

ADVERTISING FEATURE

FRACKING

WHAT EVERY SCOT SHOULD KNOW

A VISION FOR SHALE GAS
EXTRACTION IN SCOTLAND AND
WHAT WE BELIEVE IT CAN DELIVER
FOR COMMUNITIES

INEOS
Shale

WELCOME



AT INEOS, we really believe it's time to set the record straight about shale gas. We know that shale gas presents Scotland with a once-in-a-generation opportunity to change the lives of people up and down this country for the better – bringing energy security, new jobs, skills and investment to thousands of Scots.

That's why, in this supplement, we are outlining many of the key facts and exploring a number of the topical debates that surround this important issue. Scotland needs to decide its energy policy moving forward. When I talk about energy policy, at its most basic level, I mean: How are we going to keep the lights on?

Remember, there are no risk-free energy solutions but, if we don't find a solution, the lights really could go off. Coal is dirty, nuclear is expensive, importing gas means we are dependent on getting supplies from some of the most unstable regions in the world, and renewables simply don't provide enough energy all the time. This is why, at INEOS, we believe shale gas could play an important part in providing us with the energy that could power the nation into the future and help to reduce CO2 emissions.

However, we also understand there needs to be a fair and open debate that asks the challenging questions, but also one that clearly assesses the positives and negatives moving forward. It is important to acknowledge there have been some issues but they happened in the early days of US shale exploration and, remember, this isn't America, this is Scotland – where we will have one of the most rigorous regulatory regimes in the world.

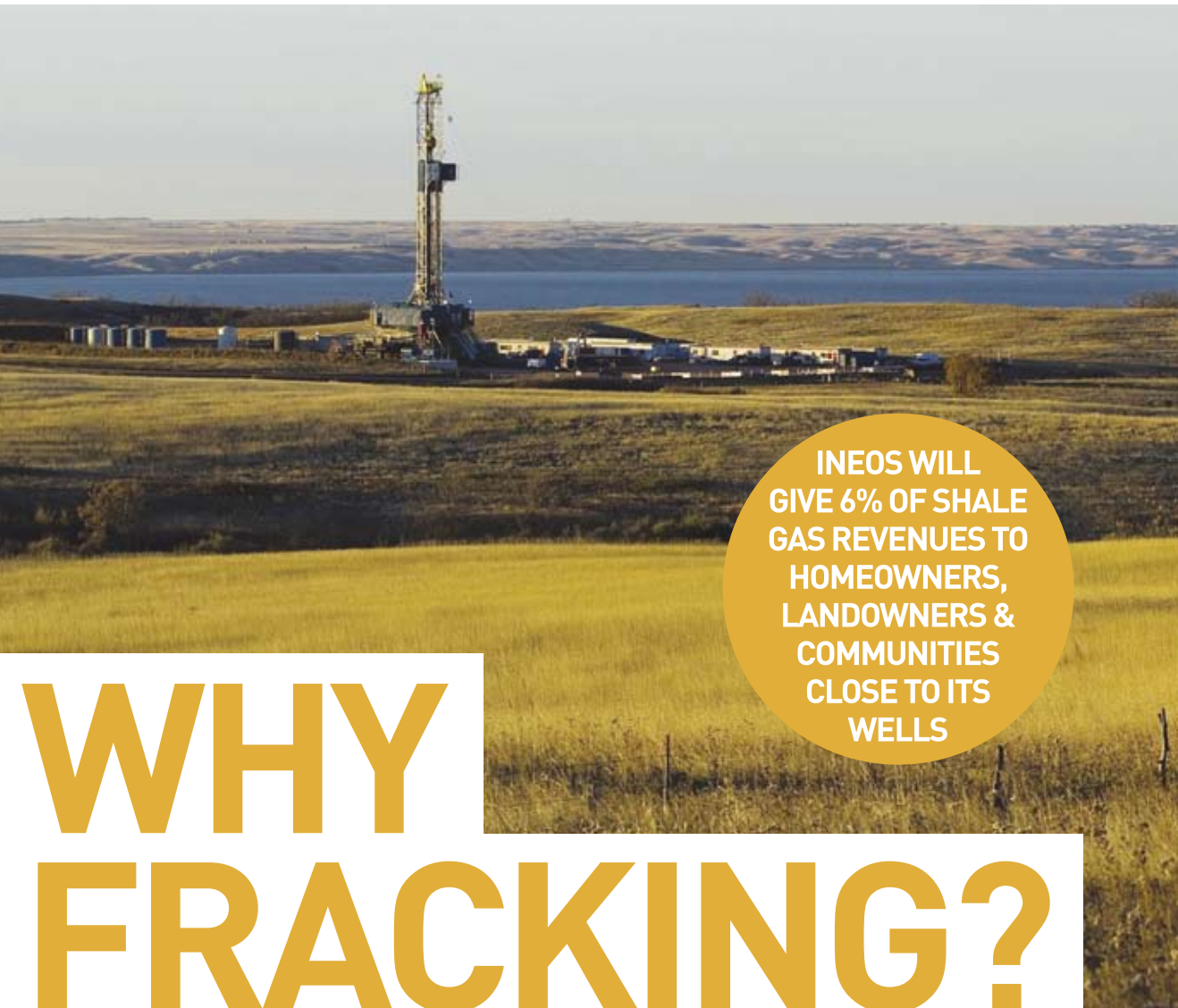
We are not complacent and I do understand people's concerns, but there has been a lot of misinformation put out. Many of the things you read about shale gas simply aren't true. In light of this, I would ask you to read this supplement and then do some research yourself and challenge us if you think we are wrong.

I'm Scottish, I've lived here all my life, I've been educated in Scotland and I've chosen to raise my family and build a career here. Why? Because I am proud of the Scottish history of pioneering world-class engineering both at home and abroad.

I believe INEOS' shale gas plans offer a once-in-a-lifetime opportunity for Scotland to become Europe's leader in the new and exciting industry, and I would urge everybody to look at this issue with an open mind and see the huge potential for our nation and future generations.

Tom Pickering

Operations Director, INEOS Upstream



Shale gas extraction has been used in the oil and gas industry for more than 50 years and could bring huge opportunities for Scotland

THE Government has recognised that shale gas has the potential to provide Scotland and the rest of the UK with energy, jobs and growth. Shale gas is the same as North Sea gas. They are both the natural gas that we use to heat our homes. Shale gas is simply gas formed in Shale formations 2-5km underground. To replace North Sea gas which is running out, the UK now imports half of its gas.

Done properly, responsible shale gas extraction, within a strict regulatory framework presents a significant opportunity for Scotland and the UK with minimal environmental impact.

The UK is committed to reducing CO2emissions by 80 per cent by 2050 and has ambitious policies in place to promote renewables and nuclear, such as the Carbon Price Floor and Contracts for Difference. Scotland, in particular, is rich in renewable energy sources and has made great progress in decarbonising electricity generation.

But it will take a couple of decades to fully transform, so gas is needed in the medium-term to meet our energy needs responsibly. As recognised by the Intergovernmental Panel on

Climate Change, gas has about half the emissions of coal, so we have an environmental duty to use gas rather than coal for energy during this period.

But gas is not just a fuel that we burn for energy. It's also a raw material used in the manufacture of chemicals that are used in a wide range of important products, including medicines, clothing, buildings, cars, computers and green technologies such as wind turbines and energy efficient materials. We will still need gas to make these essential items once we have made the transition to low-carbon energy.

So it's vital that the UK has a secure and competitive long-term supply of gas to underpin the future of the manufacturing sector.

This is particularly important in Scotland, where the petrochemicals industry is critical to the economy, providing thousands of direct jobs and generating significant tax revenue. It's estimated shale gas extraction could create more than 64,000 jobs in the UK, and protect 500,000 jobs in industry – many of them in Scotland. Producing our own shale gas will also make us less dependent on volatile regions.

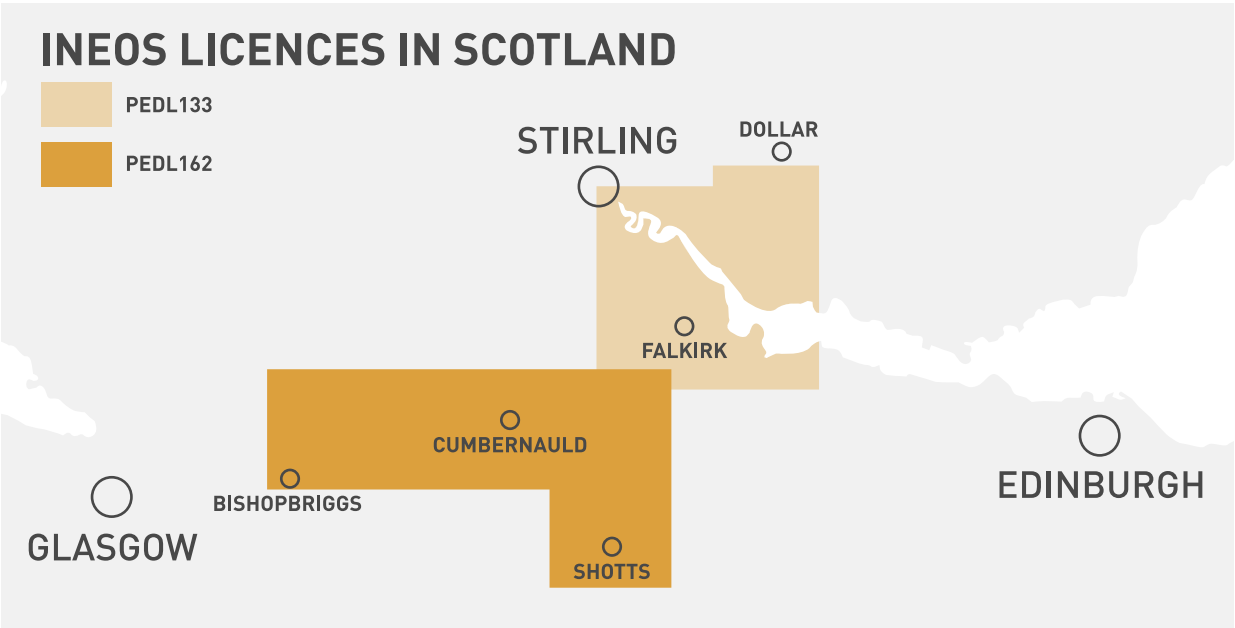
OUR VISION FOR SHALE GAS IN SCOTLAND

Our vision stems from our experience as a user in the United States. We have seen firsthand how shale gas transformed US manufacturing by providing a secure and competitive supply of energy and raw material.

Ten years ago, investment in manufacturing in the USA had dried up. Today, this trend has reversed. In the chemicals sector, \$150billion is being invested in new facilities, creating hundreds of thousands of jobs. In the UK, meanwhile, the chemicals industry faces a difficult challenge,

with its supply of raw material from the North Sea (particularly ethane and other light hydrocarbons) rapidly drying up and energy prices becoming increasingly uncompetitive compared to the rest of the world.

As a result, the UK has seen a number of high-profile closures in recent years and investment is being diverted abroad. Shale gas presents an opportunity to redress this, reinvigorating the petrochemicals industry and the manufacturing sector that relies on its products.



WHERE ARE WE NOW WITH FRACKING IN SCOTLAND?

The Independent Expert Scientific Panel set up by the Scottish Government has recognised shale gas extraction could be particularly beneficial for Scotland, given the importance of the petrochemicals industry to the economy. With North Sea oil operations facing decline, shale gas extraction could provide valuable new jobs and replace important tax revenues.

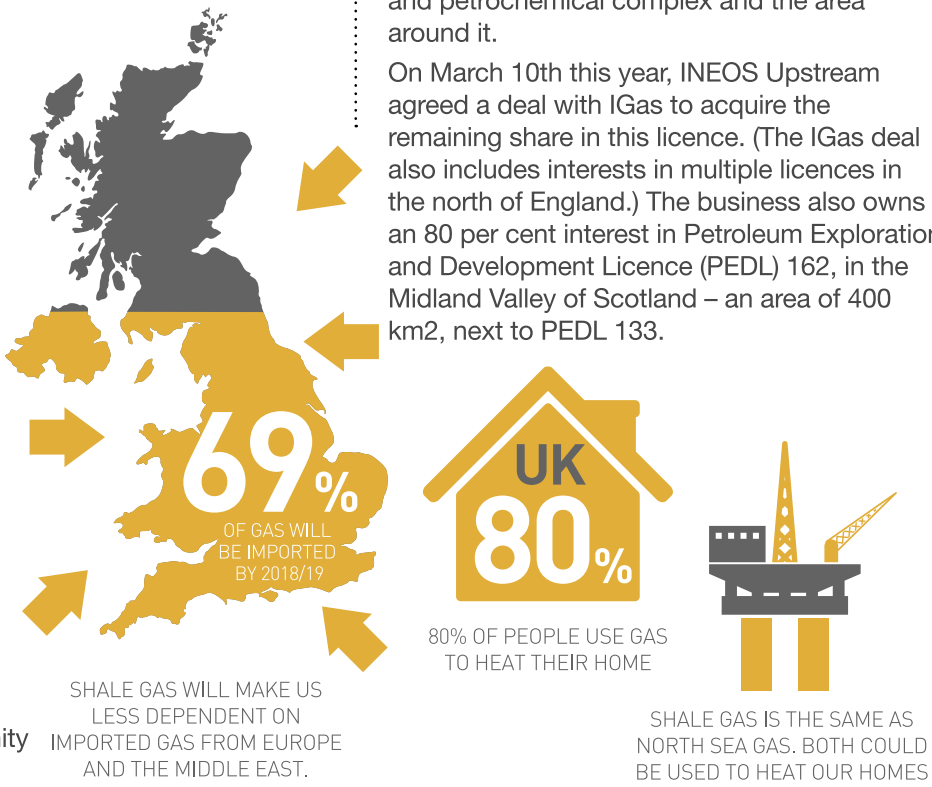
In January this year, the Scottish Government announced a moratorium on all planning consents for unconventional oil and gas extraction, including fracking. This will allow time for a full public consultation, which we fully support. We recognise shale gas extraction is a controversial issue and communities have understandable questions about the potential risks and rewards.

As a result, we're actively engaging with communities to discuss the

risks and rewards so an informed judgment can be made. It's the view of mainstream scientific authorities such as the Royal Society and Royal Academy of Engineering that shale gas can be extracted safely with appropriate regulation, and there could be real benefits from doing so, including jobs, tax revenue, local investment and improved energy security.

As recently as June this year The Royal Society of Edinburgh published its advice paper: "Options for Scotland's gas future", which found that onshore production of unconventional gas - or fracking - could offer the country security of supply without significant risk to health, wellbeing or safety.

So we think it's vital to have a thorough and evidence-based conversation to ensure this opportunity is considered properly.



INEOS UPSTREAM

INEOS started in the UK in 1998 and we've grown to become one of the largest chemicals companies in the world, with 65 sites in 16 countries. In the UK, we have large sites at Grangemouth, Runcorn and on Teesside, which employ thousands of skilled workers and make a significant contribution to their local economies.

We employ 4,000 people in the UK and are one of the country's largest manufacturing businesses. We also owns land, pipelines and storage in some of the key areas being explored in the UK.

All that, coupled with our clear manufacturing excellence and strong safety focus, means our new oil and gas exploration business, INEOS Upstream, brings something unique to the emerging shale gas industry.

INEOS make chemicals out of oil and gas to supply many of the raw materials for manufacturing across the UK and beyond. Manufacturing companies depend on secure and competitive supplies of these raw materials and energy to prosper.

With this in mind, we've recently set up a new, UK-registered, oil and gas exploration and production business called INEOS Upstream.

The business made its first move into the shale exploration arena on August 18th, 2014, with the purchase of a 51 per cent share of the shale section of a joint Petroleum Exploration and Development Licence (PEDL).

The PEDL 133 licence covers 329 square kilometres of the Midland Valley of Scotland, which includes INEOS' Grangemouth refining and petrochemical complex and the area around it.

On March 10th this year, INEOS Upstream agreed a deal with IGas to acquire the remaining share in this licence. (The IGas deal also includes interests in multiple licences in the north of England.) The business also owns an 80 per cent interest in Petroleum Exploration and Development Licence (PEDL) 162, in the Midland Valley of Scotland – an area of 400 km2, next to PEDL 133.

FRACKING. THE FACTS.

www.ineosupstream.com

WHAT IS FRACKING?

FRACKING is a common process that has been widely used in the oil and gas industry for more than 50 years. Hydraulic fracturing has been carried out more than a million times in the United States.

The process involves drilling a narrow well between 2.5 and 5 kilometres deep (typically 3.8km). Fluid is injected into the rock many thousands of feet down. This creates tiny fractures between one and five mm wide. Gas that was trapped in the rock can flow through these fractures, into the steel-lined well and up to the surface.

Fracking can't be felt on the surface and it takes just a few days to stimulate the well to provide gas for 20 to 30 years. Drilling a well and fracking is a temporary operation during which the hard-scale shale rock deep underground is stimulated to release the gas. It involves pumping fluid at high pressure into certain pre-defined locations in the wellbore to create lots of tiny fissures in the shale rock, which are then propped open by the sand carried in the frack fluid mixture.

AVERAGE DEPTH OF FRACTURE ZONE IS 4000m, EQUIVALENT TO 3 X THE HEIGHT OF BEN NEVIS

WELL DEPTH 2.5-5km

The process uses about two to six million gallons of water, which sounds like a lot, but this is just a few days in the life of well, which may then produce for a couple of decades. It is important to put this water use in perspective compared to other practices.

The amount of water used by a shale gas well over 10 years is equivalent to the amount used by an 18-hole golf course in one month, or a 1,000MW coal-fired power plant in 12 hours, or the amount lost in leaks in the north-west of England every hour. Similarly, the Chartered Institution of Water and Environmental Management (CIWEM) has recognised that, compared to other fossil fuels, shale gas has relatively low water use. The fluid is made up of 99.5% water and sand and 0.5% additives. The high purity crush resistant sand is the same as that used in water filtration plants and childrens' sandpits. Any chemical additives used in fracking will be publicly disclosed as part of the planning process and approved by the Scottish Environment Protection Agency (SEPA).



LIFECYCLE OF A FRACKING SITE

1) FIELD WITH SEISMIC EQUIPMENT - UNDERSTANDING THE GEOLOGY OF SITES USING ADVANCED 3D SIESMIC TECHNOLOGY. THIS CAN TAKE UP TO 90 DAYS TO COVER 100KM²



2) SITE WITH A RIG - A DRILLING RIG IS ASSEMBLED. THIS CAN BE IN PLACE FOR AROUND TWO MONTHS PER WELL. IT IS THEN REMOVED FROM SITE ALTOGETHER.



4) PRODUCING SITE - THE WELL SITE IS REDUCED IN SIZE. IT CAN CONTINUE TO PRODUCE GAS FOR UP TO 20 YEARS.



3) SITE WITH THE FRACKING VEHICLES ON SITE - HYDRAULIC FRACTURING EQUIPMENT IS BROUGHT ON SITE. EACH STAGE TAKES AROUND AN HOUR. A TYPICAL WELL REQUIRES UP TO 20 HOURS OF HYDRAULIC FRACTURING SPREAD OVER A PERIOD OF 7-20 DAYS. THEN THIS EQUIPMENT IS REMOVED.

GEOLOGICAL REVIEW TIMELINE



SEIZING THE DAY FOR OUR ENERGY FUTURE

PROFESSOR PETER STYLES, Professor of Applied and Environmental Geophysics at Keele University on why Scots must not close the door on the possibility of responsible shale gas extraction on our shores.

James Watt, Thomas Telford, Charles Lyell, James Hutton, Roderick Impey Murchison, Hugh Miller; all Scotsman and among the world's greatest ever engineers, scientists and geologists. What would they make of a Scotland that wasn't eager to be at the forefront of important developments in energy security and sustainability? Not much I would suggest!

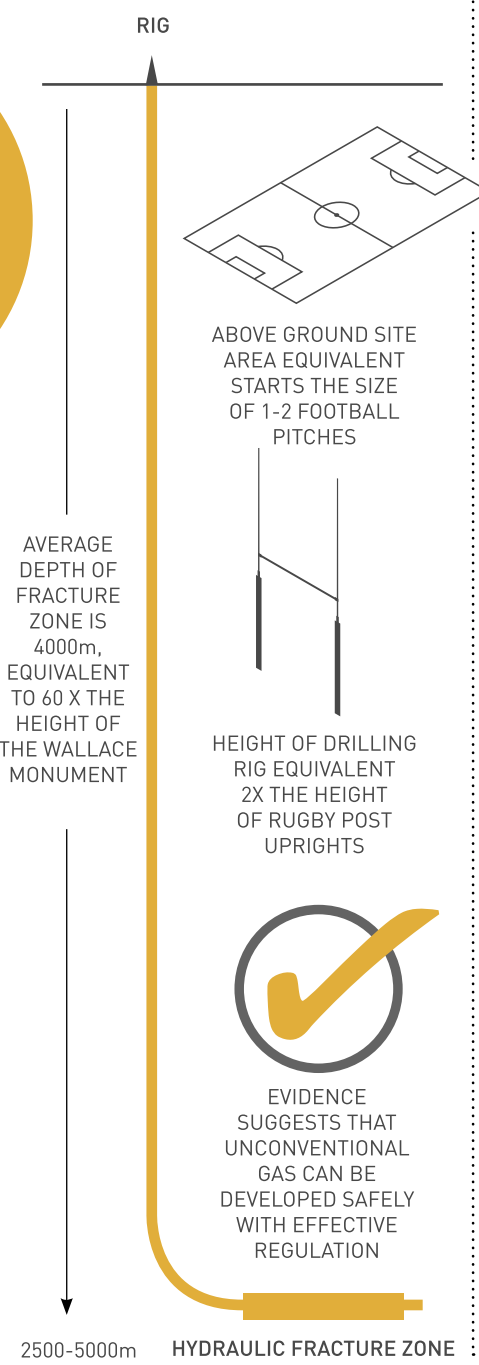
Yet today, Scotland, which has benefited greatly from once-abundant offshore hydrocarbon resources, does not wish to be involved in the debate about shale gas, which almost certainly underlies the Midland Valley in very significant quantities. Indeed, 'Fracking' has been carried out in the Midland Valley of Scotland for both gas and water since at least 1964, albeit in vertical wells. Much is made of the fact that modern fracking uses deviated drilling to turn the wells horizontal when a certain depth (usually about 3000 metres is reached) but the pressures required are the same whether the well is horizontal or vertical depending solely on the depth and hence weight of rock.

A great deal of the argument against unconventional oil and gas rests on claims the processes seriously threatened water supplies ignoring the recent report from the US Environmental Protection Agency which said "no signs of 'widespread, systemic' drinking water pollution from hydraulic fracturing" were found. All processes associated with industrial activity require careful monitoring and robust regulation – and we have arguably the most stringent environmental regulations in the world. Yet we are happy to import gas supplies from countries where environmental regulation

is honoured more in the breach than the observance. Shale gas is not just for burning! it contains Ethane - the essential feedstock for the Petrochemical Industry which is competing against US companies who have access to cheap energy and cheap raw material. With an estimated 23,000 skilled hydrocarbon-related posts to be lost in Aberdeen alone by 2020, it hardly seems sensible to close the door without investigation, research or analysis on an industry which may be a very important contributor to the economic wealth of Scotland, in or out of the Union.

It's a term used commonly in the news but here we set out what's actually involved in shale gas extraction

WORLDWIDE, THERE HAVE BEEN ABOUT 1.1 MILLION WELLS HYDRAULICALLY FRACTURED.



WHY INEOS?



Our vision for shale gas stems from our experience as a user in the United States. We have seen firsthand how shale gas transformed U.S. manufacturing by providing a secure and competitive supply of energy and raw material. Ten years ago investment in manufacturing in the USA had dried up, today this trend has reversed.

For example in the chemicals sector \$150 billion is being invested in new facilities creating hundreds of thousands of jobs. In the UK, meanwhile, the chemicals industry faces a difficult challenge, with its supply of raw material from the North Sea (particularly ethane and other light hydrocarbons) rapidly drying up, and energy prices becoming increasingly uncompetitive compared to the rest of the world. As a result the UK has seen a number of high-profile closures in recent years and investment is being diverted abroad. We see shale gas as an opportunity for the UK to redress this, reinvigorating the petrochemicals industry and the manufacturing sector that relies on its products.

Our shale gas community engagement programme includes a series of drop-in exhibitions in areas where we already hold shale gas licences and beyond. At these exhibitions INEOS Upstream staff will be available to answer questions about the importance of shale gas to Scotland and the company's production plans.

The meetings already arranged include:

Town	Venue	Date	Time
Kincardine	Kincardine Community Centre	7th Sep	3-8pm
Grangemouth	Grangemouth Town Hall	9th Sep	3-8pm
Bo'ness	Bo'ness Library	23rd Sep	3-8pm
Airth	Airth Community Hall	24th Sep	3-8pm
Saline	Saline Community Leisure Centre	6th Oct	3-8pm
Tullibody	Tullibody Civic Centre - Function Room	8th Oct	3-8pm
Plean	Balfour Centre - Main Hall	20th Oct	3-8pm
Menstrie	Dumyat Community Centre	21 Oct	3-8pm
Bannockburn	Bannockburn Community Centre	27 Oct	3-8pm
Cowie	Cowie Centre - Main Hall	28th Oct	3-8pm
Milnquarter	Bonnybridge Community Ed Centre	3 Nov	3 - 8pm
Larbert	Dobbie Hall	4 Nov	3 - 8pm
Lennoxtown	Campsie Memorial Hall	11 Nov	3 - 8pm
Blackridge	Craiginn Community Centre	2 Dec	3 - 8pm
Plains	Plains Community Centre	3 Dec	3 - 8pm
Eastfield / Harthill	Harthill Community Education Centre	8 Dec	3 - 8pm
Shotts	Shotts Community Centre	9 Dec	3 - 8pm

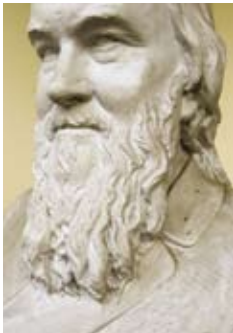
You can find more information at ineosupstream.com

FRACKING. THE FACTS.

THE HISTORY OF SHALE GAS

Scotland has a long history as a leader in shale production, led by industry pioneer James ‘Paraffin’ Young

Shale production in Scotland can be traced right back to the 1850s, when a Glasgow chemist, James “Paraffin” Young, first realised its potential.



Previously, Young had been instrumental in producing Scotland's first mineral oils from the local coals at Inchcross, near Bathgate. It was his innovative adaption of gas-making technology that created a patented process in which cannell coal was heated to release an oil vapour. Young found that by slow distillation, he could obtain a number of useful liquids from it, including “paraffine oil”. In 1859 the world’s first oil well was sunk in Pennsylvania in the USA and, as the price of oil dropped, many Scottish works closed or concentrated production on lubricants, paraffin wax and sulphate of ammonia.

By 1919 the six surviving companies, including Young's Paraffin Light and Mineral Oil Company Limited came together under the management of the newly formed Scottish Oils. In the same year Scottish Oils was acquired by the Anglo-Persian Oil Company, later to become BP.

BP was persuaded by Scottish Oils to locate a refinery near Grangemouth rather than in north-east England due to its flat ground to the east, its transport links and, most importantly, the skilled labour that already existed in the area.

By 1924 the refinery was in operation. It maintained a throughput of 360,000 tons per year until the outbreak of war in 1939 when imports of oil dwindled and forced it to close. It reopened in 1946 to a world even more hungry for refined oil products. This demand made it essential for economic reasons that the crude oil was utilised completely, and this led to the growth of the petrochemical industry.

When British Petroleum Chemicals Ltd was established in 1947 it decided to locate its site adjacent to the existing BP Refinery at Grangemouth, which had available feedstock. The petrochemical plants commissioned in 1951, were the first in Europe. Our pipeline from Finnart Ocean Terminal on the west coast, capable of receiving larger tankers, first imported crude oil in 1951. BP's operations at Grangemouth grew over the next twenty years, with the advent of North Sea Oil in 1975 further increasing the opportunities for the site. BP's operations at Grangemouth grew over the next twenty years, with the advent of North Sea Oil in 1975 further increasing the opportunities for the site. INEOS bought the Grangemouth site from BP in 2005 and continues to build upon its traditions.

WHAT COULD SHALE GAS DO FOR SCOTLAND?

From delivering new jobs and investment in local communities to even sharing in the revenue made, shale gas extraction would help reignite the Scottish economy after the recent collapse in North Sea oil revenues and decline in available gas

EXTRACTING domestic shale gas to meet our needs, rather than relying on imports, would have significant economic benefits for Scotland and the rest of the UK. A Department of Energy and Climate Change report estimates that 16,000-32,000 full-time jobs would be created in the gas industry and wider supply chain, many of them in Scotland, while studies from Ernst and Young and the Institute of Directors (IoD) estimate the figure could be over twice this.

Exploration is necessary to better understand the economics, but it's possible that shale gas could help reinvigorate and rebalance the economy.

This could be particularly beneficial in Scotland, where shale gas extraction could replace jobs and tax revenues lost as North Sea oil production declines. Communities would benefit from significant investment, new jobs and local tax revenue if extraction went ahead.

And they would receive a share of revenue from extraction, which could have a substantial impact on regional economies and local public services.

We have promised to share six per cent of revenue from shale gas, four per cent of which

would go to homeowners and landowners in the immediate vicinity of a well and a further two per cent to the wider community. Based on our estimates, a typical 10km by 10km development area would generate £375million for the area over its lifetime.

Shale gas is also an opportunity to reduce our gas import dependence in other countries for our energy needs. The British Geological Survey estimates that central Scotland contains 80 trillion cubic feet of shale gas.

Assuming that 10 per cent of this could be extracted, this would produce enough to meet Scotland's gas needs for decades to come. It's vital to undertake initial explporation in test wells to understand how much can be extracted, but it is a real possibility that shale gas could provide a secure supply of transition fuel and gas feedstock for Scotland, which would be playing to its strengths, securing its position as an energy exporter.

Shale gas is an opportunity that Scotland and the rest of the UK cannot afford to overlook. Extracting shale gas is an opportunity for the UK



IT IS ESTIMATED THAT WE WILL GIVE AWAY OVER £2.5bn FROM OUR NEW SHALE GAS BUSINESS

to reduce its dependence on imported gas while creating potentially tens of thousands of jobs and generating significant tax revenue and growth.

It is especially important to the future of the UK chemicals industry, which is significantly located in Scotland, and could have sizeable benefits for local communities. Respected authorities such as the Royal Society and the Committee on Climate Change recognise that extraction can be managed safely while meeting our carbon reduction commitments. With the US and China extracting shale gas and Germany recently issuing a draft law to enable exploratory fracking, the UK cannot afford to overlook this opportunity and risk being left behind.

This is why we believe it is essential to undertake public consultation and exploration to better understand what shale gas could mean for the UK and demonstrate its safety in order to win a social licence. Natural gas is essential for the modern world, and many of the benefits it brings cannot be replaced by renewables.



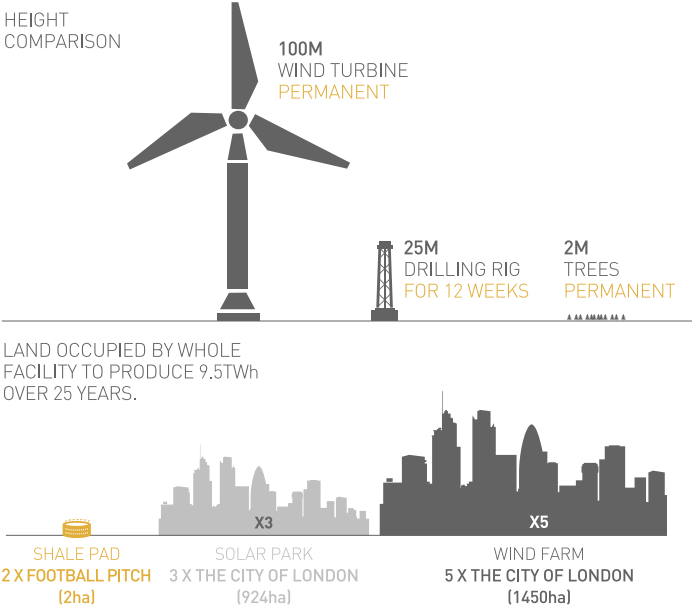
WHY CAN'T WE JUST RELY ON RENEWABLE ENERGY?

While renewables play an important part in the energy generation mix, they are not the whole solution in the short to medium term. Here's why:

- **Wind turbines** don't work when there is no wind or indeed too much wind.
- **Solar power** only works during daylight.
- If we relied on renewables, we would need to maintain all of our **fossil fuel power stations** as back-ups, and they would have to be used every day to deal with surges in demand and dips in renewable generation.
- **The national grid** has to provide a stable electricity supply with a frequency of 50Hz, otherwise the electric machines we all rely on – from computers to TVs, lights to motors to fridges – would fail. If we relied on renewables, this would not be possible. There would be times of the day where there was too much demand and there would be power cuts, blackouts and shortages.
- For the foreseeable future, we will need **fossil fuels** to provide instant energy to ensure a stable electricity supply.
- **Gas molecules** are used as the raw material to produce thousands of essential products that we all rely on every day, including packaging, pipes, car parts, footwear, clothing and electronics,
- **Many renewables** cannot be made without gas and oil. For example, important components in wind turbines and solar panels can only be made from fossil fuels.
- **Renewables** are important but we won't be able to live without Natural Gas for decades to come. We will need gas for at least 15 years for electricity, 35 years for heat and forever as a raw material.

WHY DO WE NEED GAS?

- **Natural Gas** is used for heating 22million UK homes – that's 83 per cent of all homes.
- **Without gas**, we would have to replace our gas-fired central heating with electric heating. At a cost of about £2,000 per household, this would amount to some £44billion.
- **Electric heating** costs around three times as much as gas.
- **Gas is cheaper** than coal, oil, nuclear or renewables.
- **It is 65 per cent cleaner** than coal and 25 per cent cleaner than oil.
- **In 2012, the UK imported 43 per cent of its gas**, and this will continue to rise. National Grid estimates that import dependency will reach 69 per cent by 2018/2019.
- **We have huge gas reserves** right under our feet that we can access safely.
- **Renewables** (wind, solar, hydro) currently account for 15 per cent of electricity.
- **By 2020** that will increase to 31 per cent, with gas 29 per cent, coal 22 per cent, nuclear eight per cent and others nine per cent.
- **There are currently 30,000** wind turbines in the UK. This would need to rise to at least 200,000 wind turbines to replace all other sources.



We know there are a lot of questions around fracking – and we're happy to answer them

A large, dense crowd of people, many wearing yellow hats, gathered for a public event. The image is slightly blurred, emphasizing the sheer number of attendees.

INEOS
Upstream



Ask your questions directly to INEOS on Twitter @INEOS upstream