k)fluoranthene	207-08-9	5	24	0.18	0.13-0.25	0.05	1
benzo(a)anthracene	56-55-3	2	10	na	0.13-0.16	na	0
chrysene	218-01-9	2	10	na	0.12-0.16	na	0
acenaphthylene	208-96-8	1	5	na	0.20	na	0

na = not applicable. Statistics were not calculated for chemicals in which there were fewer than three detections.

From Colburn et al, *An Exploratory Study of Air Quality near Natural Gas Operations*, 2012

- 4.4 Communities living near gas fields in Australia complain of respiratory problems, rashes and irritated eyes. An investigation by a concerned GP in early 2013 of 38 households in close proximity to coal seam gas wells in Tara, Queensland, found that 58% of residents reported definite adverse health effects related to gas drilling and a further 19% were uncertain.²⁵ Symptoms include breathing difficulties, rashes, joint and muscle pains, nausea and vomiting, and spontaneous nosebleeds, and are consistent with exposure to naturally occurring and common drilling and fracking chemicals in the unconventional gas industry.²⁶
- 4.5 Researchers from the National Oceanic and Atmospheric Administration (NOAA) and the University of Colorado, Boulder found that gas operations were leaking highly toxic and carcinogenic benzene into the air, and inferred from this pilot study that both methane and non-methane emissions are highly likely under estimated in inventories.²⁷
- 4.6 A working paper from Cornell University suggests that air and water pollution from unconventional gas activities can have a profoundly damaging effect on infant health. The study looked at birth weight outcomes in pregnant mothers living within 2.5 km of a gas well and found that the incidence of low birth weight increased by 25%.²⁸ A subsequent study building on this work by examining birth record in Pennsylvania between 2004-2011 (but yet to be peer-reviewed) backs up the Cornell findings, and finds that the risk of low-birth weight is doubled in infants born within a 2.5km radius of gas drilling sites.²⁹ While the study focussed on a gas well in the Marcellus Shale, the authors point to a number of contributing

²⁵ Symptomatology of a gas field - An independent health survey in the Tara rural residential estates and environs, Geralyn McCarron, April 2013

http://d3n8a8pro7vvhmx.cloudfront.net/lockthegate/pages/49/attachments/original/1367333672/2013-04-symptomatology_of_a_gas_field_Geralyn_McCarron.pdf?1367333672

²⁶ Colburn et al, 2012

²⁷ Petron et al Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study

Journal of Geophysical Research: Atmospheres Volume 117, Issue D4, 27 February 2012,

<http://onlinelibrary.wiley.com/doi/10.1029/2011JD016360/abstract>

²⁸ Elaine L. Hill 'Shale Gas Development and Infant Health: Evidence from Pennsylvania' Working Paper Revision

December 2013, Cornell University <http://dyson.cornell.edu/research/researchpdf/wp/2012/Cornell-Dyson-wp1212.pdf>

²⁹ The study is yet to be published online, but was presented to the [American Economic Association](http://www.aeaweb.org/) in Philadelphia on 4 January 2014 by authors Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology

<http://www.bloomberg.com/news/2014-01-04/study-shows-fracking-is-bad-for-babies.html>

factors, many of which are also present in CBM drilling, which result in a complex of pollutants that may contribute to the health impacts their study identifies.³⁰

- 4.7 We also note that the USA Environment Protection Agency has banned flaring from 2015³¹ as a result of health and environmental concerns.

5. National Policy

- 5.1 We will argue that Scottish Government energy³² and planning policy do not support unconventional gas extraction.

Scottish Planning Policy

- 5.2 The new draft Scottish Planning Policy (SPP) has removed any presumption in favour of unconventional gas that could have been read into the previous SPP, introduced more stringent guidelines for how Local Development Plans should deal with the industry, and introduced the need for buffer zones between sites and communities. However, in any event we will argue that the existing SPP³³ does not support the application.

Energy Policy

- 5.3 Dart's proposals would lead to gas being produced from this field for 25 to 30 years. Gas could still be being produced in the late 2040s. The main uses of natural gas are in electricity generation and for heating. In both areas Scottish Government policy is moving away from the use of all fossil fuels, leaving little or no market for CBM gas in the future.
- 5.4 In a recent Parliamentary Answer the First Minister stressed Scotland's over-abundance of fossil fuels, saying "We are a country that produces seven times the hydrocarbons that we consume. We should therefore proceed cautiously on the undoubted opportunities that there are for shale gas in Scotland."³⁴ This same logic applies to coal-bed methane.
- 5.5 The Scottish Government's Electricity Generation Policy Statement³⁵ sets out the Government's commitment to delivering 100% of Scotland's electricity consumption from renewable energy sources by 2020 and of largely decarbonising the electricity sector by 2030. The document suggests that fossil-fuelled electricity generation will still play a part as long power stations can be fitted with Carbon Capture and Storage (CCS), a technology which is in its infancy. There is a possibility of CCS being installed at small scale at Peterhead gas-fired power station, although the station itself is likely to shut around 2030. There are no other proposals for gas-fired power stations in Scotland and the only existing planning consent, for a new station at Cockenzie, is on hold and does not require CCS to be fitted.

³⁰ "NDG [Natural Gas Drilling] requires large quantities of truck traffic, results in loud noise around the clock, requires bright lights for drilling to occur at night, and results in direct and fugitive air emissions of a complex mixture of pollutants from the methane itself as well as diesel engines, drilling muds and tanks that contain produced water and fracturing fluids" <http://dyson.cornell.edu/research/researchpdf/wp/2012/Cornell-Dyson-wp1212.pdf>

³¹ <http://www.epa.gov/airquality/oilandgas/pdfs/20120417changes.pdf>

³² Scottish Government Electricity Generation Statement 2012 <http://scotland.gov.uk/Resource/0038/00389294.pdf>

³³ Scottish Planning Policy 2010 <http://www.scotland.gov.uk/Publications/2010/02/03132605/0>

³⁴ Official Report, Scottish Parliament, 19th December 2013,

<http://www.scottish.parliament.uk/parliamentarybusiness/28862.aspx?r=8720&mode=pdf>

³⁵ Electricity Generation Policy Statement 2013, <http://www.scotland.gov.uk/Resource/0042/00427293.pdf>

- 5.6 The Electricity Generation Policy Statement also repeats the Scottish Government's commitment to sourcing 11% of heat demand from renewables by 2020 and the target to reduce total final energy consumption in Scotland over the period to 2020 by 12%.
- 5.7 The Scottish Government will shortly publish a Heat Generation Policy Statement. The Draft Outline Heat Vision and Draft Heat Deployment Options Guidance from January 2013 reinforces the government's existing commitment to "achieve a largely de-carbonised heat sector by 2050 with significant progress by 2030 through a combination of reduced demand and energy efficiency, together with a massive increase in the use of renewable or low carbon heating."
- 5.8 With its over-abundance of fossil fuels, strong targets on climate change, energy demand and the transition to low and zero-carbon energy, Scotland has no need of the gas to be produced by this application. Research by leading renewable energy consultants Garrard Hassan demonstrates that Scotland can phase out all fossil fuel and nuclear power by 2030, maintain a secure supply and generate additional electricity for export.³⁶

Appendix 1: Expert Witnesses

Dr John Broderick

Dr John Broderick is a Knowledge Transfer Fellow at Tyndall Manchester, a core partner of the UK's leading interdisciplinary climate change research centre. In late 2011 he led the production of a high profile assessment of the climate change and environmental impacts of shale gas (available at <https://www.escholar.manchester.ac.uk/uk-ac-man-scw:156730>). This was followed up with a quantitative estimate of the emissions embodied in coal displaced in part by shale gas in the USA (<https://www.escholar.manchester.ac.uk/uk-ac-man-scw:211539>). He has presented work on emissions pathways, climate policy and shale gas at the European Parliament and House of Commons, acted as a peer reviewer for DECC and submitted evidence to House of Commons and House of Lords Enquiries. John holds a PhD in climate policy from Manchester Business School and a degree in natural sciences from Cambridge University.

Professor Christopher Hilson

Professor Christopher Hilson is a Professor of Law and Head of the School of Law at the University of Reading. He holds a BA/MA (Cantab) in Law from the University of Cambridge and a PhD in Law from the University of Sheffield. He was Editor-in-Chief of the *Journal of Environmental Law* (OUP) between 2007-2012. He has published widely in both domestic and European environmental law and policy. He was a policy advisor to the waste industry for a period during the 1990s and is currently an occasional legal advisor to Client Earth. He will give evidence in a personal capacity.

³⁶ Power of Scotland Secured: Summary for Policy Makers and Options for Coping with High Renewables Penetration in Scotland <http://www.foe-scotland.org.uk/power-secured>

Appendix 2: List of Documents

01. Anderson and Bows (2011) Beyond Dangerous Climate Change
<http://rsta.royalsocietypublishing.org/content/369/1934/20.full.pdf>
02. IPCC AR5 Summary for Policy Makers
http://www.climatechange2013.org/images/uploads/WGI_AR5_SPM_brochure.pdf
03. MacKay & Stone (2013) Potential Greenhouse Gas Emissions Associated with Shale Gas Extraction and Use, DECC.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/237330/MacKay_Stone_shale_study_report_09092013.pdf
04. Broderick et al (2011) Shale gas: an updated assessment of environmental and climate change impacts <https://www.escholar.manchester.ac.uk/uk-ac-man-schw:156730>
05. Climate Change (Scotland) Act 2009
<http://www.scotland.gov.uk/Topics/Environment/climatechange/scotlands-action/climatechangeact>
06. Copenhagen Accord (2009) 3 Report of the Conference of the Parties; fifteenth session; Copenhagen, 7 to 19 December 2009. Part Two: Action taken by the Conference of the Parties FCCC/CP/2009/11/Add.1 30 March 2010 <http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf>
07. IEA 2013 Redrawing the Climate Energy Map
<http://www.worldenergyoutlook.org/energyclimatemap/#d.en.36900>
08. Broderick & Sharmina (2014) The Greenhouse Gas Emissions Profile of Coal Bed Methane (CBM) Production: A Review of Existing Research
09. Camp David Declaration: Camp David, Maryland, United States; May 18-19, 2012
<http://www.whitehouse.gov/the-press-office/2012/05/19/camp-david-declaration>
10. Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. IPCC Cross-Working Group Meeting on Consistent Treatment of Uncertainties. Jasper Ridge, CA, USA. 6-7 July 2010 <http://www.ipcc.ch/pdf/supporting-material/uncertainty-guidance-note.pdf>
11. IEA/OECD, 2011. World Energy Outlook 2011: Are we entering a golden age of gas? Special report, Paris, France. Available at: <http://www.worldenergyoutlook.org/goldenageofgas/>
12. 'Public Bodies Climate Change Duties: Putting them into Practice', Guidance Required by Part 4 Of The Climate Change (Scotland) Act 2009
<http://www.scotland.gov.uk/Publications/2011/02/04093254/0>
13. BusinessGreen, 'CBI Rejects Calls For All-Out 'Dash for Gas'
<http://www.businessgreen.com/bg/news/2208266/cbi-rejects-calls-for-allout-dash-for-gas>
14. Deutsche Bank, 'European Gas: A First Look At EU Shale-Gas Prospects' (2011) Global Markets Research, Commodities Special Report http://www.shalegas-europe.eu/en/docs/Deutsche_Bank_Report.pdf
15. Tom Bawden, "Baseless economics": Lord Stern on David Cameron's claims that a UK fracking boom can bring down price of gas', The Independent, 3 Sept 2013

<http://www.independent.co.uk/news/uk/politics/baseless-economics-lord-stern-on-david-camersons-claims-that-a-uk-fracking-boom-can-bring-down-price-of-gas-8796758.html>

16. J Pickard, 'Fracking jobs now forecast to be a third of what Cameron quoted', Financial Times, 15 Oct 2013 <http://www.ft.com/cms/s/0/a4e24b70-35ac-11e3-b539-00144feab7de.html?siteedition=uk#axzz2pGmOHW6c>

17. Scottish Environment Link, Parliamentary Briefing, June 2013
<http://www.scotlink.org/files/policy/ParliamentaryBriefings/LINKBriefingFUGJune13.pdf>

18. SEPA, 'Regulatory Guidance: Coal Bed Methane and Shale Gas' (Version 121115)
http://www.sepa.org.uk/system_pages/quicklinks_2/unconventional_gas_guidance.aspx

19. Aileen McHarg, 'Climate Change Constitutionalism? Lessons from the United Kingdom' (2011) 2 Climate Law 469-484.

20. Colin Reid, 'A New Sort of Duty? The Significance of "Outcome" Duties in the Climate Change and Child Poverty Acts' [2012] Public Law 749-767.

21. IPCC Fifth Assessment Report: Climate Change 2013 Working Group I Report "The Physical Science Basis" http://www.climatechange2013.org/images/uploads/WGI_AR5_SPM_brochure.pdf

22. IPCC Fourth Assessment Report: Climate Change 2007 Working Group II Report "Impacts, Adaptation and Vulnerability" http://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html

23. Carbon Tracker Initiative 'Unburnable Carbon – Are the world's financial markets carrying a carbon bubble?' 2011 <http://www.carbontracker.org/wp-content/uploads/downloads/2011/07/Unburnable-Carbon-Full-rev2.pdf>

24. Alvarez, Pacala et al, Feb 2012 Greater focus needed on methane leakage from natural gas infrastructure, <http://www.pnas.org/content/109/17/6435.full>

25. Petron et al Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study Journal of Geophysical Research: Atmospheres Volume 117, Issue D4, 27 February 2012, <http://onlinelibrary.wiley.com/doi/10.1029/2011JD016360/abstract>

26. Nature, 2nd January 2013 'Methane leaks erode green credentials of natural gas'

27. Howarth and Ingraffea, Methane and the greenhouse-gas footprint of natural gas from shale formations, Cornell University <http://www.sustainablefuture.cornell.edu/news/attachments/Howarth-EtAl-2011.pdf>, &

28. Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al. 2012 http://www.eeb.cornell.edu/howarth/Howarthetal2012_Final.pdf

29. 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

30. Hardisty, P. E., Clark, T. S., Hynes, R. G., 2012. 'Life Cycle Greenhouse Gas Emissions from Electricity Generation: A Comparative Analysis of Australian Energy Sources.' Energies 5, 872897

31. Tait, Santos et al, Southern Cross University 2013 Enrichment of Radon and Carbon Dioxide in the Open Atmosphere of an Australian Coal Seam Gas Field
<http://pubs.acs.org/doi/full/10.1021/es304538g>

32. 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>
33. Colburn et al, An Exploratory Study of Air Quality near Natural Gas Operations, 2012
<http://endocrinedisruption.org/assets/media/documents/HERA12-137NGAirQualityManuscriptforwebwithfigures.pdf>
34. Symptomatology of a gas field - An independent health survey in the Tara rural residential estates and environs, Gerylann McCarron, April 2013
http://d3n8a8pro7vhmx.cloudfront.net/lockthegate/pages/49/attachments/original/1367333672/2013-04-symptomatology_of_a_gas_field_Gerylann_McCarron.pdf?1367333672
35. Elaine L. Hill 'Shale Gas Development and Infant Health: Evidence from Pennsylvania' Working Paper Revision December 2013, Cornell University
<http://dyson.cornell.edu/research/researchpdf/wp/2012/Cornell-Dyson-wp1212.pdf>
39. Scottish Government Electricity Generation Statement 2012
<http://scotland.gov.uk/Resource/0038/00389294.pdf>
40. Scottish Planning Policy 2010 <http://www.scotland.gov.uk/Publications/2010/02/03132605/0>
41. Draft Scottish Planning Policy for Consultation, April 2013
<http://www.scotland.gov.uk/Publications/2013/04/1027/0>
42. Scottish Government Position Statement on Scottish Planning Policy January 2014
<http://www.scotland.gov.uk/Resource/0044/00441852.pdf>
43. Letter from Planning Minister Derek MacKay to Dr Richard Dixon, Friends of the Earth Scotland, October 2013
44. 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