



REPORT

FRACKING FRENZY

REPORT / DECEMBER 2014



HOW THE FRACKING INDUSTRY
IS THREATENING THE PLANET



Friends of
the Earth
Europe

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We are the European arm of Friends of the Earth International which unites 74 national member organisations, some 5,000 local activist groups, and over two million supporters around the world.

We campaign on today's most urgent environmental and social issues. We challenge the current model of economic and corporate globalization, and promote solutions that will help to create environmentally sustainable and socially just societies. We promote environmentally sustainable societies on the local, national, regional and global levels. We seek to increase public participation and democratic decision-making. Greater democracy is both an end in itself and is vital to the protection of the environment and the sound management of natural resources. We work towards environmental, social, economic and political justice and equal access to resources and opportunities on the local, national, regional and international levels.

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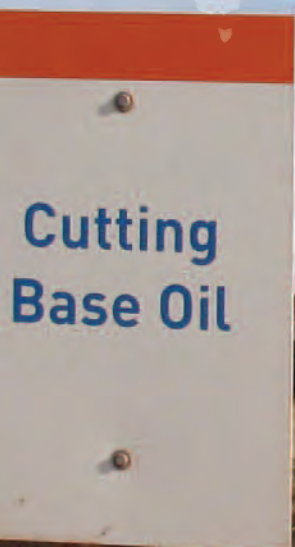
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EXECUTIVE SUMMARY

The global development of ‘unconventional’ fossil fuels (UFF) such as shale gas has provoked much debate involving scientists, industry, political decision-makers, environmental groups and civil society. More than a decade of large-scale development in North America has left a legacy of environmental damage, primarily resulting from the use of high-volume horizontal hydraulic-fracturing (also known as ‘fracking’) to extract the unconventional oil and gas. Despite the controversy surrounding this technique, the numerous unknowns and uncertainties concerning its impacts and the growing number of questions about the economic benefits of this industry, oil and gas operators are eager to identify new opportunities and so are engaged in a battle to make fracking publicly and socially acceptable worldwide.



The United States Energy Information Administration's (EIA) "World Shale Gas and Shale Oil Resource Assessment" report, published in June 2013, analyses the potential shale resources in 42 countries and 95 shale basins worldwide,¹ providing a global overview of the potential scale of the industry. It suggests that outside the EU, US, Canada & Australia, there are considerable potential shale resources (gas and/or oil) on all continents, with the most significant resources available in:

- **The former Soviet Union:** Russia, Ukraine
- **Asia and Pacific:** China, India, Indonesia, Mongolia, Pakistan, Thailand
- **Middle East and North Africa:** Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Turkey
- **Sub-Saharan Africa:** Mauritania, South Africa
- **Central & South America, and the Caribbean:** Argentina, Bolivia, Brazil, Chile, Colombia, Mexico, Paraguay, Uruguay, Venezuela

According to the EIA, the overall estimated technically recoverable resources (including the US) are between 7,299 trillion cubic feet/tcf (206,685 billion cubic metres/bcm) and 7,795 tcf (220,730 bcm) for shale gas and 345 billion barrels for shale oil. Not including the US, the global estimates are 6,634 tcf (187,854 bcm) for shale gas and 287 billion barrels for shale oil.²

These estimates are however little more than guess work, and previous assessments have been shown to be highly misleading in several cases as more accurate data about the geology of different shale areas emerges. In some cases, investments made on the back of such estimates have failed to deliver. For example, in the case of South Africa, the EIA estimated in 2011 that the country was home to significant technically recoverable shale gas resources,³ but these estimates have now been reduced by 20% from 485 tcf (13,734 bcm) to 390 tcf (11,043 bcm) after a re-assessment made in 2013. The Petroleum Agency of South Africa even believes that potential shale gas reserves are not higher than 30 tcf (850 bcm).⁴ Estimates for the shale oil potential for the Monterey basin in California were also reduced by 96 per cent in May 2014.⁵ Estimates have also been reduced in Mexico and China, suggesting that with potential further exploration the current figures could be similarly reduced in the future.

**OVERESTIMATES
HAVE RAISED
DOUBTS THE
TRUE LEVEL OF
RECOVERABLE
RESOURCES
AND QUESTIONS
ABOUT THE
ECONOMIC
VIABILITY OF
THIS INDUSTRY**



² <http://www.eia.gov/todayinenergy/detail.cfm?id=14431>

³ <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

⁴ <http://www.saoga.org.za/oil-gas-hubs/upstream-oil-gas-south-africa>

⁵ <http://www.reuters.com/article/2014/05/21/eia-monterey-shale-idUSL1N00713N20140521>

FRACKING – HOW THE TECHNOLOGY WORKS

Such overestimates have led to considerable speculation as to the quantities of oil and gas available, and have raised doubts about the true level of resources that are technically recoverable and questions about the economic viability of this industry.

While much has been written about fracking in North America and in the EU, this report seeks to provide a global overview of shale gas development in the rest of the world, focusing on a selection of the 42 countries identified by the EIA as having shale oil and gas potential. It concentrates specifically on 11 of these countries: Mexico, Brazil, Argentina, Morocco, Algeria, Tunisia, South Africa, China, India, Indonesia and Russia. These countries include seven of the EIA's top ten countries for technically recoverable shale gas resources,⁶ and are among the leaders in shale development on their respective continents. These countries also reveal the variety and specificity of the dangers associated with the expansion of the fracking industry, including environmental, social and health consequences which extend beyond the borders of individual countries.

High-volume horizontal hydraulic fracturing (fracking) is an extraction process resulting from recent technological improvements that have made it technically possible to extract unconventional sources of fossil fuels in many regions of the world. It is only in the last 20 years that new technologies have made it possible to fracture deep shale rock or clay formations 1 to 5 kilometres underground. Four specific developments have been key:

- Directional drilling (wells that go down 1-5 km and then extend horizontally for another kilometre)
- High-volume hydraulic fracturing (the use of millions of litres of fracturing fluids including sand, water and toxic chemicals, injected at high pressure into deep impermeable geological formations)
- Slick water (the use of gels and high fluid volumes at 100 barrels a minute)
- Multi-well pad and cluster drilling (the drilling of six to twelve wells from one industrial platform)

The first horizontal shale gas well was drilled in 1991, the first slick water fracture took place in 1996, and the use of cluster drilling was introduced in 2007.⁷ What we today call fracking is the result of the aggregation of these new technologies. Industry claims that fracking has been in use since the 1940s are therefore misleading.⁸

CONTROVERSIES ON ESTIMATED SHALE GAS RESOURCES

Country	EIA estimate 2011	EIA estimate 2013	Other estimates	
Poland	187 tcf (5,295 bcm)	148 tcf (4,191 bcm)	27.1 tcf (768 bcm)	Polish Geological Institute
Mexico	681 tcf (19,284 bcm)	545 tcf (15,433 bcm)	141.5 tcf (4,007 bcm)	Pemex (Mexican oil and gas company)
South Africa	485 tcf (13,734 bcm)	390 tcf (11,043 bcm)	30 tcf (850 bcm)	South African Petroleum Agency
China	1,275 tcf (36,104 bcm)	1,115 tcf (31,573 bcm)	885 tcf (20,060 bcm)	Chinese Ministry of Land and Resources

⁶ The US EIA lists the top ten countries with technically recoverable shale gas resources as China, Argentina, Algeria, US, Canada, Mexico, Australia, South Africa, Russia and Brazil. See <http://www.eia.gov/analysis/studies/worldshalegas/>

⁷ <http://thetee.ca/News/2013/01/07/Shale-Gas-Realities/>

⁸ <http://grist.org/climate-energy/stand-back-im-going-to-try-science-inside-the-brain-of-exxonmobil-ceo/>

KEY FINDINGS

Evidence from North America, with anecdotal reports backed up by countless peer-reviewed scientific studies,⁹ shows that fracking can lead to air pollution, ground and surface water contamination, radioactive releases, noise and light pollution, induced earthquakes, climate emissions, occupational health and safety hazards and competition for access to water. This report looks at these threats in the context of 11 countries in the rest of the world (Mexico, Brazil, Argentina, Morocco, Algeria, Tunisia, South Africa, China, India, Indonesia and Russia). It finds:

- **Heavy water demand in water-scarce countries:** The report highlights the crucial importance of water for the future of shale gas and oil development across the globe. Without water, shale gas and oil development cannot happen. The industry needs guaranteed access to millions of litres of (preferably fresh) water (up to 26 million litres of water per fracking operation).¹⁰ According to some analysts “companies will want to secure water rights at reasonable agreed costs stabilised for the entire project life”,¹¹ meaning companies will seek to secure the rights to access water (from lakes and rivers or from groundwater) for the projected lifetime of a project. This could give the industry an important influence over decisions about the future of fresh water resources in targeted states.

Many shale basins are found in areas where water scarcity is already a serious problem or has reached critical levels. In the Maghreb countries – where fresh water availability is expected to drop by 50 percent by the year 2050¹² – water scarcity is already affecting food prices,¹³ while in Mexico, water shortages have already led to violent confrontations. These longstanding issues over access to water can only be exacerbated by the expansion of the thirsty fracking industry.

- **Transboundary aquifers under threat:** Several shale oil and gas basins have been identified underneath important transboundary aquifers such as the Continental Intercalaire Aquifer in the Maghreb, the Karoo Aquifer in Southern Africa and the Guarani Aquifer in South America, creating competition and increasing pressure on their valuable water supplies, which for, in some cases, are non-renewable. Companies will have to drill close to or through these aquifers in order to reach the shale layers. There is a risk of contamination from methane and heavy pollutants, affecting the water supplies used by millions of people, farmers and other business for daily use, with potential severe health and social consequences at a regional level.

- **A shaky industry in earthquake-prone regions:** The geology of the shale basins can vary significantly, sometimes over very short distances. In some regions, such as the earthquake-prone Sichuan basin in China, the Karoo basin in South Africa, the Himalayas or the Sumatran basin in Indonesia, operators face very complex underground geologies, which can vastly inflate the costs and therefore the viability of shale gas extraction. This is on top of the incalculable environmental impacts and risks.

In Mexico for example, seismic activity has considerably increased in the area targeted by fracking operations. In China, devastating earthquakes have been documented in the Sichuan region in the last six years, an area targeted by the shale oil and gas operators. Though the links have not been scientifically proven, the major and deadly seismic events that have occurred here may have been linked to oil and gas activities in this high-risk earthquake region.

Considering that the fracking industry has already managed to trigger several earthquakes measuring more than magnitude 5 on the Richter scale in US regions previously considered to be seismically inactive, there are questions as to what may happen in the case of a large-scale development in these earthquake-prone countries.

- **Sensitive areas already targeted:** Shale basins are also often buried beneath important and sensitive areas including protected natural areas, indigenous territories and primary forests. This has not, however, stopped the fracking industry from developing their activities within the boundaries of these areas, jeopardizing the protection of threatened species, cultural patrimonies and fragile ecosystems.

In Neuquén, Argentina, Total and Shell are already both operating within or just outside the limits of the Auca Mahuida natural protected area, where a wildlife sanctuary is at risk.

Indigenous communities are also at risk, with drilling activities on indigenous lands in Brazil, Russia, South Africa and Argentina leading to conflicts with the local communities, who were not consulted or even informed before exploration activities began.

In the Brazilian Amazon where many areas are classified as conservation areas and also in the Sumatran forest, which has been already badly affected by deforestation for palm oil production and other harmful mining projects, drilling plans have been revealed that would further affect forest areas.

9 The Concerned Health Professionals of New York released in July 2014 an exhaustive “Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking (Unconventional Gas and Oil Extraction)” - <http://concernedhealthny.org/wp-content/uploads/2014/07/CHPNY-Fracking-Compendium.pdf>
<http://www.eia.gov/analysis/studies/worldshalegas/>
10 <http://fwap.org/shale-drilling-destroys-regional-water-resources/>
11 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
12 <http://www.fao.org/news/story/en/item/214224/icode/>
13 <http://www.ifpri.org/sites/default/files/publications/ifpridp00985.pdf>
http://www.wri.org/sites/default/files/wri14_report_shalegas.pdf

THE UGTEP NETWORK

Many of the countries in this report are listed as partners of the Unconventional Gas Technical Engagement Program (UGTEP), formerly known as the Global Shale Gas Initiative (GSGI), which was launched by the US Department of State in April 2010.

UGTEP involves at least nine major US government agencies,¹⁴ and was set-up “in order to help countries seeking to utilize their unconventional natural gas resources – shale gas, tight gas and coal bed methane – to identify and develop them safely and economically. [...] Bilateral and multilateral UGTEP engagement has included Mexico, Colombia, Chile, Poland, Ukraine, Bulgaria, Romania, Lithuania, Jordan, Kazakhstan,

Morocco, India, China, Indonesia, Vietnam, South Africa, Botswana and number of other countries, including under IEA, APEC and ASEAN umbrellas.”¹⁵

According to the US Department of the Interior, UGTEP “uses government-to-government policy engagement to bring the US federal and state governments’ technical expertise, regulatory experience and diplomatic capabilities to help selected countries understand their shale gas potential.”¹⁶

According to the 2015 US Congressional Budget Justification for Foreign Operations (Appendix 2) UGTEP will share a budget of US\$ 5.9 million with the Department of State’s Bureau of Energy Resources.¹⁷

- **New industry-friendly legal frameworks:** While Brazil recently introduced a regulatory framework which strengthens the regulations governing the development of fracking projects in unconventional fossil fuel reservoirs, it appears to be the exception to the general rule among the 11 countries analysed in this report. Under pressure from the fossil fuel industry – which has deep pockets and promises employment and investment – several governments have already started to weaken their environmental legislation, alter their tax regimes and put in place industry-friendly mining licensing and production processes, in order to attract foreign investors and expertise. This is often at the expense of the public interest.
- **Worldwide Shale Development – Made in America:** The development of the global shale gas story is – in almost all of the countries covered in this report – found to be closely linked to the activities of the US Unconventional Gas Technical Engagement Programme (UGTEP), a US administration-funded scheme which aims “to increase global energy security and meet environmental objectives through responsible and safe unconventional natural gas development.”²¹

Shale development requires long production periods of 30-50 years in order to recoup the initial investment. Companies need long-term sales contracts and a guaranteed gas price or other forms of attractive financial enticement to make projects economically viable. In the case of Argentina, for example, this ‘need’ has led to a change in the legal framework to guarantee a minimum price of US\$7.50 per unit (MMBTU) for all additional sales to the Argentinian market (above a quarterly adjusted base supply). This is compared to the previous market valuation of US\$2.80 per unit, an increase of more than 250%.¹⁸ In Russia, no taxes will be paid on oil produced from the Bazhenov basin and three other major shale fields for the next 15 years,¹⁹ while in Morocco, oil and gas producers are exempt from corporation tax for the first 10-year of operation.²⁰

UGTEP uses official government channels and US taxpayers’ money to promote high-volume horizontal hydraulic fracturing worldwide, opening doors for the main global players in the oil and gas industry. Through UGTEP, the US is also actively engaged in re-shaping existing foreign legal regulations to create the desired legal framework for the development of shale oil and gas in the targeted countries.

14 hUS government agencies that participate in the UGTEP include: the US Department of Energy’s Office of Fossil Energy (DOE/FE); the US Agency for International Development (USAID); the US Department of Interior’s US Geological Survey (USGS); the US Department of Interior’s Bureau of Ocean Energy Management (BOEM); the US Department of Commerce’s Commercial Law Development Program (CLDP); the US Environmental Protection Agency (EPA) as well as the US Department of the Interior’s (DOI) including its International Technical Assistance Program (ITAP) and the US Trade and Development Agency (USTDA) - <http://www.state.gov/r/pa/prs/ps/2013/06/211017.htm>, <http://www.gastechnology.org/Training/Pages/USTDA-China-Shale-Gas-Training-Workshops.aspx>, <http://www.eia.gov/analysis/studies/worldshalegas/#3>, Footnote 3.

15 <http://www.state.gov/s/ciea/ugtep/>

16 <http://www.doi.gov/intl/itap/ugtep.cfm>

17 <http://www.state.gov/documents/organization/224069.pdf>

18 http://www.pagbam.com.ar/newsletters/OilGas/Energy_Newsletter_-_April_2013_n_55

19 <http://www.platts.com/news-feature/2013/oil/russia-shale-oil/index>

<http://www.washingtontimes.com/news/2014/feb/18/siberian-shale-find-fuels-russias-fracking-future/?page=all>

20 <http://www.nortonrosefulbright.com/knowledge/publications/102343/morocco-ten-things-to-know-about-oil-and-gas%204>

21 http://www.securityassistance.org/sites/default/files/FY2015_CBJ.pdf

CONCLUSION

- **Growing worldwide opposition:** The report finds that even though fracking is only just starting to get underway in most of the countries analysed, public opposition to this industry is already growing and becoming more organised, bringing together a wide range of different actors such as environmentalists, trade unions, political parties, women's organisations and indigenous community representatives.

In some countries, notably in Brazil and Argentina, local authorities have also started to adopt anti-fracking resolutions, triggering a domino effect as others follow suit, as already witnessed in North America and Europe. The South African government also stopped the development of shale gas in the Karoo region for some time, in order to get more clarity about potential impacts.

- **Fracking and climate change:** Energy demand is growing worldwide, creating a major challenge for political decision-makers and civil society alike. The countries analysed in this report are no different. The dangers of climate change are creating pressure to curb coal production, and this pressure is given added weight in countries such as China, where air pollution has reached critical levels.

At the same time, countries which have a long history of oil and gas development (such as Algeria and Argentina) have seen their production levels peak, and are now facing a decline. These countries are now looking for ways to "stimulate" their remaining fossil fuel resources. The opportunity to extract shale oil and gas by fracking is seen as a way to extend production and benefit the economy.

Such a strategy, however, raises serious questions in terms of sustainability, at a time when experts state that no more than one-third of proven fossil fuel reserves can be consumed if we want globally to avoid reaching the 2°C temperature rise tipping point.²² While gas is often promoted as an ideal source of energy for the transition to decarbonising our energy systems, the most recent science has shown that gas production and transportation are far from clean²³ and that unconventional gas could even be comparable to coal in terms of climate impact.²⁴ The IPCC²⁵ and the International Energy Agency²⁶, among others, have warned that the widespread development of shale gas at the global level would have a negative climate impact.

The emerging planned expansion of the shale gas industry outside the EU and North America raises serious concerns because of the almost unavoidable environmental, social and health impacts already seen at existing fracking sites. Given that these problems have proved difficult to avoid in countries with relatively strong regulations to protect the environment, how can this industry be properly monitored in countries where environmental standards are often lower (and sometimes non-existent), and/or where enforcement capacities are frequently limited and where corruption can be an everyday reality?

The short-sighted approach of promoting the development of shale oil and gas in the rest of the world not only ignores the significant and almost inevitable environmental, social and climate impacts, but also overlooks the opportunity for longer term, more sustainable solutions. The urgent need to shift to a low carbon development path requires investment in energy efficiency and renewable energy sources. For the EU, this creates a responsibility as well as an opportunity to support these countries in moving towards a post-fossil fuel future, which is now not only necessary but also feasible.



Residents of the town of Prins Albert in the Great Karoo, South Africa, protest against the proposed hydraulic fracturing or 'fracking' of underground gas reservoirs in the Karoo. This form of drilling may cause leaking of chemicals into the Karoo's sensitive and scarce underground water resources.

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²² <http://www.iea.org/publications/freepublications/publication/english.pdf>

²³ <http://www.pnas.org/content/early/2014/06/25/1323422111>

²⁴ <http://www.nature.com/nature/journal/vaop/ncurrent/full/nature13837.html>

²⁵ <http://www.climatechange2013.org/>

²⁶ http://www.worldenergyoutlook.org/media/weowebsite/2012/goldenrules/weo2012_goldenrulesreport.pdf

<http://www.worldenergyoutlook.org/publications/weo-2014/>

GLOBAL SHALE GAS & DRINKING GROUND WATER RESERVES & EARTHQUAKE REGIONS

IN FOCUS

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MEXICO
SHALE GAS RESERVES
& WATER-STRESSED REGIONS

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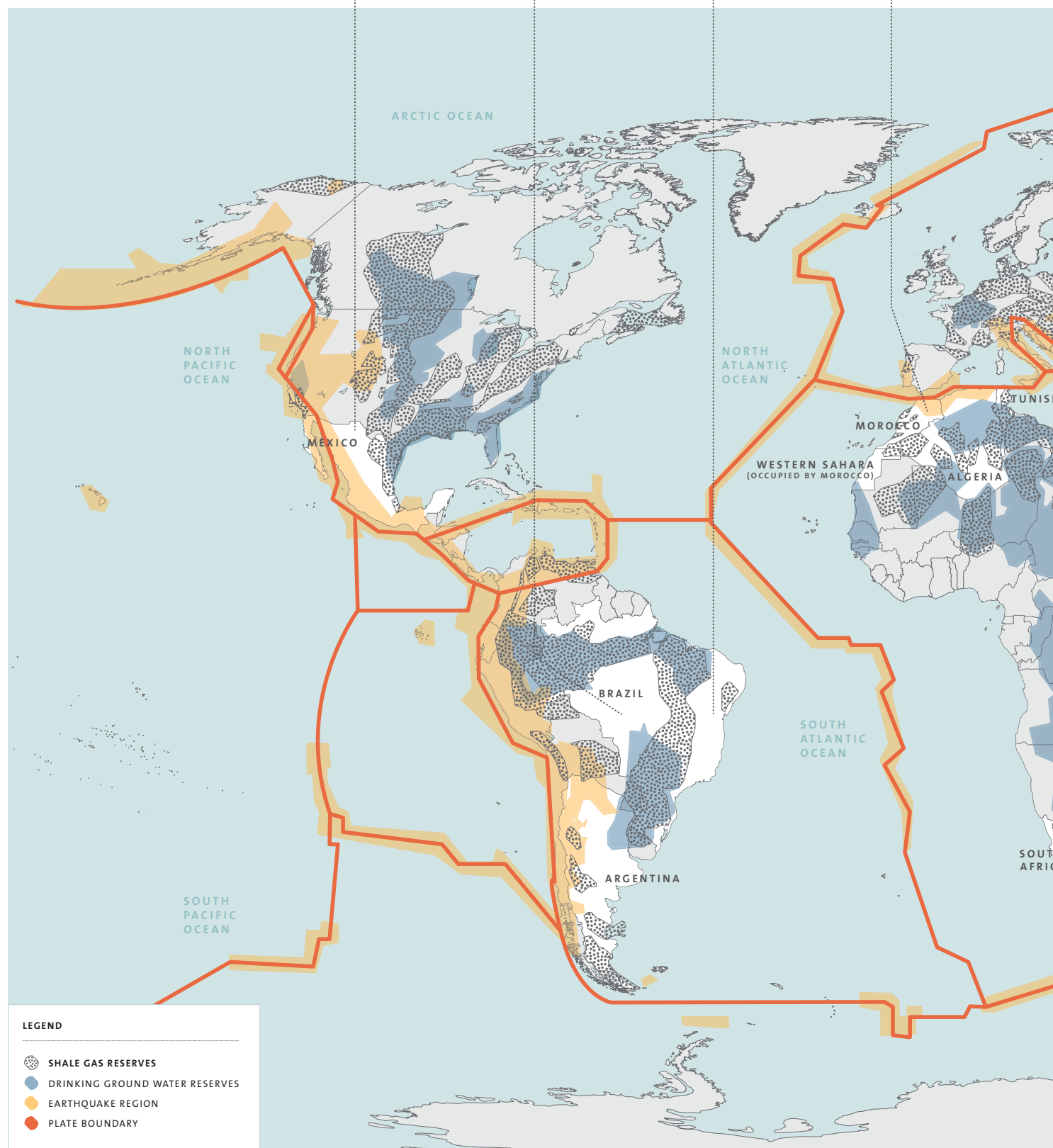
ARGENTINA
SHALE GAS RESERVES
& WATER-STRESSED REGIONS

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BRAZIL
SHALE GAS RESERVES
& DRINKING GROUND
WATER RESERVES

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MAGHREB REGION
SHALE GAS RESERVES
& WATER-STRESSED REGIONS



Sources: WVGISTC, WVU, WRI, UNESCO, USGS, NASA.

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SOUTH AFRICA
SHALE GAS RESERVES
& LICENCES

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INDIA
SHALE GAS RESERVES
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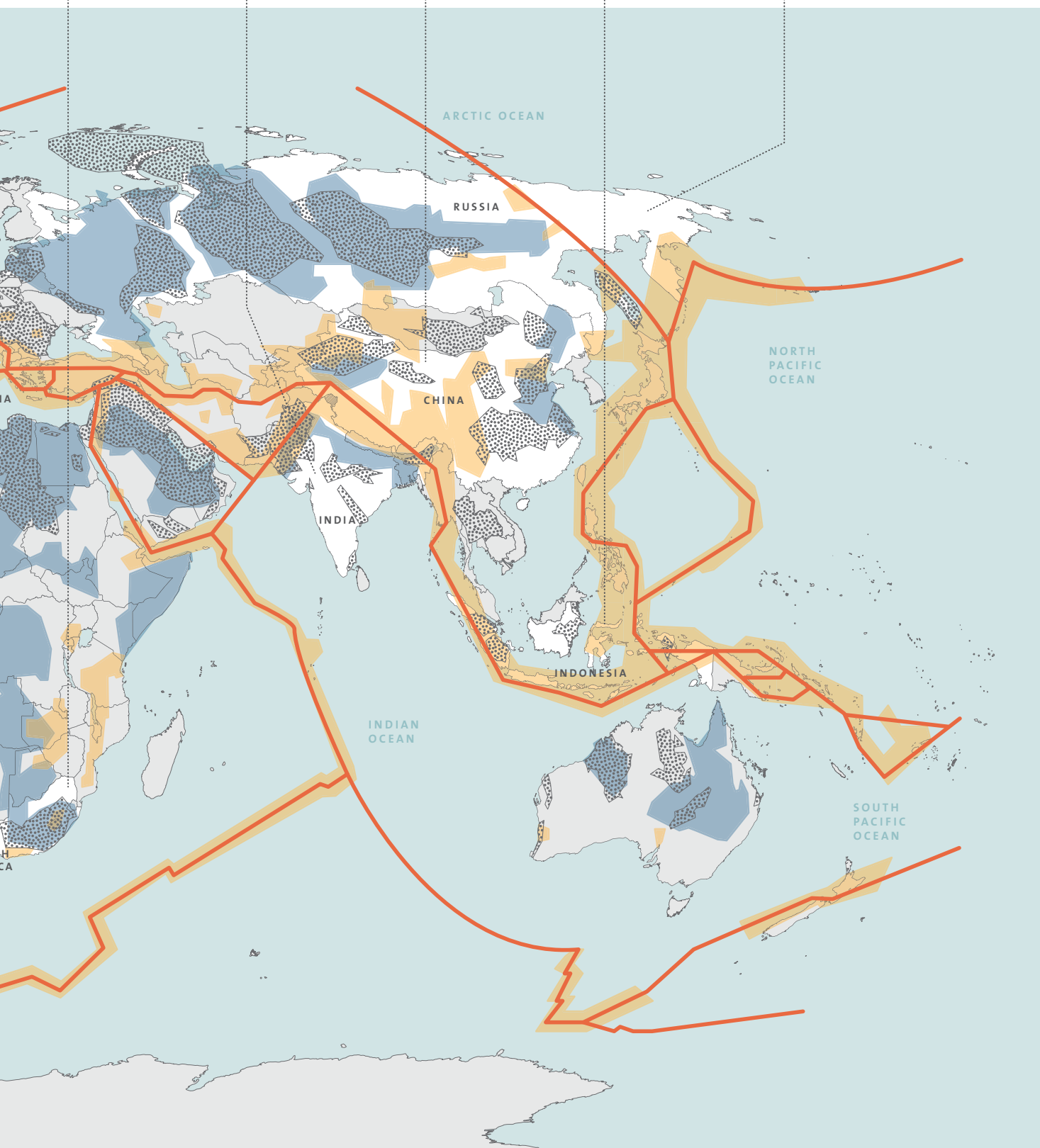
CHINA
SHALE GAS RESERVES
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INDONESIA
SHALE GAS RESERVES,
SEISMICITY & ORANGUTAN
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RUSSIA
SHALE GAS RESERVES & DRINKING
GROUND WATER RESERVES





1

MEXICO

Mexico is one of the world's largest oil producers,¹ and has been identified as having significant shale oil and gas potential. The country recently voted to end a 75-year history of state control of the energy sector, with wide-ranging energy reforms designed to facilitate foreign investment. Oil production has fallen significantly in the last decade and the government appears keen to develop its shale resources. Many of Mexico's shale resources are in areas where water is in short supply, and there are also concerns about the impact of fracking on seismic activity.

MEXICO SHALE GAS RESERVES & WATER-STRESSED REGIONS



Sources: World Resource Institute, 2014 & US EIA, 2013.

TECHNICALLY RECOVERABLE RESOURCES

Technically recoverable resources ²	Shale gas				Shale oil	
	(tcf)		(bcm)		(billion barrel)	
	US EIA	Pemex	US EIA	Pemex	US EIA	Pemex
	545	141.5	15,433	4,007	13	31.9
World ranking ³	Shale gas				Shale oil	
	US EIA	Pemex	US EIA	Pemex	US EIA	Pemex
	6		13		8	3

Technically recoverable resources & world ranking

Mexico is estimated to have the sixth largest quantity of recoverable shale gas globally, according to EIA figures. However this estimate reflects a substantial reduction from 681 tcf (19,284 bcm) in 2011, to 545 tcf (15,433 bcm) in 2013. The amount of shale gas estimated to be in the Burgos basin, which is the most promising and best documented shale formation, was reduced from 454 tcf (12,856 bcm) to 343 tcf (9,713 bcm). EIA figures suggest the country also has an estimated 13 billion barrels of shale oil, the 8th highest worldwide. The Burgos basin is estimated to contain around 6.3 billion barrels of shale oil.

As an illustration of the large uncertainties surrounding these estimates, Mexico's national oil and gas company, Pemex, made their own parallel assessment of the country's resources and came out with significantly different figures, which it then downgraded, reducing its initial estimate for the amount of technically recoverable shale gas from a median 297 tcf (8,410 bcm) to 141.5 tcf (4,007 bcm) in 2012.

This would place Mexico 13th in the global ranking for shale gas. As for shale oil, Pemex estimates technically recoverable resources at 31.9 billion barrels. These estimates would place Mexico 3rd in the global ranking for shale oil resources.

Targeted by UGTEP

Mexico is one of the countries that has participated in the US Unconventional Gas Technical Engagement Program (UGTEP). The US has an open interest in Mexico, which it considers crucial for its

own energy security. According to the US Congressional Research Service, "the future of oil and natural gas production in Mexico is of importance for both Mexico's economic growth, as well as for US energy security". The issue is considered "a key congressional interest" and the US has provided Mexico with technical assistance in resource assessment, environmental protection, and regulatory policies.⁵

At the end of 2013, the US Department of State – together with the Mexican government – organised UGTEP regulatory workshops in Mexico City.⁶ The December 2013 vote to end the state's 75-year control over the energy sector has been keenly watched by observers in the US with an interest in the opening up the country's energy sector. According to one legal advisor: "There's potential to attract additional investment into shale and ultra-deep waters so that those resources can be exploited in a way that's ultimately good for the country."⁷

A Mexico Shale Summit has been scheduled to take place in San Antonio, Texas in 2015, reflecting the interest of the US shale industry in Mexico.⁸

UGTEP - TARGETED BY / LISTED AS PARTNER

Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP) ⁴	Yes

1 <http://www.eia.gov/countries/analysisbriefs/Mexico/mexico.pdf>
2 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
3 <http://www.eia.gov/analysis/studies/worldshalegas/fracking-future/?page=all>
4 <http://www.state.gov/s/ciea/ugtep/>
<http://www.doi.gov/intl/itap/ugtep.cfm>
<http://www.eia.gov/analysis/studies/worldshalegas/#3>

⁵Other US government agencies that participate in the UGTEP include: the US Department of Energy's Office of Fossil Energy (DOE/FE); the US Agency for International Development (USAID); the US Department of Interior's US Geological Survey (USGS); US Department of

Interior's Bureau of Ocean Energy Management (BOEM); the US Department of Commerce's Commercial Law Development Program (CLDP); and the US Environmental Protection Agency (EPA). The US Department of the Interior's (DOI) International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops".

6 <http://fas.org/sgp/crs/row/R43313.pdf>

7 <http://petroleum.mines.edu/Documents/Mines%20Newsletter%202013.pdf>

8 <http://www.bloomberg.com/news/2013-12-12/mexico-lower-house-passes-oil-overhaul-to-break-state-monopoly.html>

9 <http://www.mexicoshalesummit.com/>



MAIN COMPANIES INVOLVED⁹

NOC (National Oil/ Gas Companies)

Pemex

IOC (International Oil/ Gas Companies)

Halliburton, Schlumberger
PetroRock Energy LLC,
Chevron, BP and Shell

RESOURCE OWNERSHIP¹⁰

State	Private	License required		Bidding procedure	
		Yes	No	Yes	No
X		(X)		(X)	

Resource ownership

According to Article 27 of the Mexican Constitution, all hydrocarbon resources in Mexico belong to the Mexican nation, and oil and gas exploration has been the exclusive preserve of the state company for the last 75 years. The Mexican Energy Reform introduced in 2013 is designed to change this.¹¹

The new legislation will introduce three new contract types, which will allow foreign companies to play an active role in the Mexican market. Through profit-sharing contracts, companies will receive a percentage of the profits from oil and gas development. Production-sharing contracts will allow them to own a percentage of the extracted hydrocarbons and private companies can be paid with extracted hydrocarbons through licence agreements.¹² The state is initially expected to give private investors the option of carrying out exploration and production activities on behalf of the state through exploration and production services contracts. These will be subject to a competitive bidding procedure.¹³

However some uncertainty remains as Cuauhtemoc Cardenas, son of the former Mexican president Lazaro Cardenas (the man who nationalised the Mexican oil industry in 1938), has announced that the PRD party will call for a public consultation in 2015 in order to challenge the current reforms. He told media *"the oil industry should be defended because it should serve the Mexican people and not benefit foreign interest."*¹⁴

New legislation and legal framework

Pemex is expected to retain its dominant position in the market, with priority over other oil and gas companies, and is expected to maintain roughly 83% of Mexico's proven and probable hydrocarbon reserves as well as around 30% of the country's potential oil and gas resources.¹⁶ The Mexican government plans to open the first bidding procedures for private companies to participate in the exploration and exploitation of oil and gas blocks from 2015.¹⁷

NEW LEGISLATION / LEGAL FRAMEWORK¹⁵

New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general	Yes	No	Date	Relevant legislation
	X		1917	Article 27 of Mexican Constitution and Regulations for Petroleum Branch
			7 June 1938	Law of Petróleos Mexicanos (Pemex Law)
			20 December 2013	Energy Reform

9 <http://www.forbes.com/sites/greatspeculations/2014/08/13/schlumberger-and-halliburton-can-benefit-as-mexico-overhauls-its-energy-sector/>
<http://www.mexicoshalesummit.com/#/mexico-shale-summit-speakers/c1c9f>
<http://oilpro.com/post/6235/pemex-supports-mexico-shale-summit-san-antonio-associated-partner>
<http://www.desmogblog.com/2014/05/12/no-turning-back-mexico-looming-fracking-and-offshore-oil-and-gas-bonanza>

10 <http://uk.practicallaw.com/6-524-0285?q=&qp=&qo=&qe=#a540341>

11 http://www.nytimes.com/2014/08/06/business/international/mexican-congress-approves-new-rules-for-oil-industry.html?_r=0

12 <http://www.eia.gov/todayinenergy/detail.cfm?id=17691>

13 <http://uk.practicallaw.com/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1247812498077&ssbinary=true>

14 <http://www.telesurvtv.net/english/opinion/Mexico-Lazaro-Cardenas-The-Perfect-Politician-20141018-0035.html>

15 http://zedillo.presidencia.gob.mx/welcome/PAGES/culture/note_5feb.html
<http://www.latinamericanstudies.org/mexico/1917-Constitution.htm>
http://www.ri.pemex.com/files/content/Law%20of%20Petroleos%20Mexicanos%20_versi%20ingles_.pdf
<http://latinlawyer.com/reference/topics/47/jurisdictions/16/mexico/>

<http://uk.practicallaw.com/6-524-0285?q=&qp=&qo=&qe=#a540341>

16 <http://www.forbes.com/sites/greatspeculations/2014/08/13/schlumberger-and-halliburton-can-benefit-as-mexico-overhauls-its-energy-sector/>

17 http://www.nytimes.com/2014/08/06/business/international/mexican-congress-approves-new-rules-for-oil-industry.html?_r=0



The Mexican state may now enter into contracts with state companies or private entities for the exploration and production of oil, hydrocarbons, and gas. As there are no statutory rules for exploration and production services contracts, each project has to be negotiated individually, with the current Pemex procurement mechanisms suggesting a likely agreement for up to 35 years.¹⁸



Burning gas as part of an oil well in the Mexican state of Veracruz.
© Jesús Eloy Ramos Lara/Dreamstime

Status of development

As one of the largest oil producers in the world, oil revenues play an important part in Mexico's economy. Since 2004 Mexico's oil production has steadily declined,²⁰ while its energy consumption, especially gas, has increased. The recent energy reforms provide an opportunity to satisfy this growing demand by not only increasing foreign investment in conventional supplies of oil and gas, but also by opening up the market for shale development.

Mexico has recently also approved the US - Mexican Transboundary Hydrocarbons Agreement which gives Mexico's Pemex and US companies (such as ExxonMobil and Chevron) opportunities to jointly develop oil and gas reserves which straddle the countries' marine borders.²¹ These transboundary resources include possible shale resources, such as the Eagle Ford Basin in Texas which stretches across the border into Mexico. Five areas have been identified as having shale gas potential: the Chihuahua, Sabinas-Burro-Pichachos, Burgos, Tampico-Misantla and Veracruz basins, with 165 exploration wells drilled so far. According to an official Pemex list, 20 wells (all in the Burgos in Sabinas basin) were completed between September 13, 2010 and January 30, 2014.²² According to the June 2013 EIA assessment, Pemex initially announced that it was planning to drill up to 80 wells by 2015 in the Tampico Basin and up to 10 wells by 2016 in the Veracruz basin, but no exploration has as yet taken place in these areas. Reuters has reported that the state-owned company will only drill 10 wells in 2014.²³

There are concerns that the viability of Mexico's shale resources may be limited. According to the EIA, "many of Mexico's shale basins are too deep in their center for shale gas and shale oil development (>5 km)". They are also considered expensive with a cost of \$20-\$25 million per well, while producing only modest gas flow. Production at the first well drilled (Emergente) has fallen by 70% after just two years of test production.²⁴

Nonetheless, Pemex intends to start commercial shale gas production in 2015. With an investment of \$1 billion, 750 wells are planned by 2025, with 75 shale exploration wells in the Burgos Basin in 2015 alone, developed in partnership with US companies including Halliburton²⁵ and Schlumberger.²⁶ According to Gustavo Hernandez, interim head of Pemex's exploration and exploitation division, 60,000 wells will be required in order to exploit the estimated shale gas resources in Mexico,²⁷ with some estimates suggesting that \$100 billion in investment is needed to develop the resource.²⁸

18 <http://uk.practicallaw.com/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobkey=id&blobtable=MungoBlobs&blobwhere=1247812498077&ssbinary=true>
19 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
20 <https://www.tamui.edu/binationalcenter/documents/GCDVLAREDOPRESENTACIONCOMITEBINACIONALENERO282013vf.pdf>
21 http://www.eoearth.org/files/229101_229200/229128/oil-production-consumption.png
22 <http://fas.org/sgp/crs/row/R43313.pdf>
23 https://www.foeeurope.org/sites/default/files/pemex-20-wells_1857500102714.pdf

24 <http://www.reuters.com/article/2014/02/27/mexico-shale-idUSL1N0LV2QO20140227>
25 http://www.doi.gov/intl/itap/upload/Session-02-02-JakartaShale_Lozano_Final_Def.pdf
26 http://www.rigzone.com/news/oil_gas/a/119049/Halliburton_Pemex_Tout_Technology_Success_in_Mexico
27 <http://mexicoshalegas.com/schlumbergers-take-on-mexico-shale-exploration-unconventional-drilling/>
28 <http://www.reuters.com/article/2014/02/27/mexico-shale-idUSL1N0LV2QO20140227>
29 <http://www.mexicoshalesummit.com/>



Environmental, ecological and social impacts

Water stress and scarcity

The majority of Mexico's shale basins overlap with areas that are already plagued with high levels of water stress. According to the World Resources Institute almost two thirds of Mexico's technically recoverable shale resources are located in areas that are arid or under high water stress.²⁹ The Burgos basin³⁰ overlaps parts of the transboundary Gulf Coastal Plain Aquifer,³¹ which is already considered to be overexploited. Access to water is an important issue in a country where 9% of the population lacks access to tap water and where tap water quality is recognized as poor, forcing people to rely on bottled water. Thirteen per cent of the population lack access to sanitation.³²

There have even been media reports of water wars, with street fights between riot officers and residents in a town on the outskirts of Mexico City over access to the local spring water supply.³³ Demand for water in Mexico is predicted to rise from 78.4 billion m³ per year to 91.2 billion m³ per year by 2030, creating an estimated gap between supply and demand of 23 billion m³.³⁴

The fracking industry argues that it can overcome problems with water supply by recycling the waste water from fracking. However, a significant proportion of fracking fluid cannot technically be pumped back at the end of the process. According to the US Geological Survey only 10% of all water used is recovered from the drilled and fractured formation in north-eastern Pennsylvania.³⁵ Another study found that over 90% of the water used for fracking operations remains underground and is therefore permanently removed from the water cycle.³⁶ The same study also noted that 80% of fracking water comes from rivers and streams.

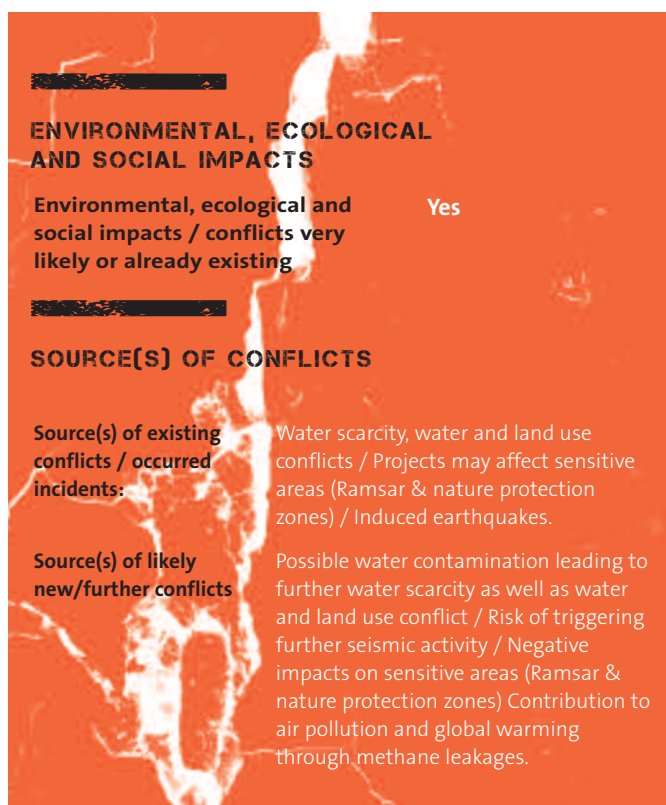
Conflict with natural protected areas

The development of the oil and gas industry in the targeted shale gas basins is also considered a threat to natural areas which are protected because of their importance for biodiversity. These include sites protected under the Ramsar Convention,³⁷ nature protection zones such as the Laguna Madre y Delta del Rio Bravo on the Gulf of Mexico, national parks including the Cumbres de Monterey and biosphere reserves such as Los Tuxtlas and Tehuacan-Cuicatland.³⁸

Wells operating without necessary environmental impact assessments

There is also evidence that some wells in Mexico are operating without the legally-required Environmental Impact Assessment, as highlighted by a state Advisory Council for Sustainable Development in Coahuila. In a letter to the Federal Delegation of Semarnat, Coahuila, the body raised concerns about six wells, some of which appeared to have been drilled at different sites from those cited in the permits. According to the letter, the Environmental Impact Assessment for the 3,214 wells planned stated that only conventional drilling techniques would be used. Permission had not therefore been given for the use of fracking.³⁹

According to the Mexican Center for Analysis and Research, Fundar, all hydrocarbon projects must be approved by the Mexican Environmental Ministry. The wells in Coahuila,⁴⁰ which are managed by Pemex, were operating without the required Environmental Impact Assessment. The Alliance Against Fracking, in collaboration with an organisation specialized in environmental litigation (CEMDA), is taking legal action to challenge whether permission should have been granted for drilling at these sites.⁴¹



29 http://www.wri.org/sites/default/files/wri14_report_shalegas.pdf
 30 http://www.eia.gov/countries/analysisbriefs/Mexico/images/shale_gas_basins_map.png
 31 http://www.whymap.org/whymap/EN/Downloads/Continental_maps/gwrm_namerica_pdf.pdf?_blob=publicationFile&v=2
 32 <http://www.forbes.com/sites/ivancastano/2012/02/22/mexicos-water-war/>
 33 <https://news.vice.com/article/a-bloody-war-for-water-in-mexico>
 34 http://www3.weforum.org/docs/WEF/WRG_Background_Impact_and_Way_Forward.pdf

35 <http://pubs.usgs.gov/of/2013/1137/pdf/ofr2013-1137.pdf>
 36 http://www.downstreamstrategies.com/documents/reports_publication/marcellus_wv_pa.pdf
 37 http://www.conanp.gob.mx/sig/imgmapoteca/map_grales/map_ramsar.jpg
 38 http://www.conanp.gob.mx/sig/imgmapoteca/map_grales/ANP_Abril_2011.pdf
 39 https://www.foeeurope.org/sites/default/files/no_hay_mias_dg-6845-13-2_no-eia.pdf
 40 <http://fundar.org.mx/english/#VB0-LBYfK6l>
 41 E-mail correspondence with Aroa de la Fuente of Fundar

Earthquakes

In 2014 media reported that seismic experts had identified a phenomenon described as a “swarm of earthquakes” in the northern states of Tamaulipas and Nuevo León, close to the fracking operations in the Burgos basin.⁴² Between October 2013 and March 2014, Mexico’s National Seismological Service recorded more than 100 earthquakes in northern Mexico with an intensity of between 2.8 and 4.5 on the Richter scale.⁴³ The scientists say that the seismic activity cannot be attributed to a single cause,⁴⁴ but the earthquakes are all in a region where fracking operations are underway.⁴⁵

One expert who mapped the seismic activities warned:

*“Earthquakes will increase as a result of the higher-scale shale gas production. The government is misguided. Fracking should be banned.”*⁴⁶

Opposition to the development of shale gas / oil

A 2012 report on the Global Anti-Fracking Movement found evidence of moderate anti-fracking activism in Mexico, as well as minor or moderate political opposition.⁴⁷ The report, carried out by the Control Risks Group Ltd, finds that there is however a high security risk in the regions of Coahuila, Nuevo León and Tamaulipas, all of which are considered to have shale potential. Drug violence in northern Mexico is considered a threat to fracking’s potential, with media reports that development is unlikely to go ahead unless the security situation is improved.⁴⁸

In August 2014, a 5,000 member Gendarmerie Division was launched in order to guard “agriculture, mining, and oil and gas production against criminal groups”.⁴⁹

While the global report finds only moderate opposition to fracking, there is evidence that this is growing. The Mexican Alliance against Fracking (Alianza Mexicana contra el Fracking) was created in August 2013 bringing together a broad range of organisations fighting fracking in Mexico and elsewhere.⁵⁰ Other organizations have also sprung up, including Chihuahua vs Fracking. This group, launched in June 2014, has gained the support of elected officials such as Senator Javier Corral.⁵¹ This is a clear sign that the anti-fracking movement is growing in Mexico.



Demonstration against fracking in Mexico.
© Alianza Mexicana Contra El Fracking

42 <http://www.ipsnews.net/2014/04/fracking-seismic-activity-grow-hand-hand-mexico/>

43 <http://www.ssn.unam.mx/jsp/reportesEspeciales/Nuevoleon.03.2014.pdf>

44 <http://www.ssn.unam.mx/jsp/reportesEspeciales/Nuevoleon.03.2014.pdf>

45 https://www.foeeurope.org/sites/default/files/pemex-20-wells_1857500102714.pdf

46 <http://www.ipsnews.net/2014/04/fracking-seismic-activity-grow-hand-hand-mexico/>

47 http://www.controlrisks.com/~media/Public%20Site/Files/Oversized%20Assets/shale_gas_whitepaper.pdf

48 <http://www.ibtimes.com/violent-drug-cartels-northern-mexico-threaten-forestall-countrys-fracking-boom-1609202>

49 <http://www.reuters.com/article/2014/08/22/us-mexico-security-idUSKBN0GM20620140822>

50 <http://nofrackingmexico.org/quienes-somos/>

51 <http://javiercorral.org/prensa/comunicados.php?id=8344>



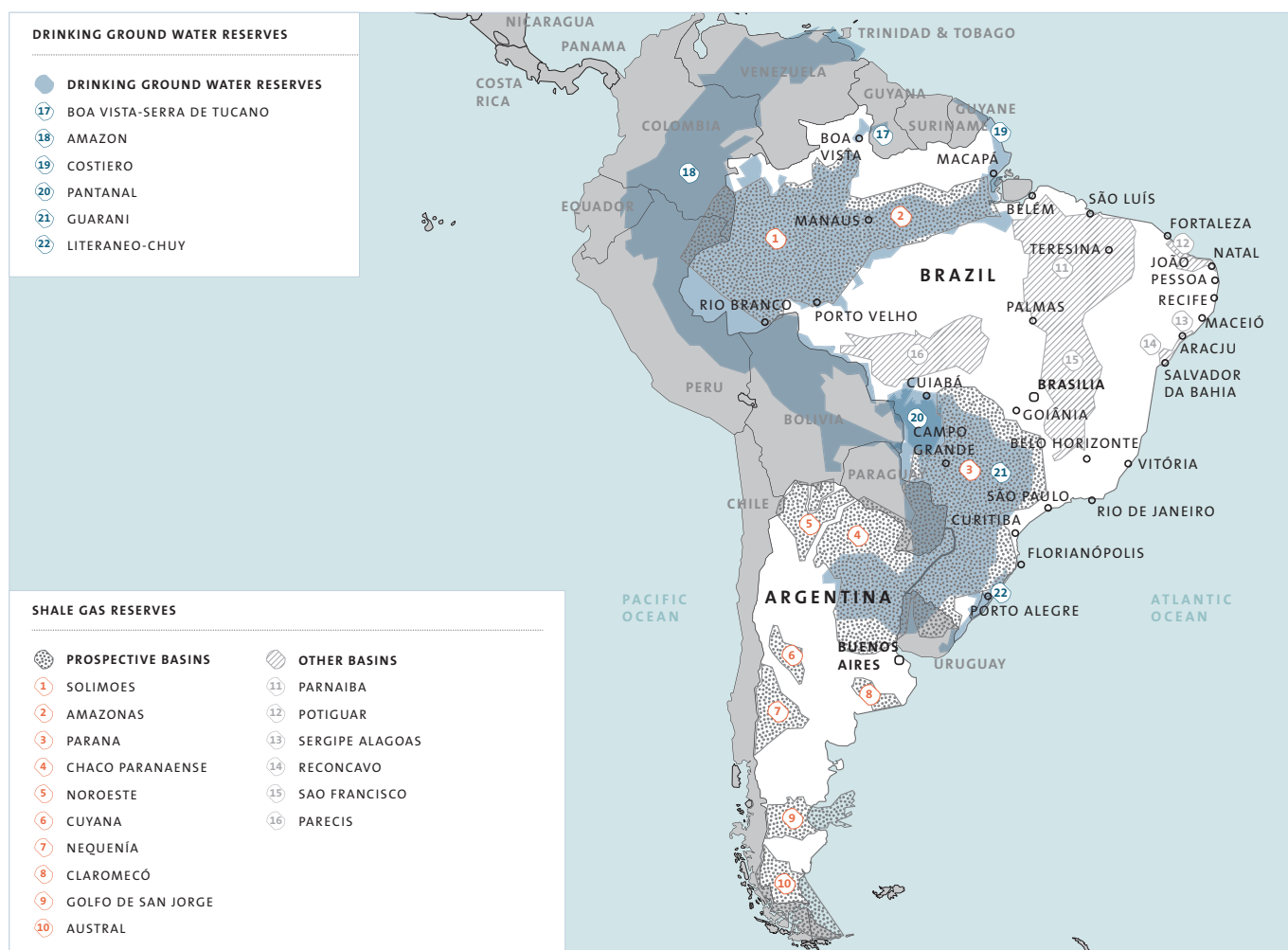
2

BRAZIL

Thanks to the recent discovery of off-shore oil reserves,¹ the Brazilian government hopes for a booming energy sector which will boost its economy. The country is also thought to have significant reserves of shale oil and gas. While the country has held an initial bidding round, allowing foreign companies to partner with Brazilian entities to bid for concessions, development

of the industry faces uncertainty, with proposals for a moratorium on all fracking activities for a five-year period currently being considered by the parliament. There are concerns that fracking could threaten the regionally-important transboundary Guarani Aquifer, while exploration in the Amazon basin threatens indigenous rights and would involve deforestation.

BRAZIL & ARGENTINA SHALE GAS & DRINKING GROUND WATER RESERVES



Sources: US EIA, 2013, Swedish Water House, Advanced Resources International, International Groundwater Resources Assessment Centre.

1 http://www.washingtonpost.com/world/brazils-oil-euphoria-hits-reality-hard/2014/01/05/0d213790-4d4b-11e3-bf60-c1ca136ae14a_story.html

TECHNICALLY RECOVERABLE RESOURCES

Technically recoverable resources ²	Shale gas (tcf)	Shale gas (bcm)	Shale oil (billion barrel)
	245	6,938	5.3
World ranking ³	Shale gas	Shale oil	
	6	14	

UGTEP - TARGETED BY / LISTED AS PARTNER

Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP) ⁴	Yes

Technically recoverable resources & world ranking

According to the EIA's World Shale Gas Assessment, the Paraná basin, which extends from Brazil into Argentina, has an estimated 80 tcf (2.265 bcm) of shale gas and some 4.3 billion barrels of shale oil on the Brazilian side. In northern Brazil, the Solimões Basin has an estimated 65 tcf (1.841 bcm) of shale gas and 0.3 billion barrels of shale oil. The Amazonas basin, which is nearby, is estimated to have some 100 tcf (2.832 bcm) of shale gas and some 0.8 billion barrels of shale oil. Overall, Brazil is estimated to have 245 tcf (6.938 bcm) of recoverable shale gas resources, placing it 10th in the world rankings. The estimate shale oil resources total 5.3 billion barrels, the 14th largest shale oil resource globally.

Targeted by UGTEP

Brazil is not officially listed as a UGTEP partner, but the country is considered eligible for UGTEP funding for bilateral and regional engagement, including government workshops,⁵ and there is evidence of US engagement with the Brazilian government over the development of the country's shale resources.

For example, in 2012, officials from the US Department of Energy and Brazil's Ministry of Mines and Energy met in Houston, Texas, in order to discuss regulatory and technological aspects of shale gas. Discussions included the organisation of a workshop in Brazil to support the process for the next round of bidding for shale concessions in Brazil.⁶

In 2013, the 3rd US-Brazil technical workshop on unconventional oil and gas development took place in Rio de Janeiro, Brazil, with sessions on US unconventional oil and gas improvements, the Brazilian regulatory situation, and support on how to attract private investment.⁷



Deployment of pipelines to transport natural gas on a stretch of rising hill, using tube settlers, hydraulic excavators and other heavy equipment.

© ValterCunha/Istockphoto

² <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

³ <http://www.eia.gov/analysis/studies/worldshalegas/>

⁴ <http://www.state.gov/s/ciea/ugtep/>

<http://www.doi.gov/intl/itap/ugtep.cfm>

<http://www.eia.gov/analysis/studies/worldshalegas/#3>

⁵ Other U.S. government agencies that participate in the UGTEP include: the U.S. Department of Energy's Office of Fossil Energy (DOE/FE); the U.S. Agency for International Development (USAID); the U.S. Department of Interior's U.S. Geological Survey (USGS); U.S. Department of Interior's Bureau of Ocean Energy Management (BOEM); the U.S.

Department of Commerce's Commercial Law Development Program (CLDP); and the U.S. Environmental Protection Agency (EPA). The U.S. Department of the Interior's (DOI) International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops.

⁶ http://www.securityassistance.org/sites/default/files/FY2015_CBJ.pdf

⁷ http://energy.gov/sites/prod/files/BrazilUSA%20-%20Strategic%20Energy%20Dialogue%2003.19.2013_0.pdf

<http://www.brazilcouncil.org/events/partner-event-3rd-us-brazil-technical-workshop-unconventional-oil-and-gas-development>



MAIN COMPANIES INVOLVED*	
NOC (National Oil/ Gas Companies)	IOC (International Oil/ Gas Companies)
Petróleo Brasileiro S.A. (Petrobras), Pré-Sal Petróleo S.A. (PPSA), Petra Energia S.A.	GDF Suez, Trayectoria Oil & Gas, Shell, Frac Tech (FTSI)

RESOURCE OWNERSHIP*					
State	Private	License required		Bidding procedure	
		Yes	No	Yes	No
X		X		X	

Resource ownership

According to Article 176 of the Brazilian Federal Constitution, oilfields and other mineral resources belong to the state. Article 3 of Law No. 9.478 (the Petroleum Law) guarantees ownership of oil deposits, natural gas and other fluid hydrocarbons to the Federal Republic of Brazil while Article 21 states that the Federal Republic owns exploration and production rights on Brazilian territory. Concession holders are however granted ownership of extracted oil and gas (Article 26, Petroleum Law), with the proviso that they must pay an equivalent share of 0.5 - 1 % of the production to the landowner (Article 52, Petroleum Law).

Under the Petroleum Law concession contracts allow both exploration and exploitation (Article 24, Petroleum Law). During the exploration phase, the company can evaluate and conduct test drilling in order to assess the economic value of the hydrocarbons (Article 24, Petroleum Law). Once the production phase has started, further development can take place (Article 24 Paragraph 2 Petroleum Law).

Concession contracts are awarded by the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP) via licensing rounds. Companies can participate in the bidding procedure as operators or non-operators. Multinational companies must form a partnership with a company registered/based in Brazil to sign a concession contract.

New legislation & legal framework

Uncertainty currently hangs over the future of fracking in Brazil, with a bill introduced in August 2014 seeking to introduce a five-year-ban on hydraulic fracturing in the country. This legislative move follows a recent round to establish concession contracts for five onshore oil and gas basins with national and international bidders.

Brazil's legal framework, including the constitution, has been amended a number of times in recent years to allow the commercial development of the country's oil and gas resources. Article 177 of the Constitution was amended in 1995 to allow the Federal Republic to contract with state-owned and private companies for the exploration and exploitation of oil and gas resources. In 1997, ANP was created and the concession system put in place through the Petroleum Law.

A new regulatory framework has also been introduced for the development of fracking projects in unconventional fossil fuel reservoirs, (Resolution No. 21/2014), following a public consultation in November 2013. Under the new resolution, operators will have to disclose all chemical products used, transported and stored for the hydraulic fracturing operations.¹⁰ Details regarding the source, treatment and disposal of the water used throughout the fracking process must also be disclosed. Companies also must submit (1) a mandatory environmental impact assessment; (2) water use licenses; (3) a report regarding all superficial water bodies and underground water wells within 1,000 meters of the well head; (4) a statement by the technician responsible for the project stating that it complies with legal requirements and all tests have been performed; and (5) an assessment concerning natural and induced seismic occurrences.¹¹ ANP is responsible for giving final approval, dependent on the necessary environmental permits being in place, including specific permission for fracking activities in unconventional reservoirs.¹²

8 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
<http://photos.state.gov/libraries/brazil/165950/unconventional-gas-development/Unconventional-Hydrocarbon-Potential-in-Brazil.pdf>
<http://www.globalpost.com/dispatch/news/agencia-efe/131128/colombias-trayectoria-oil-gas-wins-4-concessions-brazil>
<http://www.bnamerica.com/company-profile/en/petra-energia-sa-petra-energia>
<http://www.timesofoman.com/News/Article-24313.aspx>
9 <http://www.eisourcebook.org/cms/Brazil,%20Exploration%20and%20Production%20of%20Oil%20&%20Gas%20Legislation.pdf>
<http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
<http://www.panoramaofbrazilianlaw.com/index.php/%20BrLaw/article/download/7/12>
10 <http://www.mattosfilho.com.br/pagina.php?item=Memos&pag=5710&lang=en>
11 <http://www.mattosfilho.com.br/pagina.php?item=Memos&pag=5710&lang=en>
12 <http://www.mayerbrown.com/de/Unconventional-Reservoirs-ANP-Approves-New-Resolution-for-Hydraulic-Fracturing-04-25-2014/>

NEW LEGISLATION / LEGAL FRAMEWORK¹³

New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general	Yes	No	Date	Relevant legislation
X			1988	Article 176 Brazilian Constitution (ownership of hydrocarbons)
			1995	Amendment of Article 177 (co-operation contracts allowed)
			August 06, 1997	Law No. 9,478 (the Petroleum Law)
			August 02, 2010	Law No. 12,304 (Pré-Sal Petróleo/PPSA Law)
			December 22, 2010	Law No. 12,351 (the Pre-Salt Law) Resolution No. 21/2014
			April 11, 2014	(Regulation of Hydraulic Fracturing in Unconventional Reservoirs)
			August, 2014	Bill on Five-Year-Moratorium

The country also has significant conventional oil resources, with an important discovery made off the coast of Brazil by a consortium of Brazil's Petrobras, the UK's BG Group, and Portugal's Petrogal in 2007. It is estimated that this field contains some 8 -12 billion barrels of recoverable oil,¹⁴ and some analysts estimate that there is even more.¹⁵

The move to introduce a temporary moratorium on fracking in Brazil would allow time to carry out further studies on the potential environmental impacts of the technique. A national vote is expected on the legislation in 2015.¹⁶



Shipyard with the manufacture of Petroleum Ferry in Manaus - Amazonas Brazil.
© guentermanaus/shutterstock

13 <http://www.eisourcebook.org/cms/Brazil,%20Exploration%20and%20Production%20of%20Oil%20&%20Gas%20Legislation.pdf>
<http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
<http://www.panoramaofbrazilianlaw.com/index.php/%20BrLaw/article/download/7/12>
14 <http://www.eia.gov/todayinenergy/detail.cfm?id=13771>
15 <http://www.eia.gov/countries/cab.cfm?fips=br>
16 <http://www.sidley.com/09-02-14-The-Sidley-Shale-and-Hydraulic-Fracturing-Report/>
<http://www.omm.com/current-developments-affecting-hydraulic-fracturing-operations-09-02-2014/>

17 <http://photos.state.gov/libraries/brazil/165950/unconventional-gas-development/Unconventional-Hydrocarbon-Potential-in-Brazil.pdf>
http://www.rigzone.com/news/oil_gas/a/130783/Brazil_Advances_in_the_Shale_Game/?all=HG2
18 <http://www.eisourcebook.org/cms/Brazil,%20Exploration%20and%20Production%20of%20Oil%20&%20Gas%20Legislation.pdf>
19 http://www.rigzone.com/news/oil_gas/a/130783/Brazil_Advances_in_the_Shale_Game
20 <http://www.upstreamonline.com/hardcopy/news/article1320234.ece>
21 <http://www.reuters.com/article/2012/11/20/column-kemp-fracking-international-idUSL5E8MK9U020121120>



Status of development

Under the 12th Licensing Bid Round in 2013, 240 concessions, including unconventional reservoirs, were made available for oil and gas exploration and exploitation. Of the 240 blocks made available, 72 blocks were auctioned off. Of these, 49 were purchased by Petrobras, the state-owned oil company.¹⁸ The French company GDF Suez now owns six blocks, through two consortia with the Brazilian companies Petrobras and Cowan Petroleo e Gas.¹⁹

Shell is hoping to drill in the state of Minas Gerais, working in partnership with Brazil's Petra Energia, and has said its ambition is to "lead way for fracking in the São Francisco basin".²⁰ Petro Energia had discovered gas in tight sandstones and carbonates in 12 of the 14 wells drilled. It has teamed up with the international company Frac Tech (FTSI), a leading supplier of fracking equipment, to access services to develop the São Francisco and Recôncavo basins. These shale resources were not included in the EIA assessment of Brazil's estimated shale potential.²¹

The involvement of foreign companies in bids to exploit Brazil's off-shore oil fields have fuelled street protests.²² Petrobras has formed a consortium with Shell, Total, and the Chinese companies CNOOC and CNPC to develop the concession. The size of the off-shore findings has made it a government priority, putting shale gas developments on the backburner.²³

Some states have even introduced fracking bans. In Paraná state, a fracking ban was upheld by a court decision in June 2014, which might affect concessions held by Petrobras and Petra Energia²⁴ and potentially slow the overall pace of shale gas and oil development in Brazil.



Environmental, ecological and social impacts

Guarani Aquifer

The Paraná shale basin²⁵ overlaps a large section of the Guarani Aquifer, one of the world's largest aquifers. This natural resource, which extends into Argentina, Paraguay and Uruguay is governed by the unique Guarani Aquifer Agreement (GAS), signed by the four countries in August 2010, with all four parties undertaking to protect its sustainable common use and respect the obligation of not "causing significant harm to the other Parties or the environment."²⁶

The São Paulo Declaration on the Management of the Guarani Aquifer System highlights the "potential threats posed to the aquifer due to changes in land use, increase in population, and climate effects".²⁷ Furthermore, the Group of Experts "encourages the governments of the four countries to follow up the ratification process of the Guarani Aquifer Agreement, highlighting the relevance of its Article 4: The Parties shall promote the conservation and environmental protection of the Guarani Aquifer System so as to ensure multiple, reasonable, sustainable, and equitable use of its water resources".²⁸ Environmental groups have raised concerns that fracking could lead to the risk of groundwater contamination in the vicinity of the Guarani Aquifer.²⁹

22 <http://m.aljazeera.com/story/2013102244618284582.pdf>

23 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

24 <http://www.guardian.co.uk/business/2014-08-28/brazil%E2%80%99s-lower-house-considers-fracking-ban>
<http://www.shalemarkets.com/brazils-lower-house-considers-fracking-ban-brazil-south-america-201408234276/>

25 <http://www.eia.gov/countries/analysisbriefs/cabs/Argentina/images/Shale%20Gas%20Basins%20of%20Southern%20South%20America.gif>

26 http://www.globalwaterforum.org/wp-content/uploads/2013/09/The-Agreement-on-the-Guarani-Aquifer-Cooperation-without-conflict_GWF1334.pdf

27 http://webworld.unesco.org/water/wwap/news/pdf/SAG_eng_30April_USP.pdf

28 http://www.cepas.net.br/images/evntos/cisag2011/cisag_carta_sao_paulo_en.pdf

29 <http://www.omm.com/current-developments-affecting-hydraulic-fracturing-operations-09-02-2014/>

The risks are considerable. Scientific studies have consistently shown what seems to be an inherent tendency for shale oil and gas wells to fail, generating a significant risk of methane and fracking chemicals leaking into ground and surface water. On average, 6.2% of unconventional wells in Pennsylvania were found leaking.³⁰ The cumulative consequences of similar levels of leakage in wells near the Guarani Aquifer would be devastating for the water resources of the entire region if fracking was allowed.

Concessions overlapping indigenous territory

The concessions awarded for the development of unconventional fossil fuels in Acre in the Amazon basin are situated in the middle of indigenous lands. Large parts of the Amazon basin are classified as a conservation area,³¹ including areas adjacent to the areas licensed for shale development.³²

Shale exploration in the Amazon will add to existing pressures on the forests, in an area that has already suffered from high levels of deforestation as a result of ever-growing demand for land.³³ The geology of the Amazon basin is complex, but is considered to have significant oil and gas resources.³⁴ The final declaration of the World Indigenous Peoples Conference on Territories, Rights and Sustainable Development, which took place in Rio in 2012, called on the UN, governments and corporations to abandon “false solutions to climate change” such as “hydraulic fracturing” which “endanger the future of life as we know it”.³⁵

“Instead of helping to reduce global warming, they poison and destroy the environment and let the climate crisis spiral exponentially, which may render the planet almost uninhabitable.”³⁶



Mato Grosso deforestation.

© Pedro Biondi/ABr/commons.wikimedia.org

OPPOSITION TO THE DEVELOPMENT

Opposition to the development
of shale gas / oil

Yes

Opposition to the development of shale gas & oil

There is a moderate level of anti-fracking activism in Brazil according to the 2012 Global Anti-Fracking Movement report,³⁷ and a minor to moderate political and security risk. However, as with everywhere else in the world, the anti-fracking movement in Brazil is growing, with a number of initiatives from citizens, environmental groups, indigenous people, workers organisations, officials and political decision makers. Recent political developments to introduce a moratorium suggest that the “political risk” for shale gas investment in the country has increased since the 2012 report.

For example, a group has been set up in Paraná – Paraná sem Fracking – to oppose all fracking in the state,³⁸ while some municipalities such as Toledo have opposed the development of fracking in their region.³⁹ The National Association of Brazil's Environmental Specialists and Civil Servants (ASIBAMA Nacional - Associação Nacional dos Serv. Carreira de Especialista em Meio Ambiente e PECMA) is also opposed to fracking in Brazil and is supporting the call for a moratorium.⁴⁰

- 30 <http://www.pnas.org/content/early/2014/06/25/1323422111>
- 31 http://policymix.nina.no/portals/policymix/Images/Case%20studies/Brazil/Mapa1_LegalAmazon.jpg
- 32 <http://raisg.socioambiental.org/system/files/ENGLISH-reduzido.jpg>
- 33 <http://assets.geoexpro.com/uploads/a642b73d-6845-4d21-bce8-54e8da70c4cc/map.jpg>
- 34 <http://www.whrc.org/news/pressroom/PR-2013-Coe-IOP-ERL-No-win-situation-for-agricultural-expansion-in-the-Amazon.html>
- 35 <http://www.oj.com/articles/print/volume-109/issue-10/exploration-development/shale-gas-oil-minerals-processing-offer-synergies.html>
- 36 <http://www.ienearth.org/kari-oca-2-declaration/>
- 37 <http://www.ienearth.org/kari-oca-2-declaration/>
- 38 http://www.controlrisks.com/~media/Public%20Site/Files/Oversized%20Assets/shale_gas_whitepaper.pdf
- 39 <https://pt-br.facebook.com/paranasesemfracking>
- 40 <http://www.toledo.pr.gov.br/noticia/toledo-se-une-em-manifesto-contr-o-fracking>
- 41 http://www.asibamanacional.org.br/wp-content/uploads/2013/09/Resolu%C3%A7%C3%A3o_petr%C3%B3leo_ingles.pdf

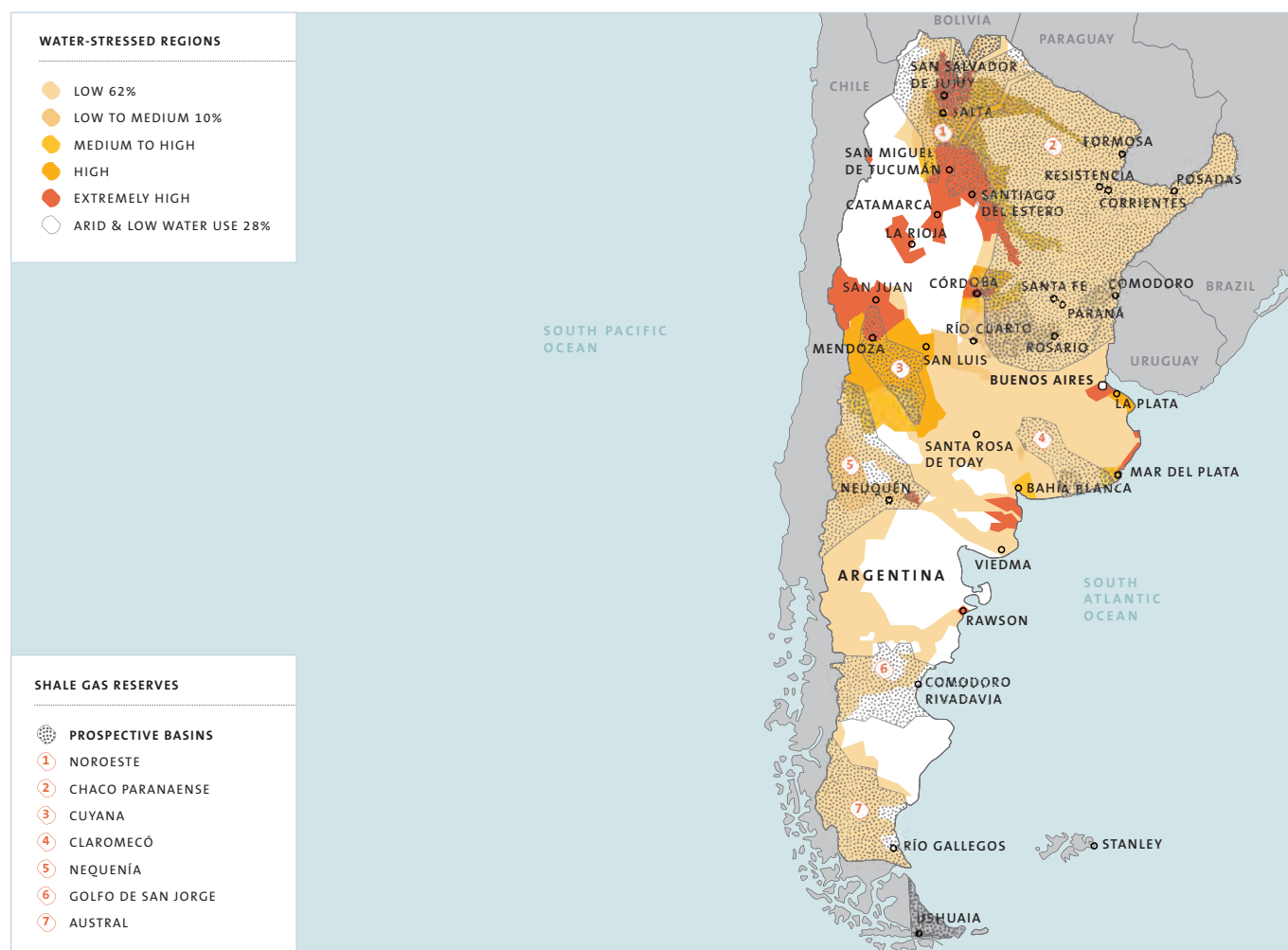


3

ARGENTINA

Argentina is heavily dependent on fossil fuels, and the country's economy is dependent on the oil and gas sector. In 2011, the country had an energy balance deficit of US\$ 3.4 billion¹, leading it to embrace the development of shale oil and gas following the discovery of significant deposits in the Loma de Lata field in Neuquén province in 2010. There are a number of concerns about the environmental and social impacts of fracking, particularly concerning the demand for water, and the violation of indigenous people's territory rights.

ARGENTINA SHALE GAS RESERVES & WATER-STRESSED REGIONS



Sources: World Resource Institute, 2014 & US EIA, 2013, Swedish Water House.

TECHNICALLY RECOVERABLE RESOURCES

Technically recoverable resources ²	Shale gas (tcf)	(bcm)	Shale oil (billion barrel)
	802	22,710	27
World ranking ³	Shale gas		Shale oil
	2		4

Technically recoverable resources & world ranking

According to EIA estimates, Argentina has the world's second largest reserves of technically recoverable shale gas, with an estimated 802 tcf (22,710 bcm). The country also has an estimated 27 billion barrels of technically recoverable shale oil resources, the fourth largest shale oil reserves identified.

In July 2013, the first big investment joint venture was announced in the Vaca Muerta area, in Neuquén province. The partly re-nationalised Argentine oil company YPF (Yacimientos Petrolíferos Fiscales) has formed a partnership with the US company Chevron to develop some projects to extract the estimated 308 tcf (8721 bcm) of shale gas and 16 billion barrels of oil located there.⁴ The Vaca Muerta shale basin covers some 30,000 km² in Neuquén province, making it one of the largest shale basins outside of the U.S.⁵

UGTEP - TARGETED BY / LISTED AS PARTNER⁶

Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP)	Yes

RESOURCE OWNERSHIP⁹

State	Private	License required		Bidding procedure	
		Yes	No	Yes	No
X		X		X	

Targeted by UGTEP

Argentina is not an official partner of the US Unconventional Gas Technical Engagement Programme (UGTEP). However, the country's substantial shale potential and existing infrastructure are already attracting significant foreign investment in shale oil and gas development. UGTEP lists Argentina as a target country for diplomatic engagement or regional workshops in 2014 and it is likely to have had some contact with the program.⁷

MAIN COMPANIES INVOLVED⁸

NOC (National Oil/ Gas Companies)	IOC (International Oil/ Gas Companies)
YPF S.A. (Yacimientos Petrolíferos Fiscales), GyP, (Gas & Petróleo de Neuquén)	Vaca Muerta Consortium, (Chevron, Shell, Halliburton, Pluspetrol, Weatherford), Total, ExxonMobil, Dow Chemical, Pan American Energy (CNOOC Ltd., Bidas Corp., BP), Petrobras, Wintershall

1 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf

2 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

3 <http://www.eia.gov/analysis/studies/worldshalegas/>

4 http://www.chevron.com/chevron/presreleases/article/07162013_chevronargentinasyppsignaccordtodevelopvacamuertashale.news

5 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>

6 <http://www.state.gov/s/ciea/ugtep/>
<http://www.doi.gov/intl/itap/ugtep.cfm>
<http://www.eia.gov/analysis/studies/worldshalegas/#3>

"Other U.S. government agencies that participate in the UGTEP include: the U.S. Department of Energy's Office of Fossil Energy (DOE/FE); the U.S. Agency for International Development (USAID); the U.S. Department of Interior's U.S. Geological Survey (USGS); U.S. Department of Interior's Bureau of Ocean Energy Management (BOEM); the U.S. Department of Commerce's Commercial Law Development Program (CLDP); and the U.S. Environmental Protection Agency (EPA). The U.S. Department of the Interior's (DOI)

International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops"

7 <http://www.longtailpipe.com/2014/02/state-department-pushes-fracking-and.html>
<http://docs.house.gov/meetings/FA/FA07/20130411/100622/HHRG-113-FA07-Wstate-GoldwynD-20130411.pdf>

8 <http://www.haynesboone.com/files/Uploads/Documents/Argentina%20presentation%201.21.pdf>
<http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
<http://ungi.mines.edu/vm.html>
http://geology.mines.edu/Vaca_Muerta/index.html
<http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

9 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://www.yppf.com/enu/InversoresAccionistas/Documents/Presentations/29-08-2013-Presentation-YPF.pdf>



Resource ownership

Under the Argentine Hydrocarbon Law (No. 17,319), oil and gas fields belong to the national government, although the right to grant exploration permits and exploitation concessions has been given to the provinces under Law No. 26,197 (Short Law) in 2007. Once extracted, the oil and gas belong to the extracting company.

In Neuquén province, holders of exploration rights can transport, process and market the extracted hydrocarbons as long as they respect the general right of the Province to receive a share of the hydrocarbons produced (Article 12 of Hydrocarbons Law No. 2,453 of Neuquén Province).

The YPF oil company was recently partly re-nationalized, with 51% of its shares held by the national state and provincial governments. However, YPF remains a corporation and is not subject to any legislation or regulation applicable to national entities or state-owned companies. It holds the rights to most of the unconventional oil and gas potential in Neuquén, in partnership with the provincial Gas y Petróleo de Neuquén.

Under provincial law, some areas may be explicitly reserved for exploration/exploitation by state-owned companies. International oil and gas companies therefore have to sign a joint venture contract in order to develop shale oil and gas exploration and/or exploitation in Neuquén.

New legislation & legal framework

The partial re-nationalisation of YPF, which has cost the Argentine people at least US\$ 5 billion in compensation to the previous owner, Repsol,¹¹ follows the establishment, in May 2012, of the “Hydrocarbon Sovereignty” law (Law No. 26,741), through which the Argentine Government has attempted to regain control over the energy sector and increase state revenues. This legal change allows the state to press ahead with oil and gas development, including through joint ventures with strategic partners, with a view to securing self-sufficiency in hydrocarbons.¹² This has been declared as being in the public interest and a priority for the country.¹³

NEW LEGISLATION / LEGAL FRAMEWORK¹⁰

New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general	Yes	No	Date	Relevant legislation
	X		1994	Law No. 17,319 (Hydrocarbons Law)
			2007	Law No. 26,197 (the ‘Short Law’)
			May 2012	Law No 26,741 and Regulatory Decree No. 1,277/2012 (Hydrocarbon Sovereignty/YPF-Law)
			2013	Resolution 1/2013 (Programme for the Stimulation of Surpluses of Natural Gas Injection)
				Resolution No. 130/2013 (“Argentine Hydrocarbon Fund” US\$2 billion)
				Executive Decree No. 929/2013 (creates promotional system for investment “Chevron Decree”)
				Hydrocarbons Law No. 2,453 of the Province of Neuquén (“Law”)
				Provincial Executive Order No. 3,124 implementing Hydrocarbons Law No. 2,453 of the Province of Neuquén
				Provincial Executive Order No. 1,447
			2014	Law No. 33.001 (New National Hydrocarbon Law)

¹⁰ <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://www.haynesboone.com/files/Uploads/Documents/Argentina%20presentation%201.21.pdf>
<http://latinex.com/app/article.aspx?id=1227>
http://www.pagbam.com.ar/newsletters/OilGas/Energy_Newsletter_-_April_2013_n_55

¹¹ http://articles.chicagotribune.com/2014-05-09/business/sns-rt-us-repsol-20140509_1_repsol-spanish-oil-ypf
<http://www.laht.com/article.asp?ArticleId=1860993&CategoryId=14093>
<http://latino.foxnews.com/latino/politics/2014/04/24/argentine-congress-oks-settlement-with-spain-repsol-over-ypf/>

¹² <http://www.haynesboone.com/files/Uploads/Documents/Argentina%20presentation%201.21.pdf>
¹³ https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf

In February 2013, the Commission for Strategic Planning and Coordination for the National Hydrocarbons Plan issued Resolution 1/2013 which included a “Programme Intended to Foster Natural Gas Excess Injection” and guaranteed:

- A minimum price of US\$ 7.50 per million unit (MMBTU) for all additional sales to the Argentine market (above a quarterly adjusted base supply); and
- A minimum price of US\$ 2.30 per unit for all sales within the base injection levels. The base level is put forward by potential producers and is usually based on the 2012 average for production.¹⁴

Given that the average price for incremental sales was previously approximately US\$ 2.80 per unit, the new minimum guaranteed price has been increased by a factor of almost three. This reflects the shale gas industry’s dependence on high prices to make their capital-intensive projects economically viable. It also shows that shale gas development does not necessarily mean that gas prices will fall.

In April 2013, the Ministry of Economy and Public Finance created Resolution 130/2013, known as the “Argentine Hydrocarbon Fund”, which has been set up with US\$ 2 billion to finance exploration and/or exploitation and marketing of hydrocarbons, provided that the Argentine state is a shareholder or has voting or economic rights in the applicant oil and gas company.

A new financial framework, the so-called “Chevron decree”, creates a supportive framework for investment in the oil and gas industry, recognising that companies need long time contracts, guaranteed minimum prices and a continuous capital flow in order to ensure the economic viability of the shale oil and gas development. The decree was signed by Argentina’s President Cristina Fernández de Kirchner in July 2013, a day before the YPF-Chevron-deal was sealed. It encourages companies to invest more than US\$ 1 billion over a five-year period by allowing companies to trade 20 % of the extracted hydrocarbons at international prices on either the export or domestic markets, free from export taxes. The decree also introduces the Unconventional Exploitation Concession, which allows companies to develop unconventional fossil fuels in existing concessions without going through a new bidding process. It also extends YPF’s existing concession until 2048.¹⁵ In May 2014, an appeals court ordered an investigation into the legality of the “Chevron Decree”.¹⁶

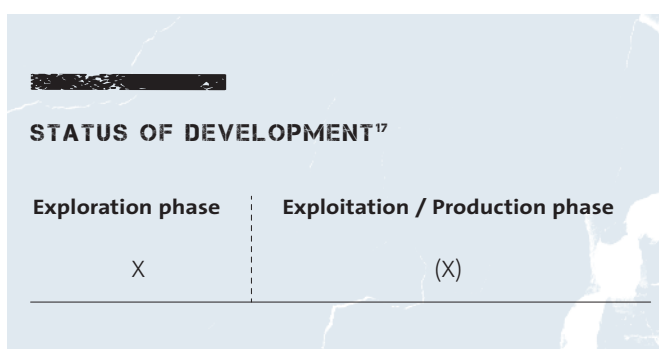
According to Articles 10 and 22 of the provincial Neuquén Hydrocarbon Law, exploration permits can be granted for 9 – 13 years, and can cover a minimum area of 100 km² and a maximum of 100,000 km² (Article 23 and 24). Exploitation concessions are granted for 25 years, with an extension option of up to 10 years (Article 34), although they can be extended if there is time remaining under the exploration permit (Article 22).

In October 2014, the Argentine government enacted a new National Hydrocarbon Law, incorporating explicit references to non-conventional hydrocarbon activities to specifically promote shale investments in the country.¹⁷ The new law establishes terms for concessions, differentiating by type of operations: a maximum of 13 years for exploration permits for non-conventional shale gas and shale oil (two periods of 4 years and an extension of 5 years), 25 years for the extraction of conventional and 35 years for non-conventional (shale), and 25 – 30 years for offshore production. It also fixes - in general - provincial tax on production at 12%. A further 3% might be charged if the licence is extended. At the same time, provinces can reduce taxes to 5% to stimulate decreasing production.¹⁸

Status of development

Argentina has a long history of oil and gas drilling, including in Neuquén province, where the first oil-producing wells in the Vaca Muerta formation were drilled in 1918.¹⁹ Today, 40% of Argentine oil and 50% of the gas comes from the Neuquén basin.²⁰ The EIA has also identified three other basins in Argentina with potential for shale oil and gas development: the Paraná & Chaco-Paraná basin (shared with Brazil, Uruguay and Paraguay), the Golfo San Jorge basin and the Austral-Magallanes Basin in the ‘Tierra del Fuego’ (shared with Chile).

The Austral Magallanes Basin has an estimated 129 tcf (3,652 bcm) of shale gas and 6.6 billion barrels of shale oil, although no shale exploration has taken place as yet on the Argentine side. A UK-based company, GeoPark, carried out fracture injection tests on the Chilean side of the border in 2012. According to EIA estimates, 48 tcf (1,359 bcm) of shale gas and 2.3 billion barrels of shale oil could be technically recoverable.²¹



14 E-mail correspondence with Pagbam
15 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
<http://oilprice.com/Energy/Natural-Gas/Political/Setbacks-Injects-Uncertainty-In-Argentina-Shale.html>
<http://en.mercopress.com/2013/07/15/markets-exist-argentina-offers-attractive-incentives-to-promote-oil-and-gas-production>
16 <http://www.argentinaindependent.com/tag/ypf/>
17 <http://fracking.cedha.net/wp-content/uploads/2014/10/Ley-de-Hidrocarburos-27007-Oct-2014.pdf>
18 <http://www.natlawreview.com/article/argentina-amendment-hydrocarbons-law>
19 <http://www.searchanddiscovery.com/abstracts/html/2013/90165gtw/abstracts/lea.htm>
20 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
21 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>



The Golfo San Jorge Basin already produces a quarter of Argentina's conventional oil and gas, but no shale oil or gas development has taken place so far. It is estimated that the Aguada Bandera Formation within the basin has a technically recoverable shale gas potential of 51 tcf (1,444 bcm), while the Pozo D-129 well is thought to have an estimated 35 tcf (991 bcm). The Paraná-Chaco basin is estimated to have 164 tcf (4,644 bcm) of gas resources,²² although the EIA estimates only 3 tcf (85 bcm) of this is technically recoverable.²³

The Vaca Muerta region is the most promising of Argentina's shale resources, with an estimated 308 tcf (8,721 bcm) of technically recoverable shale gas resources and a geological structure which the oil company, Chevron, has described as Argentina's winning geological lottery ticket.²⁴ There is also significant potential at Los Molles in the Neuquén basin, which has between 167 tcf (4,729 bcm) and 275 tcf (7,787 bcm) of estimated recoverable shale gas.^{25, 26} It is thought that some US\$ 300 billion will be needed over a six-year period to develop the Vaca Muerta basin.²⁷

In 2011, Repsol-YPF, at that time a wholly private company, confirmed its largest ever shale oil and gas discovery in the Loma de la Lata area of the Vaca Muerta formation. An estimated 927 million barrels of oil equivalent are estimated to be recoverable, of which roughly three quarters are shale oil and a quarter gas. It took 15 wells to confirm the findings.²⁸



Chevron unconventional gas drilling site in Loma Campana.

© Observatorio Petrolero Sur

However, it was the deal signed between Chevron and the partly-renationalised YPF in 2013 that really started the shale gas bonanza in Argentina.²⁹ The first phase of the 50-50 joint venture will see US\$ 1.24 billion invested in drilling 100 wells in a 20 km² field (the Loma Campana Project), part of a 388 km² concession in the Vaca Muerta formation. In April 2014, Chevron and YPF signed an agreement to invest a further US\$ 1.6 billion to develop shale gas elsewhere in the Vaca Muerta formation, with 170 wells scheduled for drilling before the end of 2014.³⁰ YPF and Chevron have already invested more than US\$ 2 billion and have 245 wells producing more than 25,000 barrels of shale oil daily.³¹

Overall, more than US\$ 16 billion is to be invested in drilling some 1,500 wells, with estimated total operating costs of more than US\$ 9 billion. The operation has an estimated lifetime of 35 years, and at its peak, is expected to produce 50,000 barrels of oil and 3 million m³ of gas per day.³² Because exploration will not stop when production starts, to be economically viable the project will need a continuous cash flow to finance on-going drilling over a long period.³³ This shows that the development of unconventional fossil fuels will only prolong the transition towards a post fossil fuel era while simultaneously withdrawing from the financial markets a significant amount of capital which is needed for investment into the renewable energy sector.

To develop its activities in the Vaca Muerta area, YPF has also sought investment partnerships with the US company Dow Chemical, the Chinese company CNOOC³⁴, and most recently with the Malaysian national petroleum company, Petronas. This joint venture has announced several dozen fracking wells as part of the pilot phase, with around 1,000 wells planned over the next decade and an initial investment of more than \$500 million needed.³⁵

Four main companies hold the exploration rights for oil and gas covering more than 6.8 million acres of the 7.4 million acres in the Vaca Muerta formation.³⁶ YPF has the largest share with its directly owned 4 million acres (1.6 million hectares), plus the 1.8 million acres (0.7 million hectares) owned by Apache, bought by YPF for \$800 million in spring 2014.³⁷ The other two big exploration-license holders in the Vaca Muerta Basin are ExxonMobil (1.2 million acres / 0.5 million hectares) and Americas Petrogas (almost 1 million acres / 0.4 million hectares). The provincial company, GyP (Gas & Petróleo de

22 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>

23 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

24 <http://www.reuters.com/article/2014/05/22/chevron-argentina-idUSL1N00824V20140522>

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<http://www.bloomberg.com/news/2013-12-10/shell-to-triple-argentine-shale-spending-as-winds-change.html>

27 <http://www.bloomberg.com/news/2013-12-10/shell-to-triple-argentine-shale-spending-as-winds-change.html>

28 <http://www.ft.com/cms/s/0/b77004b0-0969-11e1-a20c-00144feabdc0.html#axzz3BEdxlZGC>

<http://www.mintpressnews.com/argentina-enormous-fracking-potential-opposition-match/192158/>

29 http://www.chevron.com/chevron/pressreleases/article/07162013_chevronargentinasyppsignaccordtodevelopvacamuertashale.news

30 <http://www.bloomberg.com/news/2013-12-10/shell-to-triple-argentine-shale-spending-as-winds-change.html>

31 <http://online.wsj.com/articles/fracking-deal-is-reached-by-ypf-petronas-1409209249>

32 <http://www.chevron.com/documents/pdf/argentinafactsheet.pdf>

<http://www.bloomberg.com/news/2014-04-10/chevron-to-invest-1-6-billion-with-ypf-in-argentina-shale-wells.html>

<http://www.ypf.com/enu/InversoresAccionistas/Documents/Presentations/29-08-2013-Presentation-YPF.pdf>

33 http://f.datasrv.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

34 <http://money.morning.com/2013/08/13/the-shale-oil-boom-is-going-global-starting-with-this-huge-deal-in-argentina/>

35 <http://online.wsj.com/articles/fracking-deal-is-reached-by-ypf-petronas-1409209249>

36 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>

37 http://files.shareholder.com/downloads/APA/3416852619x0x733469/70c68f99-2f87-44ef-86c7-86efcf46ed24/APA_News_2014_3_12_General.pdf

38 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf

Neuquén) also holds the exploration rights for more than 3 million acres (1.2 million hectares), and has signed 62 joint venture agreements with different multinational companies (including Total, Shell, Pan American Energy and the German company, Wintershall) to explore and develop these areas.³⁸

In August 2014, YPF announced it had discovered shale oil in the Filo Morado well in Mendoza. The discovery seems to have boosted investments, with the Soros Fund Management LLC buying a further 8.47 million shares in YPF, giving it a 3.5% interest in the company's American depository receipts. This was worth \$450 million at the end of June 2014, making Soros the fourth-biggest share-holder in YPF.³⁹

French company Total, for example, already the biggest gas producer in the country, entered the shale arena in 2010 and owns 11 permits, including 7 as the operator. It has drilled 9 shale wells in Neuquén: Total operates four wells in the San Roque concessions and five in those in Aguada Pichana. The company has announced it will be investing US\$ 400 million in two shale projects in Aguada Pichana, which will entail 20 wells altogether. Production is due to start before the end of 2014.

Shell is involved in five concessions in the Vaca Muerta region and has already drilled and fractured 11 wells, of which four are in partnership with Total. The company also operates through a subsidiary named O & G Development SA and uses a range of different joint venture frameworks. At the end of 2013, Shell decided to triple its investment in Vaca Muerta from US\$ 170 million to about US\$ 500 million.⁴⁰ The German company Wintershall has invested some US €80 million in six wells in the province.⁴¹



Total unconventional well on the San Roque concession along the Auca Mahuida area. © Observatorio Petrolero Sur

ENVIRONMENTAL, ECOLOGICAL AND SOCIAL IMPACTS

Environmental, ecological and social impacts / conflicts very likely or already existing	Yes
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SOURCE(S) OF CONFLICTS

Source(s) of existing conflicts / incidents:	Violation of indigenous rights (especially ILO 169) / Water scarcity / Water and land use conflicts / Projects near or within sensitive areas (nature protection zones) / Ignoring public opinion (municipal fracking ban) / Insufficient personnel for the enforcement of state regulations.
Source(s) of likely future conflicts:	Further violation of indigenous peoples' rights / Water scarcity / Water and land use conflict / Threat of triggering seismic activities (Volcano Copahue) / Overstretching legal framework / Contribution to air pollution and global warming through methane leakage.

Environmental, ecological and social impacts

Environmental Provisional Legal Framework

Argentina has national and regional regulatory frameworks designed to protect the environment, but as a result of legal gaps, overlapping areas of jurisdiction, weak wording and a lack of state regulatory and enforcement capacity, effective levels of protection cannot be assumed.⁴²

One of the key areas for regulation concerns water use. Fracking tends to require ongoing supplies of large quantities of water, and although waste water, or flowback, can be partly reused, this will not significantly change the need for fresh water. A major part of the fracking fluid cannot be retrieved at the end of the process (which can represent depending on the site up to 93%), which seriously limits the potential for re-using water.⁴³ The industry is also advised to use fresh water, *"because brackish water – salty water occurring in fossil aquifers⁴⁴ – is more likely to damage the equipment, require a higher concentration of proppants and result in formation damage"*.⁴⁵ This puts pressure on existing water uses, including access to drinking water.

39 <http://www.bloomberg.com/news/2014-08-14/soros-adds-to-ypf-trims-teva-exits-monster-in-quarter.html>

40 <http://www.bloomberg.com/news/2013-12-10/shell-to-triple-argentine-shale-spending-as-winds-change.html>

41 <http://www.wintershall.com/en/press-news/detail/news/wintershall-signs-farm-in-agreement-with-gas-y-petroleo-del-neuquen.htm>
http://www.wintershall.com/uploads/user_pxbxconnector/pxbxrawdata/330/wintershall-14501.pdf

42 <http://www.inece.org/conf/proceedings1/ProceedingsBook%20%20%20%20%2059-72.pdf>

43 http://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_53_2014_umweltauswirkungen_von_fracking_28.07.2014_0.pdf

44 http://www.sciencedaily.com/articles/b/brackish_water.htm

45 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf



In Neuquén province, according to the “Standards and Procedures for the Exploration and Exploitation of Unconventional Resources” (provincial Decree No. 1483, August 2012), regulations have been introduced to control water use in fracking operations. The use of surface water is allowed, but the use of drinking water is prohibited. Flowback must also either be re-used or disposed of underground.

However, there are concerns that the re-injection of fracking flowback may be linked to significant earthquakes.⁴⁶ In Argentina, there are also particular concerns regarding increased volcanic activity at the Copahue volcano which lies between Neuquén province and Chile.⁴⁷ The two countries issued a red alert in 2013 and ordered the evacuation of some 3,000 people after thousands of minor earth tremors were recorded in the region.⁴⁸

As well as the existing flaws in the legal framework intended to protect the environment, there is also evidence of pressure to “liberate” companies involved in fracking activities from the bureaucratic burden of environmental regulations. The most recent amendment to provincial Law No. 1875 on “Preservation, Conservation and Protection of Environment” in Neuquén practically removed any requirement for public hearings on the development of unconventional fossil fuel projects.⁴⁹

The Environmental Impact Assessments (EIAs) prepared by Total Austral and obtained by environmental groups are sometimes full of inconsistencies, mentioning for example flora and fauna that are not found in the concession areas, while there are also issues concerning access to the reports, and examples of concessions being granted inside natural protected areas despite objections being raised by the Department of Natural Protected Areas.⁵⁰ The EIA submitted for the YPF-Chevron 50-50 joint venture project Loma Campana, for example, states that the impacts of the fracking activities will be low or moderate, despite the fact that the project includes plans for drilling a total of 1,500 wells in a 395 km² area.⁵¹



Open tailing pond inside a Mapuche territory in Neuquén.
© Observatorio Petrolero Sur

Questions have also been raised about the capacity of the state's Secretariat for the Environment and Sustainable Development to effectively monitor and enforce existing regulations. Many of the 131 employees are on precarious short term contracts, with contract extensions depending on the will of the Provincial Government.⁵²

Disregarding local fracking bans

The city of Allen (in Rio Negro province, neighbouring Neuquén) decided to ban fracking, but the provincial authority filed a complaint against this decision which was accepted by the Supreme Court of Justice. More than 30 similar decrees have been issued by other cities and “fracking-free zones” across the country.

Disregarding indigenous rights

There are also concerns that fracking has taken place on the territory of the indigenous Mapuche, Kaxypayñ and Gelay Ko people without proper consultation. According to Article 5 (a) of the International Labour Organization (ILO) Indigenous and Tribal Peoples Convention (Convention 169), which has been ratified by Argentina in 2000,⁵³ *“the social, cultural, religious and spiritual values and practices of these peoples shall be recognised and protected, and due account shall be taken of the nature of the problems which face them both as groups and as individuals”*. According to Article 6, (1a) *“governments shall consult the peoples concerned, through appropriate procedures and in particular through their representative institutions, whenever consideration is being given to legislative or administrative measures which may affect them directly”*.⁵⁴

More than a third of the indigenous communities in the province of Neuquén are directly affected by the development of the fracking industry, with oil and gas concession permits granted on their land.⁵⁵ The YPF-Chevron joint venture is planned on Mapuche territory but the indigenous groups have not been properly consulted as required, infringing their human rights. Mount Auca Mahuida, which is in the Auca Mahuida natural protection area, is a spiritual and mythological ceremonial site for the indigenous people of the area.

- 46 <http://www.sciencemag.org/content/345/6195/448>
<http://www.theguardian.com/environment/2014/jul/03/oklahoma-earthquakes-fracking-waste-water-wells>
<http://link.springer.com/article/10.1007%2Fs11589-014-0062-3>
47 <http://www.anbariloch.com.ar/fotos/4/1/foto41758a428.jpg>
48 <http://www.bbc.co.uk/news/world-latin-america-22684322>
<http://www.livescience.com/34744-copahue-volcano-evacuation-eruption-warning.html>
49 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
50 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
51 <http://www.ypf.com/enu/InversoresAccionistas/Documents/Presentations/29-08-2013-Presentation-YPF.pdf>
http://www.laprensasa.com/309_america-in-english/2494837_ypf-chevron-to-invest-1-6-bn-in-2014-in-argentina-s-vaca-muerta.html
52 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
53 http://www.ilo.org/dyn/normlex/en/f?p=1000:11200:0:NO:11200_P11200_COUNTRY_ID:102536
54 http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0:NO:12100_P12100_INSTRUMENT_ID:312314:NO

Disregarding nature protection zones, causing further water and land use conflicts and risking contamination of groundwater resources

The Auca Mahuida is a very important natural site, which serves as a significant reservoir for water storage and is home to endangered and rare flora and fauna species. This biodiversity-rich area is being surrounded and threatened by oil and gas concessions owned by YPF, GyP, Total, Shell, Pan American Energy, and Wintershall. There are concerns that these threats will increase once full fracking gets underway. Shell's Águila Mora concession partially overlaps the site, with three of the wells that have been drilled so far lying inside what would have been the boundaries of the protected area, had changes not been made to the management plan.⁵⁶

The shale industry also poses a threat to small livestock farmers who farm in parts of Neuquén Province, and who are particularly vulnerable to the variable availability of water, and have struggled during droughts in previous years. Further water and land use conflicts appear likely as a result of 'accommodating' the demands of the fracking industry. For example, the water permit for Total's drilling well PLY.x-1 in Pampa Las Yeguas II did not cover fracking because the source of groundwater required for the process had not been authorised. Usually, groundwater can be only used if it is not suitable as drinking water. Despite this, Total has reported using the fracking technique a number of times, requiring some 8 million litres of water per operation.⁵⁷

Shale oil and gas development is also expected to expand into the San Patricio del Chañar region, which is known for its cattle, wine and fruit cultivation. This is raising concerns among the local people over land rights. In one example, Shell drilled three wells and built a fresh water storage pool on the land of one family without any consultation or compensation, claiming that the family did not have official titles for the land. This is despite community rights that state that anyone occupying land for more than 20 years officially owns the land.⁵⁸

There are concerns that not enough is known about how drilling for shale will affect important water resources, such as the Guarani Aquifer,⁵⁹ one of the largest groundwater resources on Earth, with a capacity of 45,000 km³ and a surface area of 1.2 million km²,⁶⁰ and which is overlapped by the Paraná and the Chaco-Paraná shale basins.⁶¹ The Guarani Aquifer (GAS) is named after the Guarani people, a group of indigenous people who live in parts of Paraguay, Uruguay, Brazil and Argentina. In August 2010, these four countries signed the first shared management agreement for transboundary aquifers in Latin America. The agreement requires all parties to "promote the conservation and environmental protection of the Guarani Aquifer System so as to ensure multiple, reasonable, sustainable, and equitable use of its water resources."⁶²

Andrew Liveris, President, Chairman and Chief Executive of the Dow Chemical Company told the Economist that: "Water is the oil of the 21st century".⁶³



Opposition to the development of shale gas & oil

Argentina has been identified as having moderate levels of anti-fracking-activism and the political and security risk is also considered to be minor or moderate.⁶⁴

Risks have been identified, however, due to the high levels of water use and water contamination linked to fracking. Mapuche protestors seized a gas plant near Zapala in late 2011 and there have been numerous protests against the mining industry.

In August, 2013, some 5,000 people demonstrated against the YPF-Chevron project in Neuquén province. Local police tried to suppress the demonstration with rubber bullets and tear gas, and more than 25 people were injured, including a teacher who was shot in the chest.⁶⁵ The following day, ten thousand people marched on the streets, after several unions issued a strike call in response to the brutal actions of the riot police.

Observatorio Petrolero Sur (OPSur), an active anti fossil-fuel group is just one of the organisations involved in the 'Multisectorial contra la hidrofractura' network in Argentina, which brings together actors, activists and experts from all levels of society.⁶⁶ Despite the national and provincial government support in Neuquén for the development of shale oil and gas, the anti-fracking alliance has successfully raised awareness about the environmental concerns, and other broader issues,⁶⁷ despite the serious economic crisis faced by the country, bringing together trade unions, environmentalists, feminists, indigenous communities and others. Several municipalities have declared themselves frack-free zones.

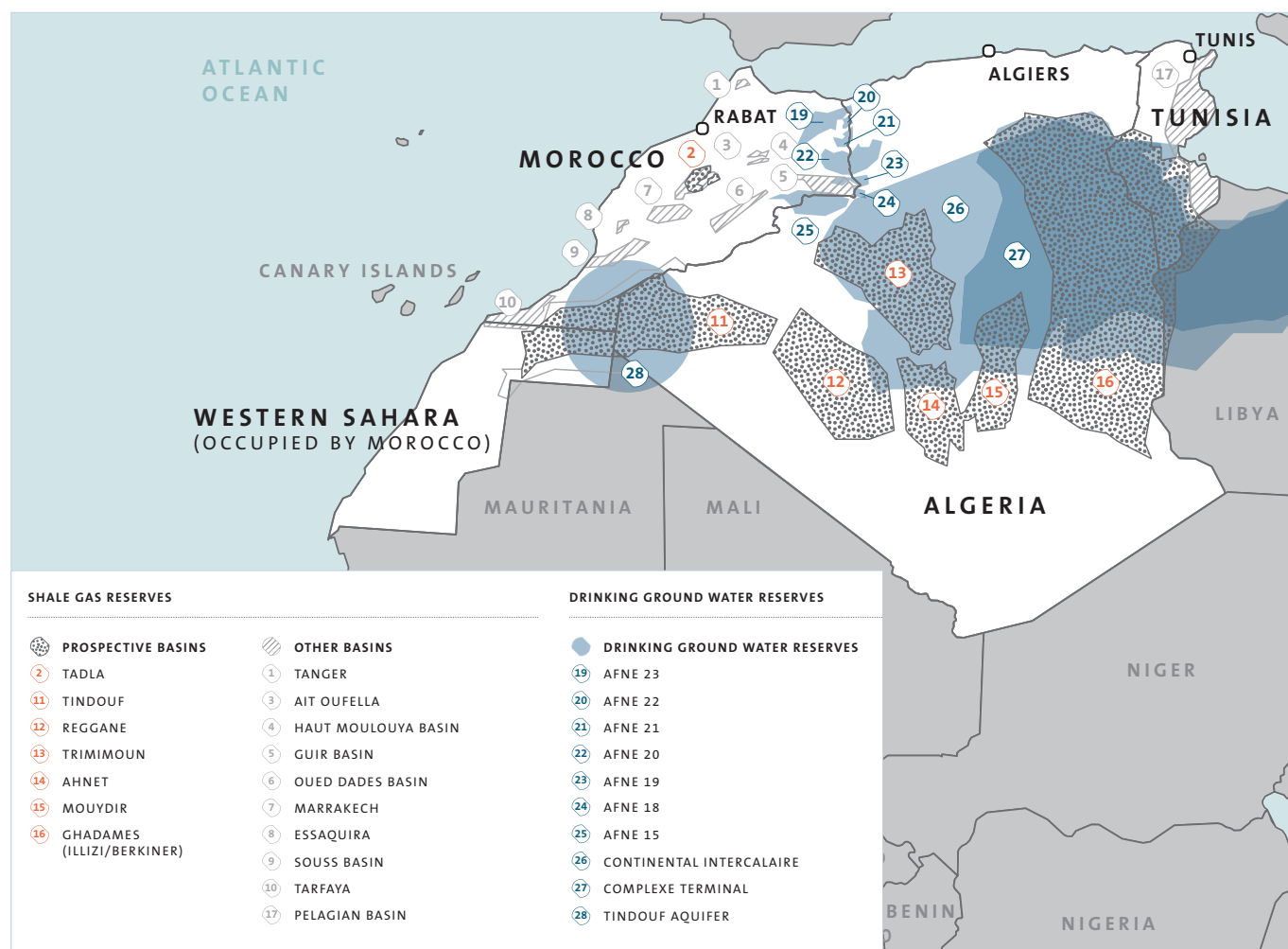
- 55 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
- 56 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
- 57 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
- 58 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf
- 59 <http://bankwatch.org/news-media/blog/sharing-shale-experience>
- 60 <http://annalisabrambilla.files.wordpress.com/2011/03/guaranimap-mp1.jpg>
- 61 <http://upload.wikimedia.org/wikipedia/commons/e/ef/Aquiferoguarani.jpg>
- 62 http://www.transboundarywaters.orst.edu/research/case_studies/GuaraniAquifer_New.htm
- 63 <http://assets.geoexplor.com/uploads/23a73cf4-125c-43c7-ad7a-2b924d135e1d/EGI-GeoExpro-figure-2-01%5B1%5D.jpg>
- 64 <http://www.eia.gov/countries/analysisbriefs/cabs/Argentina/images/Shale%20Gas%20Basins%20of%20Southern%20South%20America.gif>
- 65 <http://www.globalwaterforum.org/2013/09/02/the-agreement-on-the-guarani-aquifer-cooperation-without-conflict/>
- 66 <http://www.economist.com/node/11966993>
- 67 http://www.controlrisks.com/~media/Public%20Site/Files/Oversized%20Assets/shale_gas_whitepaper.pdf
- 68 <http://www.opsur.org.ar/blog/2013/09/03/anti-fracking-mobilization-suppressed-and-indigenous-houses-burnt-due-to-resistance-over-chevron-ypf-agreement/>
- 69 <https://www.facebook.com/pages/Multisectorial-en-contra-de-la-Hidrofractura-Neuquen/455106247969406>
- 70 <http://bankwatch.org/news-media/blog/sharing-shale-experience>



MAGHREB COUNTRIES - ALGERIA, MOROCCO, TUNISIA

Shale resources have been identified across the Maghreb countries (Algeria, Tunisia and Morocco), but the most significant quantities are found in Algeria, which is estimated to have the third largest shale gas potential world-wide. However major questions remain about development of the industry given that water resources in the region are already scarce. Fracking's demand for water would directly compete with farmers who need water to irrigate their crops.

MAGHREB SHALE GAS & DRINKING GROUND WATER RESERVES



Sources: Académie de l'Eau, BRGM, OIEau, UNESCO - August 2011, pg 62, US EIA, WRI, Swedish Water House.

TECHNICALLY RECOVERABLE RESOURCES¹**Technically recoverable resources²**

	Shale gas		Shale oil
	(tcf)	(bcm)	(billion barrel)
Algeria	707	20,020	5.7
Morocco	12	340	0.2
Tunisia	23	651	1.5

World ranking³

	Shale gas	Shale oil
Algeria	3	13
Morocco	32	34
Tunisia	29	24

Technically recoverable resources & world ranking

Algeria has significant conventional fossil fuel resources, and produces oil and gas for export. With domestic consumption increasing, the Algerian government is looking to develop its shale resources, allowing Algeria to continue exporting fossil fuels and benefiting from oil and gas revenues.¹ Algeria has an estimated 707 tcf (20,020 bcm) of shale gas, and an estimated 5.7 billion barrels of shale oil.

Morocco and Tunisia produce small quantities of conventional fossil fuels, and both are net gas importers.^{4,5} Neither country is estimated to have large enough quantities of shale resources to make a significant difference to the global market nor to have a real impact on national gas prices, but both countries have been identified as having some potential. Tunisia is estimated to have 23 tcf (651 bcm) of shale gas (29th in the global ranking) and 1.5 billion barrels of shale oil (24th globally). Morocco's estimated resources are smaller, with 12 tcf (340 bcm) of technically recoverable shale gas, placing the country 32nd in the global rankings.

UGTEP - TARGETED BY / LISTED AS PARTNER⁷**Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP)**

Algeria	No
Morocco	Yes
Tunisia	No

Both Morocco and Tunisia have only limited experience with the management of hydrocarbons sectors and therefore have only limited expertise and infrastructure.⁶ This is likely to mean they will have to rely on foreign companies for expertise, which may reduce the economic benefits for their domestic economies.

Targeted by UGTEP

Morocco is officially listed as a partner of the UGTEP, but the other Maghreb countries are not. This might be the consequence of personal connections between Dr. Kent Moors, executive chair of the Global Energy Symposium (GES) and a member of the UGTEP task force, who was also an adviser to the Moroccan government.⁸ Whatever the real reasons, UGTEP does not appear to be very active in North Africa, although there have been suggestions that Algeria and Tunisia are likely to become more involved in the future.⁹

1 <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Shale%20Gas%20and%20its%20Implications%20for%20Africa%20and%20the%20African%20Development%20Bank.pdf>

2 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

3 <http://www.eia.gov/analysis/studies/worldshalegas/>

4 <http://www.eia.gov/countries/country-data.cfm?fips=mo>

5 <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Shale%20Gas%20and%20its%20Implications%20for%20Africa%20and%20the%20African%20Development%20Bank.pdf>

6 <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Shale%20Gas%20and%20its%20Implications%20for%20Africa%20and%20the%20African%20Development%20Bank.pdf>

7 <http://www.state.gov/s/ciea/ugtep/>
<http://www.doi.gov/intl/itap/ugtep.cfm>
<http://www.eia.gov/analysis/studies/worldshalegas/#3>

⁸Other U.S. government agencies that participate in the UGTEP include: the U.S. Department of Energy's Office of Fossil Energy (DOE/FE); the U.S. Agency for International Development (USAID); the U.S. Department of Interior's U.S. Geological Survey (USGS); U.S. Department of Interior's Bureau of Ocean Energy Management (BOEM); the U.S. Department of Commerce's Commercial Law Development Program (CLDP); and the U.S. Environmental Protection Agency (EPA). The U.S. Department of the Interior's (DOI) International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops"

8 <http://www.washingtonspeakers.com/speakers/biography.cfm?SpeakerID=5652>

9 <http://www.longtailpipe.com/2014/02/state-department-pushes-fracking-and.html>



MAIN COMPANIES INVOLVED*

	NOC (National Oil/Gas Companies)	IOC (International Oil/Gas Companies)
Algeria ¹⁰	Sonatrach, ALNAFT, (Agence Nationale pour la Valorisation des Ressources en Hydrocarbures)	ENI, Royal Dutch Shell Plc, Talisman Energy
Morocco ¹¹	ONHYM, (Office National des Hydrocarbures et des Mines)	Petrobras, Total, San Leon, Chevron, Repsol, Andarko
Tunisia ¹²	ETAP, (L'Entreprise Tunisienne d'Activités Pétrolières)	Royal Dutch Shell Plc., Cygam Energy, Winstar, Perenco, MedcoEnergy, African Hydrocarbons, Rigo Oil, Storm Oil Venture, Schlumberger

RESOURCE OWNERSHIP*

	State	Private	License required		Bidding procedure	
			Yes	No	Yes	No
Algeria ¹⁰	X		X		X	
Morocco ¹¹	X		X			X
Tunisia ¹²	X		X			X

Resource ownership

Algeria According to Article 3 of Algeria's "Hydrocarbon Law" (Law No. 13-01), the Algerian State owns all hydrocarbon resources. The 'Agence Nationale pour la Valorisation des Ressources en Hydrocarbures' (ALNAFT) is responsible for granting permission for exploration and holds a competitive bidding process for exploration and/or exploitation activities.¹⁶ The state-owned company Sonatrach is responsible for exploration, exploitation, transportation and marketing of hydrocarbons in general. According to Article 32 of the Hydrocarbons Law, Sonatrach holds a minimum of 51% interest in all exploration and exploitation contracts.¹⁷

Morocco Under Morocco's Hydrocarbons Law and Decree, the State owns hydrocarbon deposits. The 'Office National des Hydrocarbures et des Mines' (ONHYM) is the national agency responsible for shale resources, and was created to increase petroleum and mining exploration in Morocco. Through ONHYM, Morocco owns 25% of the working interests in all oil and gas field developments.¹⁸

Tunisia Under Tunisian law, all hydrocarbons located under Tunisian territory and within Tunisian maritime space belong to the state (Article 4 of the Tunisian Hydrocarbons Code, Law No. 99-93). The state-owned oil and gas company, ETAP (*Entreprise Tunisienne d'Activités Pétrolières*) is responsible for the management of oil and gas exploration and production activities on behalf of the state. ETAP can decide whether or not to participate in exploitation concessions. Exploration permits do not require a competitive bidding processes.

¹⁰ http://www.egyptoil-gas.com/read_article_issues.php?AID=679

¹¹ <http://www.moroccoboard.com/news/34-news-release/1004-morocco-oil-shale-deposits-an-alternative-oil-source-following-disastrous-oil-spill-in-us-golf>
<http://www.fastnetoilandgas.com/~media/Files/F/Fastnet-Oil-and-Gas/analyst-coverage/citi-oil-insight-exploring-morocco.pdf>
<http://www.tarsandsworld.com/brazil/2013/04/petrobras-and-total-evaluate-oil-shale-opportunities-africa-and-middle-east>

¹² <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
<http://www.naturalgasasia.com/indonesias-medco-energi-acquires-chinooks-tunisian-oil-gas-assets-12721>

¹³ <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
http://f.datasrv.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

¹⁴ <http://www.nortonrosefulbright.com/knowledge/publications/102343/morocco-ten-things-to-know-about-oil-and-gas#section2>

¹⁵ http://www.etap.com.tn/uploads/telechargement/code_hydrocarbures.pdf
http://www.researchandmarkets.com/research/mmzg2c/tunisia_upstream
<http://www.deplc.com/tunisian-oil-and-gas>

¹⁶ http://www.cygameenergy.com/index.php?option=com_content&view=article&id=5&Itemid=10

¹⁷ <http://www.eia.gov/countries/country-data.cfm?fips=ag>

¹⁸ http://f.datasrv.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

¹⁹ <http://www.2b1stconsulting.com/morocco-to-boost-offshore-exploration-and-oil-shale-development/>

NEW LEGISLATION / LEGAL FRAMEWORK¹⁰

New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general

	Yes	No	Date	Relevant legislation/tax incentives
Algeria ¹⁹	X		20.02.2013	Law No. 13-01 (amending/supplementing Law No. 05-07)
Morocco ²⁰	X		22.05.1991 03.11.1993 17.08.2005	Hydrocarbon Code (Law No. 21-90) Hydrocarbon Decree (Law No. 27-99) Creation of ONHYM (Law 33.01)
Tunisia ²¹		X	17.08.1999	Hydrocarbons Code, Law No. 99-93

Algeria Algeria is the only Maghreb country – so far – to have altered its legal framework in order to specifically cover the exploration and exploitation of unconventional fossil fuels and to make it more attractive for multinational companies to invest. Exploration and exploitation licenses are granted following a competitive bidding process. An exploration licence is granted for up to 11 years (Article 35, Hydrocarbons Law) with the possibility of extension. Exploitation licenses are granted for 35 years (liquid hydrocarbons) or 40 years (gas), again with possible extensions.

Morocco While Morocco has not introduced specific legislation relating to shale, the ONHYM agency was in part set up to support the development of shale oil resources. Oil and gas developers holding exploitation concessions are exempt from corporation tax for a ten-year period, dated from the start of production.

There are three types of licence issued to developers in Morocco: reconnaissance permits (for the geological or geophysical work pre-drilling), which are granted for a maximum of 1 year; exploration permits, which are granted for up to 8 years; and production permits, which can be granted for up to 25 years. The details of the terms and conditions for exploration and exploitation activities are defined by a contract (*accord pétrolier*) between the state and the contractor.

Tunisia Tunisia also does not have a specific legal framework for unconventional fossil fuels. Exploration and exploitation licenses for oil and gas projects are granted by the Minister responsible for hydrocarbons. Four types of licence are issued: an initial prospecting authorisation (which allows prospecting but not seismological surveys or drilling), which can be granted for up to 1 year; a prospecting permit for further prospecting work, which can be granted for up to 2 years; exploration permits, which can be granted for up to 5 years; and exploitation licences which can extend up to 30 years.

All exploration and exploitation activities for hydrocarbons must be carried out by the Tunisian State or by any company with the financial and technical capabilities (Article 7). The Hydrocarbon Law of 1999 also contains the framework for establishing production sharing agreements or joint operations.

¹⁹ http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://www.amcham-algeria.org/upload/file/Hydrocarbons%20law%20reform%2026032013-1.pdf>

²⁰ <http://www.nortonrosefulbright.com/knowledge/publications/102343/morocco-ten-things-to-know-about-oil-and-gas>
<http://www.onhym.com/en/the-office/who-we-are2/strategy.html>
<http://www.onhym.com/en/unconventional-petroleum2/strategic-guidelines22.html>

²¹ <http://www.deplc.com/tunisian-oil-and-gas>
http://www.etap.com.tn/uploads/telechargement/code_hydrocarbures.pdf



Status of development

While each of the Maghreb countries are at different stages in their development of shale resources, there are some overlaps, with some resources crossing borders. Algeria shares the Ghadames Basin with Tunisia and the Tindouf Basin with Morocco.²² None of the countries have as yet reached the exploitation phase and exploration activities have been limited. There is public opposition to shale gas development in all three countries.

Algeria Of all the three Maghreb countries, Algeria has the most technical expertise to help manage a shale gas development.²³ Sonatrach, the Algerian national oil and gas company, drilled its first exploratory shale wells in 2011. The company has high ambitions for shale, announcing a five-year investment plan for oil and gas fields (both conventional and unconventional) worth more than US \$100bn in July 2014.²⁴

The Italian oil and gas multinational, ENI SpA, which has been in Algeria for three decades,²⁵ has signed a cooperation agreement with Sonatrach, focusing on the development of unconventional gas.²⁶ Other foreign companies including Shell, Talisman and Anadarko have also signed contracts with the Algerian government to explore the country's shale gas potential, and a number of other multinationals (including ExxonMobil²⁷, Total and GDF Suez) have shown an interest.²⁸

In January 2014, ALNAFT launched a new bidding round, offering 31 fields for oil and gas exploration, including some shale gas and oil basins.²⁹ In September 2014, Algeria awarded four of the 31 available oil and gas field blocks. In the north of the country, Royal Dutch Shell won in partnership with Spanish Repsol the Bougezoul, while in the east, Shell will partner with Norwegian Statoil. None of the offered shale gas blocks were awarded in this round.³⁰ Sonatrach estimates that more than 400 wells need to be drilled over the next few years to determine the economic potential of Algeria's shale gas deposits.³¹ In 2012, the company drilled a test shale well in the Ahnet basin and in 2014 it announced plans for four exploratory shale gas wells in the Ahnet and Illizi basins.³² No contracts have been signed so far for shale gas exploitation³³ and shale gas production is not expected to begin before 2020.³⁴ In July 2014, the country's Council of Ministers agreed a programme to drill 11 wells over the next 7 to 13 years³⁵ reflecting a cautious approach to development.

In October 2014, Algerian Energy Minister Youcef Yousfi said that companies could begin shale gas production in 2022, producing 10 billion cubic metres by 2025, although this forecast is being questioned due to the lacking infrastructure as well as security reasons.³⁶

Morocco As a net energy importer, Morocco's government has been trying to push the development of shale oil for a number of years, setting up the National Office of Hydrocarbons and Mines (ONHYM) to drive development.³⁷

The Brazilian oil and gas company Petrobras has been involved in exploring for shale oil in the Tihmadit basin since 2008, and the French company, Total, has now joined the project via a cooperation agreement with Petrobras.³⁸

In 2009, ONHYM signed a Memorandum of Understanding (MoU) with the Irish company, San Leon Energy, to develop the Tarfaya shale oil field,³⁹ and also has links with Longreach Oil and Gas (Canada).⁴⁰ In January 2012, San Leon Energy announced that they were ready to begin shale oil production at a site in the Tarfaya Oil Shale Field Pilot Project.⁴¹ Two years later they announced a MoU with Chevron Lummus Global LLC "to exclusively cooperate in respect of the oil shale upgrading technology required to produce high quality synthetic crude oil from the raw shale oil to be produced in the Company's Timahdit oil shale License Area, Morocco."⁴² Construction for the shale oil plant is expected to begin after 2015. Repsol and Anadarko have also been awarded reconnaissance and exploration licenses for unconventional oil and gas shale fields in Morocco.⁴³

STATUS OF DEVELOPMENT

	Exploration phase	Exploitation/ Production phase
Algeria	X	
Morocco	X	
Tunisia	X	

22 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
23 <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Shale%20Gas%20and%20its%20Implications%20for%20Africa%20and%20the%20African%20Development%20Bank.pdf>

24 <http://www.africa-energy.com/algeria-sonatrach-plans-ambitious-projects-0>

25 <http://northafricapost.com/4081-algeria-energy-and-mines-minister-discusses-strategy-with-eni.html>

26 http://www.europarl.europa.eu/RegData/etudes/briefing_note/join/2013/491498/EXPO-AFET_SP%282013%29491498_EN.pdf

27 <http://www.bloomberg.com/news/2012-11-26/europe-s-shale-boom-lies-in-sahara-as-algeria-woos-exxon.html>

28 <http://www.aljazeera.com/news/middleeast/2014/07/algeria-shale-gas-2014722901333264.html>

29 <http://www.reuters.com/article/2014/01/21/algeria-energy-idUSL5N0KV35620140121>

30 <http://uk.reuters.com/article/2014/09/30/algeria-energy-idUKL6N0RV2FG20140930>

31 <http://www.bloomberg.com/news/2012-11-26/europe-s-shale-boom-lies-in-sahara-as-algeria-woos-exxon.html>

32 <http://www.aps.dz/en/economy/3366-shale-gas-sonatrach-to-drill-4-wells-in-ahnet-illizi-in-2014>
<http://www.wyfp.com/en/InversoresAccionistas/Documents/Presentations/29-08-2013-Presentation-YPF.pdf>

33 <http://www.aps.dz/en/economy/2959-no-contract-was-signed-on-shale-gas-exploitation-in-algeria>

34 <http://www.egyptoil-gas.com/admin/industry/in%20Focus%20EOC%20Newspaper%20September%202013%20Issue.pdf>
http://www.rigzone.com/news/oil_gas/a/125078/Time_to_Look_for_Unconventional_Gas_in_the_Middle_East

35 <http://www.aljazeera.com/news/middleeast/2014/07/algeria-shale-gas-2014722901333264.html>

36 <http://interfaxenergy.com/gasdaily/article/13983/algeria-dreams-of-10-bcm-y-shale-production>

37 <http://www.onhym.com/en/the-office/who-we-are/strategy.html>

38 <http://www.moroccoboard.com/news/34-news-release/1004-morocco-oil-shale-deposits-an-alternative-oil-source-following-disastrous-oil-spill-in-us-gulf>

39 <http://www.2b1stconsulting.com/morocco-to-boost-offshore-exploration-and-oil-shale-development/>

40 http://www.eia.gov/analysis/studies/worldshalegas/pdf/chaptersxiv_xix.pdf

41 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

42 <http://medinsight.wordpress.com/2012/01/30/shale-energy-and-north-africas-future/>

43 <http://www.sanleonenergy.com/media-centre/news-releases/2014/january/28/memorandum-of-understanding-%28mou%29-signed-with-chevron-lummus-global.aspx>

44 <http://www.fastnetoilandgas.com/~media/Files/F/Fastnet-Oil-and-Gas/analyst-coverage/citi-oil-insight-exploring-morocco.pdf>

The Moroccan government has promised that companies with the right expertise to help develop these resources will find “competitive fiscal terms, a supportive and stimulating regulatory framework”.⁴⁴ However, the EIA suggests that “accurately identifying promising shale basins and estimating their resource potential in such geologically complex areas requires significant amount of data, which are not widely available in Morocco ... because of limited well drilling and data confidentiality.”⁴⁵

Tunisia Development of Tunisia’s oil and gas resources has been described as “immature” by one industry player, with just 1,050 wells (480 of which were exploratory) drilled from 1932 to 2008.⁴⁶

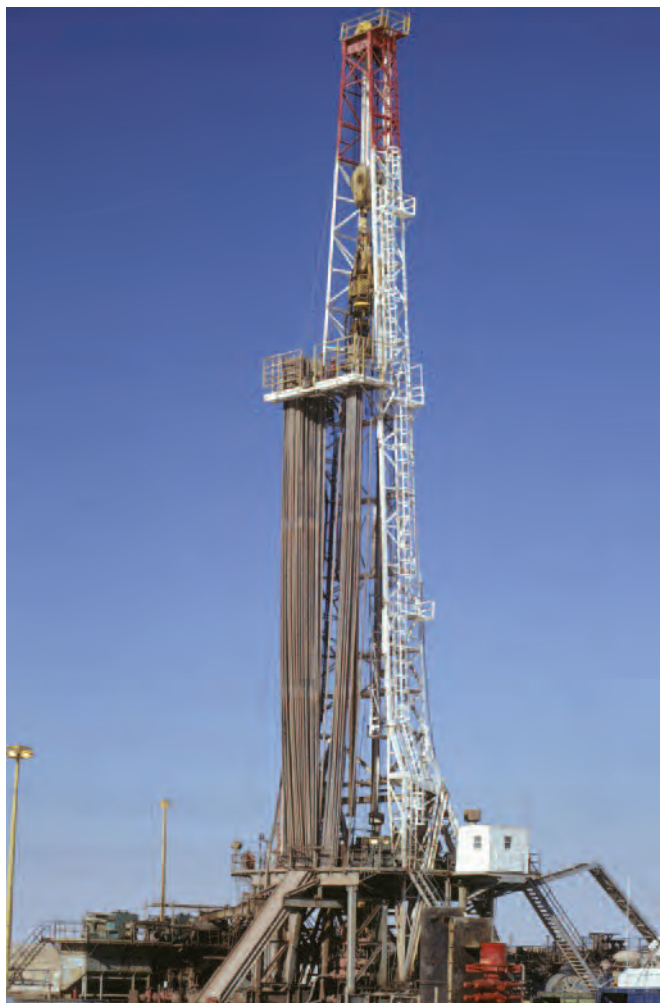
In 2010, the French company Perenco announced a fracked test shale gas well in the El Franig Field.⁴⁷ The following year, Cygam Energy Inc. said it had carried out different test fracture stimulations on shale and tight oil in the Sud Remada area, near the Libyan border.⁴⁸ However, the company operating Cygam’s test wells was bought out in 2014 by an Indonesian company, MedCoEnergi, for \$114 million. The deal included oil and gas blocks in the Ghadames basin.⁴⁹

Shell has applied for an exploration licence for the Kairouan region,⁵⁰ which would involve 742 wells in the production phase, or one well per every five square kilometres.⁵¹ The government has not yet issued the licence.

A study on the economic impact of liquid rich shale and shale gas exploration in Tunisia, based on Shell data, suggested that shale could have “transformative implications” for the Tunisian market.⁵² Without shale, Tunisia would be likely to become increasingly dependent on fuel imports.⁵³ The study however clearly shows that shale gas development will require long-term investment, with drilling in the development phase likely to continue until 2038. It suggests that at least 10 wells per year will need to be drilled from 2018 onwards, reaching a peak in 2024 with approximately 70 wells. The “headline findings” – which assume there is at least one successful economical basin – are that the project is expected to create an average annual direct contribution to GDP of €106 million (0.3% of GDP). This relies on an assumption that approximately 5,000 jobs per year will be created.

Others have seriously questioned the ability of the shale oil and gas sector to create such a significant number of jobs. Not only do these numbers appear speculative (based on best-case scenarios) but they ignore the sustainability of the jobs and questions as to who will benefit from these job opportunities (high-skilled migrant workers or local workers). One study from 2013 states that “Optimistic job estimates by industry have relied heavily on unrealistic multipliers to claim vast numbers of indirect jobs. Such job estimates in industry studies often include professions such as strippers and prostitutes in the overall job gains - not the sort of jobs that most people think of when they hear optimistic numbers from the oil and gas industry. Moreover, direct industry jobs (for onshore and offshore oil and gas) have accounted for less than 1/20 of 1% of the overall US labor market since 2003, according to the Bureau of Labor Statistics. This cannot be construed as game changing job creation.”⁵⁴

The future of shale gas and oil development in the Maghreb countries may also depend on the security situation in the region. Forty workers died in an attack on the In Amenas oil field in January 2013. Instability in neighbouring Libya is also a concern.⁵⁵



A drilling rig is loaded with pipe for the drilling of an exploration well in the Sahara Desert, Algeria, Africa.

© Zview/Istock

44 <http://www.moroccosummit.com/#!about/ci8l>
45 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
46 http://www.cygameenergy.com/index.php?option=com_content&view=article&id=5&Itemid=10
47 http://www.eia.gov/analysis/studies/worldshalegas/pdf/chaptersxiv_xix.pdf
48 <http://www.cygameenergy.com/images/pdf/news/2011-05-25.pdf>
<http://www.cygameenergy.com/images/tunisia-concession-map.gif>
49 <http://www.naturalgasasia.com/indonesias-medco-energi-acquires-chinooks-tunisian-oil-gas-assets-12721>
50 <http://ejatlas.org/conflict/fracking-opposition-tunisia>
51 <http://nawaat.org/portail/2013/10/18/feu-vert-a-shell-pour-742-puits-de-gaz-de-schiste/>
52 <https://www.oxfordeconomics.com/publication/open/243655>
53 <http://www.leboulanger-avocats.com/projet/publications/ClosingSession.pdf>
54 <http://shalebubble.org/wp-content/uploads/2013/02/SWS-report-FINAL.pdf>
55 <http://www.reuters.com/article/2013/09/26/us-bp-algeria-idUSBRE98P0YR20130926>



Environmental, ecological and social impacts

Access to water is a major issue in the Maghreb countries, which have collectively been described as one of the most water-scarce regions in the world.⁵⁶ Water scarcity has already reached a critical point in the region, with Algeria and Tunisia already considered to be suffering from a severe water shortage (less than 500 m³ per inhabitant per year), and severe drought is likely in the future. This poses a major problem for the agriculture sector, which is the main user of water.⁵⁷

Despite the general aridity of the region, most parts of the Maghreb are still able to grow food. However, production levels have stagnated, and the Maghreb countries now import a number of food products, particularly cereals. Increasing costs for food imports is becoming a major problem.

The push for shale gas and oil development will require millions of litres of fresh water, adding to existing demand. One recent study estimates that the water demand for shale gas production is between 60,000 m³ and 192,000 m³ per well site/drilling rig.⁵⁸ This would mean a water demand of 5.6 million m³ – 43.7 million m³, or the equivalent of 14,500 Olympic swimming pools of water, to develop a 260km² shale field.⁵⁹

Fracking could also pose a threat to existing groundwater supplies as a result of the fracking process. Access to water is needed throughout the lifetime of the project, and project developers are advised to secure water rights at the start of the project.⁶⁰ This is so as to avoid the risk of rising costs which could make projects unviable as water resources become more expensive.

It is estimated that by 2025, water demand in this already water-stressed region could increase by a further 25%,⁶¹ but climate change means that the available levels of the resource are likely to fall. According to the United Nations Environment Programme: “for the western Maghreb countries (Morocco, Algeria and Tunisia), climate change scenarios predict a rise in temperature of between 2° and 4°C this century, accompanied by a reduction in rainfall of up to 20 per cent and increased evapotranspiration (IPCC 2001). This would result in decreased soil moisture and reduced surface and groundwater resources.”⁶²

The development of shale gas and oil could cause severe and irreversible damage to North African aquifer systems (some of which are transboundary),⁶³ and which overlap with many of the potential shale fields.⁶⁴ This is a particular risk in the Northwest Sahara Aquifer System,⁶⁵ also known as the SASS (Système d’Aquifères du Sahara Septentrional)⁶⁶, which provides water for



people across Algeria, Tunisia and Libya and includes both the Complex Terminal⁶⁷ and the Continental Intercalaire Aquifers.⁶⁸ The Errachidia Basin and the Tindouf Aquifer between Algeria and Morocco are also at risk.⁶⁹

The Continental Intercalaire Aquifer for example is one of the largest aquifers in the world, extending over an area of more than 1 million km². Together with the Complex Terminal, it forms a major transboundary aquifer system, shared between Algeria, Tunisia and Libya. Some 4 million people depend on the resources of this vast underground sea for survival.⁷⁰ This resource is already under threat with an average of 2.75 km³ of water extracted each year from the SASS system, while only around 1.4 km³ is replenished, mostly from rainfall.⁷¹ Demand for freshwater from the shale industry will aggravate this situation, putting further pressure on resources.

56 <http://edepot.wur.nl/262881>

57 <http://edepot.wur.nl/262881>

58 http://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_53_2014_umweltauswirkungen_von_fracking_28.07.2014_0.pdf

59 https://www.foeeurope.org/sites/default/files/publications/shalegas_heading_south_june2014.pdf

60 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

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64 http://www.2b1stconsulting.com/wp-content/uploads/2012/08/Sonatrach_Algeria_Shale_Gas_Potential_map.jpg
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http://www.mem-algeria.org/francais/uploads/slides/Unconventional_Resources_Tight_Gas_Sands_Shale_Gas.pdf

65 http://projects.inweh.unu.edu/inweh/inweh/content/2041/IWLEARN/scientific-report-on-iullumeden-aquifer-system-13_1.jpg

66 http://www3.gaf.de/aquifer/images/aoi_sass.jpg

67 http://www.geo.fu-berlin.de/geol/institutsleben/exkursionen/sued-tunesien/07_Grundwassermanagement/f11-Abb7_500.jpg?1373750321

68 http://www.oss-online.org/sites/default/files/limites_du_sass.jpg

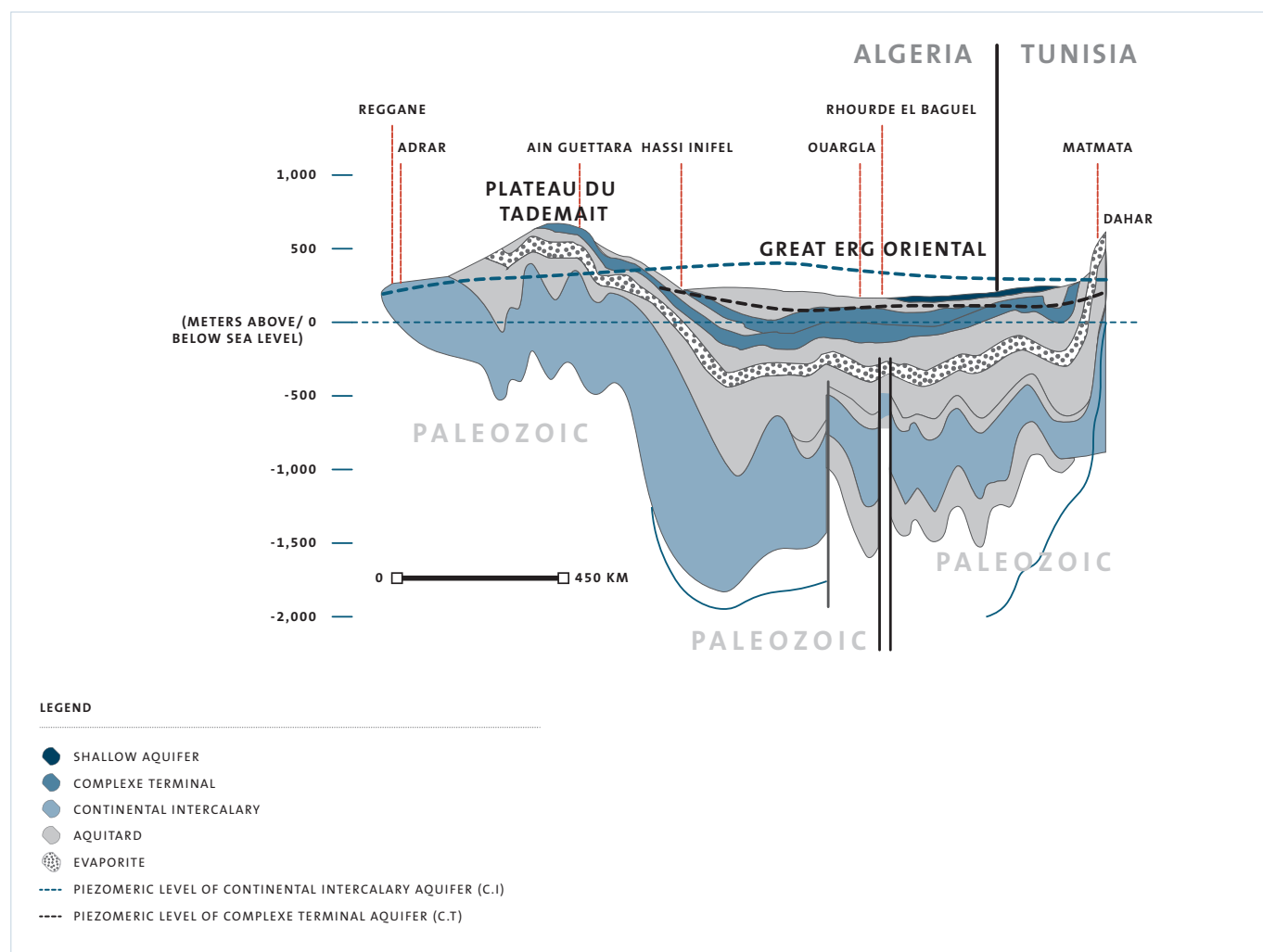
69 https://na.unep.net/atlas/africaWater/downloads/africa_water_atlas.pdf (Page 107)

70 http://www.isarm.org/dynamics/modules/SFI0100/view.php?fil_id=254

71 http://hispagua.cedex.es/sites/default/files/hispagua_documento/documentacion/documentos/recursos_compartidos_sahara.pdf

71 <http://www.ird.fr/la-mediathèque/fiches-d-actualite-scientifique/431-l-eau-sous-le-sahara-pas-si-fossile-que-ca>

MAGHREB EAST-WEST SIMPLIFIED GEOLOGICAL CROSS-SECTION OF THE SASS, AND DRILLINGS



Source: UNESCO 1972 & SASS database.

Excessive freshwater demand is however not the only threat for these regional aquifers. The risk of methane or chemical contamination is also an important concern. A look at the hydrogeological section of the Northwest Sahara Aquifer System also reveals the complex geological and hydrogeological situation, which varies – sometimes dramatically – depending on the site, with a lot of underground rejections and folds.⁷² The depths of the aquifer also vary from around 400m up to 2,000m below ground,⁷³ which contradicts industry claims that groundwater reserves are close to the surface away from depths where fracking is done so that there is no risk of contamination.⁷⁴ The proximity between aquifers and shale layers, and the complexity of the Maghreb geology, further emphasize the risk of toxic waste polluting vital drinking water sources for the entire region.

The African Development Bank has warned that fracking may pose a threat to other sectors of the economy in Algeria, particularly agriculture, adding that “*the challenge for Algeria will be to determine whether there is sufficient water supply available to permit fracking without damage to other sectors of the economy, such as agriculture. In addition, despite its long experience with developing a gas sector, Algeria does not yet have experience with the regulations and monitoring required to ensure that fracking does not pose an unacceptable environmental risk*”.⁷⁵

72 <http://www.intechopen.com/source/html/37447/media/image2.jpeg>
<http://bankwatch.org/news-media/blog/sharing-shale-experience>

73 <http://www.sciencedirect.com/science/article/pii/S0883292702001890>

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75 <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Shale%20Gas%20and%20its%20Implications%20for%20Africa%20and%20the%20African%20Development%20Bank.pdf>



It also warns that Tunisia and Morocco have “very limited experience with managing a hydrocarbons sector, and those difficulties would be added to the struggles of managing the environmental risks. Yet again, the adequacy of water supply and measures that might be taken to minimize its impact on the economy will be important.”⁷⁶

Important questions remain as to who would be held liable for the possible contamination of these transboundary underground aquifers. Furthermore, it is unclear if anyone will want to take the decision that fresh water in an extremely water-scarce region should be used for shale gas development rather than to provide water to irrigate farmland.

Opposition to the development of shale gas & oil

Algeria Algeria has been described as having minor levels of anti-fracking-activism, but a high risk of political and security threats, particularly in the main urban centres and the southern oil-producing areas.⁷⁷ There has been an on-going state of emergency in Algeria since 1992, which outlaws peaceful demonstrations in the capital, Algiers.⁷⁸ This represents a serious challenge to the democratic rights of citizens objecting to the development of fracking.

Anti-fracking campaigners in Algeria are however quite active, with groups including the Collectif National pour les Libertés Citoyennes (CNLC)⁷⁹ actively challenging corporate plans, including during the World Social Forum in Tunis.⁸⁰

Members of the Algeria Solidarity Campaign (ASC) and the Algerian Cultural Collective (ACC) protested – together with supporters from Frack Off and Ribble Estuary Against Fracking (both UK) – against Algerian fracking plans in London in 2013, with the support of the Comité Nationale de Défense des Droits de Chômeurs (CNDDC), Algeria, L’Observatoire Algérien des Droits de l’Homme (OADH), Algeria, Anti-Shale Gas Euro-Maghreban Collective (CEMAGAS), Algeria, Agir pour le changement et la démocratie en Algérie (ACDA), France, Front de Gauche (London Committee), UK, and the Green Left, UK.⁸¹

Morocco Morocco is considered to have a moderate level of anti-fracking activism, while the political risk is seen as low and the security risk is considered to be medium.⁸²

This “moderate” opposition includes very active groups such as l’Espace de Solidarité et de Coopération de l’Oriental (ESCO), which has made links with European anti-fracking-groups. The “Déclaration de la Conférence d’Oujda contre les Gaz de schiste” (Declaration of the Conference of Oujda against shale gas) is one of the results of the exchange between North African and European experts and activists mobilised against shale oil and gas development who came together at a conference in December 2013 (notably attended by parliamentarians, regional and local elected officials, University professors and representatives of national agencies).⁸³

OPPOSITION TO THE DEVELOPMENT

Opposition to the development of shale gas / oil

Algeria	Yes
Morocco	Yes
Tunisia	Yes

Tunisia Tunisia was not included in the global risk assessment of anti-fracking activity,⁸⁴ but there is a very active and well-connected anti-fracking movement in the country, bringing together organisations such as Eco-Conscience, the Tunisian Association for Transparency in Energy and Mines (ATTEM),⁸⁵ the Tunisian General Labour Union (UGTT),⁸⁶ the Tunisian Workers Party, Public Services International (PSI)⁸⁷ and AgriEcoForest. There have been street protests as well as official complaints, letters and petitions, drawing support from local scientists and professionals.⁸⁸

Objections have also been raised about European Bank for Reconstruction and Development (EBRD) funding for the development of fracking in Tunisia. The CEE Bankwatch Network, with the support of a number of Tunisian groups, has registered serious concerns with the President and Executive Director of the EBRD regarding a \$60 million loan to Serinus Energy Inc. for shale gas development in Tunisia.⁸⁹

While the Tunisian General Labour Union has objected to plans for fracking in Tunisia, the Union’s deputy secretary general, Anour Ben Gaddour has been quoted as saying that “the government must start the extraction of shale gas”⁹⁰ – despite the objections of members.

76 <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Shale%20Gas%20and%20its%20implications%20for%20Africa%20and%20the%20African%20Development%20Bank.pdf>

77 http://www.controlrisks.com/~media/Public%20Site/Files/Oversized%20Assets/shale_gas_whitepaper.pdf

78 http://www.lexpress.fr/actualite/monde/afrique/que-signifie-vraiment-la-fin-de-l-etat-d-urgence-en-algerie_966280.html

79 <http://cnlc-dz.org/>

80 <http://platformlondon.org/2013/10/18/shale-gas-exploitation-in-algeria-interview-with-an-algerian-journalist-and-anti-fracking-campaigner/>
<http://www.tni.org/article/networking-against-fracking>

81 <http://platformlondon.org/2013/04/17/gaz-de-schiste-cest-fasciste-fracking-algeria/>

82 http://www.controlrisks.com/~media/Public%20Site/Files/Oversized%20Assets/shale_gas_whitepaper.pdf

83 <http://www.massolia.com/rencontre/mohamed-benata-ingenieur-agronome-president-de-l-espace-de-solidarite-et-de-cooperation-de-l-oriental-esco-la-declaration-de-la-conference-doujda-contre-les-gaz/>

84 http://www.controlrisks.com/~media/Public%20Site/Files/Oversized%20Assets/shale_gas_whitepaper.pdf

85 http://www.africanmanager.com/site_eng/detail_article.php?art_id=19227

86 <http://www.world-psi.org/en/tunisia-trade-unions-organise-national-campaign-against-fracking>

87 <http://www.tunisia-live.net/2012/11/24/international-union-enters-debate-on-shale-gas-in-tunisia/>

88 <http://ejatlas.org/conflict/fracking-opposition-tunisia>

89 <http://bankwatch.org/sites/default/files/letter-EBRDSerinusEnergy-02Jul2013.pdf>

90 <http://www.radioexpressfm.com/lire/anouar-ben-gaddour-le-gouvernement-doit-lancer-l-extraction-du-gaz-de-schiste-2211>



Alternatives to fracking. The Ain Beni Mathar Solar Plant in Morocco. The solar plant is the first hybrid combined solar cycle plant worldwide. It has a 470 MW capacity and avoids 33,000 tonnes CO₂ emissions per year.
© Markel Redondo/Greenpeace

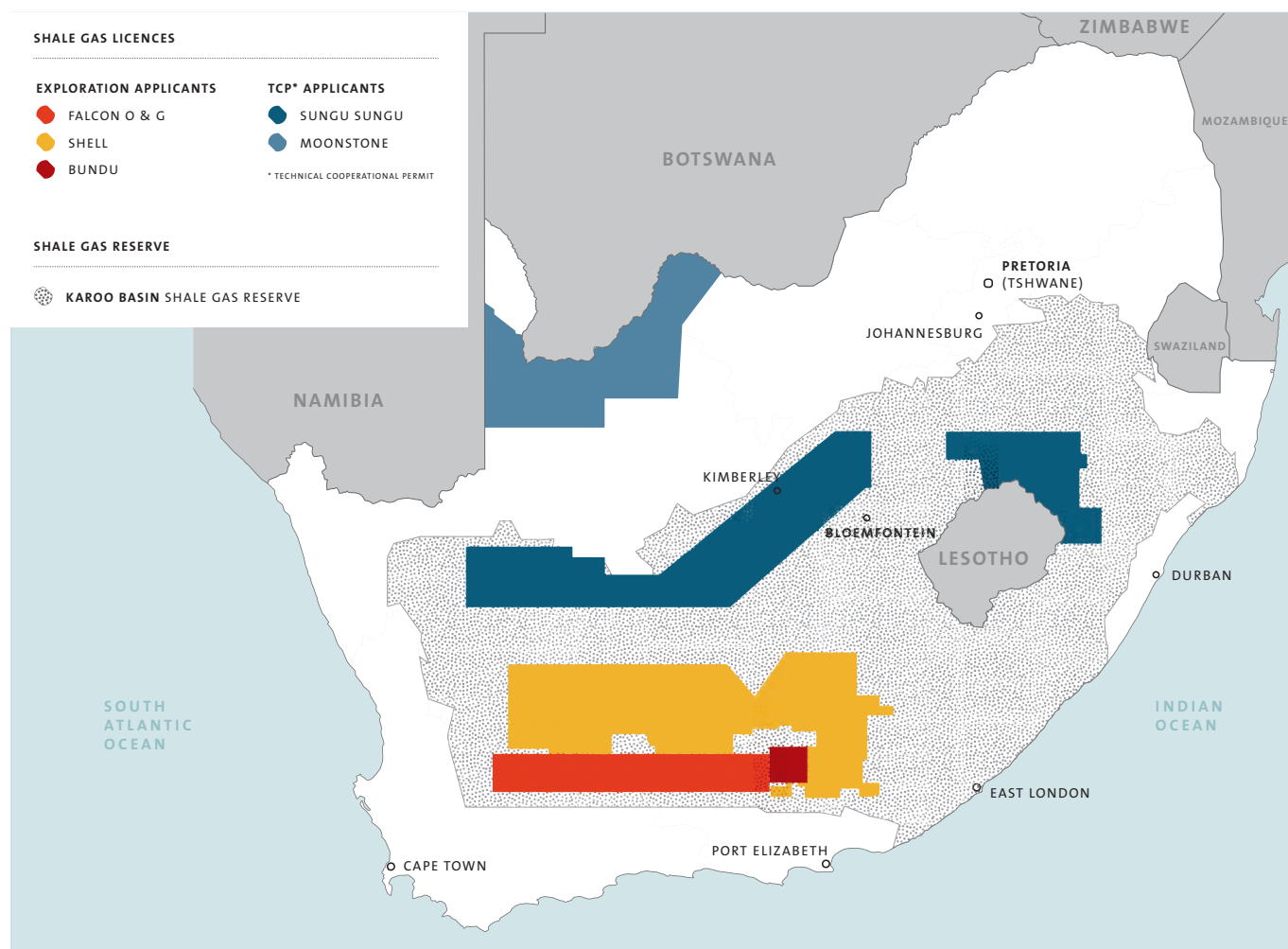


5

SOUTH AFRICA

South Africa currently relies predominantly on coal for its energy.¹ The country has also started developing shale gas reserves, but recent estimates have downgraded the amount considered technically recoverable. There are concerns about the impact of shale exploitation on water resources in the Karoo aquifer system. The country imposed a moratorium on shale development in 2011, but this was lifted in 2012 following the report of a working group looking at impacts.

SOUTH AFRICA SHALE GAS RESERVES & LICENCES



Sources: Treasure the Karoo Action Group (TKAG), US EIA, 2013.

TECHNICALLY RECOVERABLE RESOURCES

Technically recoverable resources ²	Shale gas				Shale oil	
	(tcf)		(bcm)		(billion barrel)	
	US EIA	SAPA [*]	US EIA	SAPA	US EIA	SAPA
	390	30	11,043	850	-	-

World ranking ³	Shale gas		Shale oil	
	US EIA	SAPA	US EIA	SAPA
	8	26	-	-

^{*}SA Petroleum Agency

Technically recoverable resources & world ranking

South Africa was previously thought to have significant shale gas resources but the most recent EIA figures downgraded the technically recoverable shale gas estimate from 485 tcf (13,733 bcm) to 390 tcf (11,043 bcm) because of the very complex geology of the Karoo basin where most of South Africa's shale gas resources are thought to be found.

The Petroleum Agency of South Africa, however, estimates that there is only 30 tcf (850 bcm) of technically recoverable shale gas resources in the country,⁴ which would move South Africa to 26th place from 8th in the world ranking. The South African government still considers that this smaller resource has *"the potential to have a major impact on the national economy"*.⁵

According to the Working Group of the South African Task Team on Shale Gas and Hydraulic Fracturing, there is currently insufficient data *"to accurately assess the size, quality and extractability of the shale gas resources"*.⁶

Targeted by UGTEP

South Africa is listed as one of the countries that have been selected to participate in the UGTEP, benefiting from *"the US federal and state governments' technical expertise, regulatory experience and diplomatic capabilities to help selected countries understand their shale gas potential"*.⁸

As a result of this involvement, the government took part in a US field study as part of its Investigation into Hydraulic Fracturing in the Karoo Basin, with visits to the Marcellus and Eagle Ford Shales, as well as talks with the US Environmental Protection Agency (EPA) and the Railroad Commission of Texas.⁹

The US Bureau of Energy Resources (ENR) also organised an event for officials from the South African government, civil society and the private sector to discuss unconventional energy in Pretoria, South Africa in February 2014.¹⁰

UGTEP - TARGETED BY / LISTED AS PARTNER

Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP) ⁷	Yes
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1 <http://www.poa.gov.za/Outcomes%20Publications/National%20Development%20Plan.pdf>
2 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
3 <http://www.eia.gov/analysis/studies/worldshalegas/>
4 <http://www.saoga.org.za/oil-gas-hubs/upstream-oil-gas-south-africa>
5 <http://www.dmr.gov.za/publications/summary/182-report-on-hydraulic-fracturing/852-executive-summary-investigation-of-hydraulic-fracturing-in-the-karoo-basin-of-south-africa.html>
6 http://www.gov.za/sites/www.gov.za/files/investigation_hydraulic_fracturing_Karoo_basin_sa_executive_summary.pdf
7 <http://www.state.gov/s/ciea/ugtep/>
<http://www.doi.gov/intl/itap/ugtep.cfm>
<http://www.eia.gov/analysis/studies/worldshalegas/#3>

^{*}Other U.S. government agencies that participate in the UGTEP include: the U.S. Department of Energy's Office of Fossil Energy (DOE/FE); the U.S. Agency for International Development (USAID); the U.S. Department of Interior's U.S. Geological Survey (USGS); U.S. Department of Interior's Bureau of Ocean Energy Management (BOEM); the U.S. Department of Commerce's Commercial Law Development Program (CLDP); and the U.S. Environmental Protection Agency (EPA). The U.S. Department of the Interior's (DOI) International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops"
8 <http://www.state.gov/s/ciea/ugtep/>
9 <http://www.dmr.gov.za/publications/summary/182-report-on-hydraulic-fracturing/852-executive-summary-investigation-of-hydraulic-fracturing-in-the-karoo-basin-of-south-africa.html>
10 <http://www.state.gov/e/enr/>



RESOURCE OWNERSHIP ¹²					
State	Private	License required		Bidding procedure	
		Yes	No	Yes	No
X		X			X

MAIN COMPANIES INVOLVED ¹¹	
NOC (National Oil/ Gas Companies)	IOC (International Oil/ Gas Companies)
Petroleum Agency South Africa, Sungu Sungu Gas Ltd., Moonstone Investments 89 (Pty) Ltd.	Shell Exploration Company BV, Challenger Energy Ltd. (via Sunset Energy and Bundu Ltd.), Falcon Oil & Gas Ltd. & Chevron

Resource ownership

According to South Africa's Mineral and Petroleum Resources Development Act (MPRDA), the State is "*the custodian of the nation's mineral and petroleum resources*" (Chapter 2, Section 3 (2) a). This means that exploration and exploitation operations are allowed on private land as long as the prospective developer notifies and consults the land owner or lawful occupier.

Under the current law, the state doesn't need to be involved in oil and gas exploration and/or exploitation, although it has an option of taking a 10% participating interest. Under amendments that have been proposed to the Mineral and Petroleum Resources Development Act, the state would have a right to 20% free carried interest share in the profits¹³ from all oil and gas exploration and production rights. The proposals would also entitle the state to further participation of up to 80%.¹⁴

NEW LEGISLATION / LEGAL FRAMEWORK ¹⁵				
New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general	Yes	No	Date	Relevant legislation
	X		2002	Minerals and Petroleum Resources Development Act, No. 28 of 2002
			2012	Recommendations of Task Team on Shale Gas and Hydraulic Fracturing in the Karoo Basin of South Africa (Part of the Investigation Report)
			31 May 2013	Mineral and Petroleum Resources Development Amendment (Bill)
			15 October 2013	Proposed Technical Regulations for Petroleum Exploration and Exploitation (Draft Regulations, Notice 1032 of 2013)

- 11 <http://www.treasurethekaroo.co.za/fracking-facts/applications-for-shale-gas-exploration>
<http://www.cornell-landproject.org/download/landgrab2012papers/fig.pdf>
http://www.eia.gov/analysis/studies/worldshalegas/pdf/chaptersxiv_xix.pdf
<http://www.treasurethekaroo.co.za/fracking-facts>
<http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
<https://milieudefensie.nl/publicaties/rapporten/shell-dont-frack-the-karoo>
- 12 <http://www.dmr.gov.za/publications/summary/109-mineral-and-petroleum-resources-development-act-2002/225-mineral-and-petroleum-resources-development-act-2002>
http://fdatasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
- 13 A free carried interest is a share in the annual profits. The State doesn't have to make any contribution to the capital expenditure in order to profit from the free carry interest

- (<http://www.bowman.co.za/FileBrowser/ArticleDocuments/Getting-the-Deal-Through-Mining-2013.pdf>)
- 14 <http://www.bdlive.co.za/business/mining/2014/03/06/anc-overrides-opposition-to-minerals-act-amendments>
- 15 <http://www.dmr.gov.za/publications/viewcategory/109-mineral-and-petroleum-resources-development-act-2002.html>
http://jtalaw.co.za/media/filestore/2013/06/b015_2013.pdf
<http://www.dmr.gov.za/publications/summary/109-mineral-and-petroleum-resources-development-act-2002/225-mineral-and-petroleum-resources-development-act-2002>
<http://www.dmr.gov.za/publications/summary/218-hydraulic-fracturing/1025-gazetted-proposed-technical-regulations-for-petroleum-exploration-and-exploitation.html>
<http://www.dmr.gov.za/publications/summary/182-report-on-hydraulic-fracturing/852-executive-summary-investigation-of-hydraulic-fracturing-in-the-karoo-basin-of-south-africa.html>

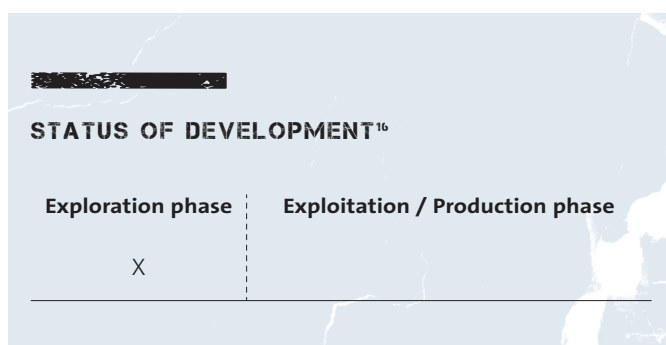
New legislation & legal framework

South Africa has four different mining licences for oil and gas activities. The “reconnaissance operation permit” covers geological and geophysical surveys; a “technical co-operation permit”, gives the applicant the exclusive right to apply for and to be granted an exploration right after carrying out detailed studies, including collecting seismic data. Both are valid for up to one year. The “exploration right” entitles the holder to do extended well testing, and is valid for three years (with a possible extension of up to 6 years). Holders of exploration rights can apply for production rights, which allows the exploration, appraisal, development and production of oil and gas, and are valid for 30 years (with possible multiple extensions of up to 30 years).

The Proposed Technical Regulations for Petroleum Exploration and Exploitation, published in 2013, include rules on the operation and management of hydraulic fracturing, including the need for a water-use license; the need for pre-fracturing modelling, monitoring, documentation, disclosure of the fracking fluids, risk assessment (especially for the faults and igneous intrusions), and mitigation against the environmental, safety and sanitary risks associated with fracking.

The use of reserve pits will also be allowed – though only for temporary storage of flowback for 7 days. Discharge of fracking fluids or flowback into surface water or water drainage is explicitly prohibited.

The draft Regulations state that operations must not have an adverse impact on water quality in the catchment area and that designated and existing uses for water resources must be protected and maintained. No fracking well is allowed within 1km of any existing water well, centre of a perennial stream or wetland or within 500m of the edge of any water resource.



Status of development

Shale gas development started in South Africa in 2009 when the Petroleum Agency South Africa (PASA) awarded Shell a Technical Cooperation Permit (TCP) to carry out a study to determine the natural gas potential in the Karoo Basin.¹⁷ Shell submitted three applications in December 2010 for exploration licences in the Karoo (Western, Eastern and Northern Cape), covering an area of 90,000 km². Shell was reported to be planning to drill six exploratory wells by 2014, with 1,500 wells needed for the production phase.¹⁸ The applications were accepted in 2010 and 2011.¹⁹

However, in April 2011, the South African government decided to step back and chose to “invoke a moratorium on licenses in the Karoo”²⁰, in order to lead an investigation into the implications of hydraulic fracturing, including the various possible environmental impacts. This decision, mostly taken after a large demonstration organised by farmers, conservationists and environmentalists, led to the establishment of a task team working group on shale gas and hydraulic fracturing in the Karoo basin. The moratorium was lifted more than a year later, in September 2012, following the publication of the Working Group’s recommendations:²¹

- Allow normal exploration (excluding actual hydraulic fracturing),
- Constitute a monitoring committee,
- Augment the current legal framework,
- Collaborate in developing mechanisms for the co-existence of the Astronomy Research Projects and development of shale gas in the Karoo,
- Authorise hydraulic fracturing under strict supervision of the monitoring committee and
- Conduct ongoing scientific research, in particular into the hydrogeology of the targeted areas.

Falcon Oil and Gas Ltd., an Irish company, signed a five-year co-operation contract with Chevron in 2012 to develop a further 30,350 km² area of the Karoo basin (Eastern Cape). The Australian company, Challenger Energy Ltd., has also acquired an interest in shale development in South Africa, through Sunset Energy which purchased Bundu Oil and Gas Ltd., committing A\$ 1.2 million (€838 million) for the exploration of tight oil and shale gas in the Thelma and Cranmere Projects.²² Bundu and Falcon had also made applications for exploration rights in 2010 but a ministerial decision is still pending.²³

16 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>

<https://milieudefensie.nl/publicaties/rapporten/shell-dont-frack-the-karoo>

<http://www.tni.org/sites/www.tni.org/files/dfig64.pdf>

<http://www.treasurethekaroo.co.za/fracking-facts/applications-for-shale-gas-exploration>

17 <http://www.shell.com/zaf/aboutshell/shell-businesses/e-and-p/karoo/karoo.html>

18 http://www.nytimes.com/2011/12/31/world/south-african-farmers-see-threat-from-fracking.html?pagewanted=3&adxnlnx=1333911646-zNsJNdZlycp%20q%20N/Ogq7qQ&_r=0

19 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>

20 <http://www.naturalgaseurope.com/south-africa-takes-cautionary-approach>

21 <http://www.dmr.gov.za/publications/summary/182-report-on-hydraulic-fracturing/852-executive-summary-investigation-of-hydraulic-fracturing-in-the-karoo-basin-of-south-africa.html>

22 <http://challengerenergy.com.au/wp-content/uploads/2010/10/Significant-Purchase-of-Oil-and-Gas-Assets-in-South-Africa.pdf>

23 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>



Technical co-operation permits covering part of the Northern Cape, Free State, KwaZulu Natal and North West Province have been taken over by Sungu Sungu Ltd., a South African company from the Sasol-Statoil-Chesapeake collective. The two blocks cover an area of about 100,000 km².²⁴ Technical co-operation permits are also held by Moonstone Investment 89 (Pty) Ltd.,²⁵ for a concession near the border with Botswana.²⁶

In November 2014, Falcon Oil & Gas Ltd. announced that PASA has decided to proceed with processing the company's application for a shale gas exploration licence. The South African Department of Mineral Resources announced that the government would issue companies with licences to explore for shale gas soon.²⁷ Shell is also strongly pushing the South African government to decide on its application for shale gas exploration in the Karoo.²⁸

According to the Treasure Karoo Action Group (TKAG), a South African anti-fracking group, it is expected that the government will consult with communities and other relevant authorities on shale gas exploration regulations from December 2014 to June 2015 and then issue the exploration licences in July/August 2015.²⁹

Several research projects are underway on the hydrogeology of the Karoo Basin. A Water Expert Group, for example, funded by Shell, has been looking at groundwater in the basin and released the Karoo Groundwater Atlas in February 2012.³⁰ The Africa Earth Observatory Network and the Nelson Mandela Metropolitan University Earth Stewardship Science Research Institute (AEON-ESSRI) are carrying out a five-year study in to the Karoo Shale Gas Baseline, in parallel to the exploratory phase, with support from the Eastern Cape Government.³¹

Many oil and gas operators are seeking to flood the public debate with figures abusively promoting the economic benefits that this industry could bring to the South African economy. Shell for instance published a study in 2012 arguing that developing one tenth of South Africa's estimated resources could boost the economy by \$24.2 billion a year and create 700,000 jobs.³² Given that the shale gas industry on average creates no more than four jobs per well,³³ and that the US shale gas industry claims to have created 500,000 jobs,³⁴ with suggestions that even this figure could be exaggerated, it seems hardly credible that job creation in South Africa could be so extensive.

However, given South Africa's current dependence on coal, the Government is keen to push the development of shale gas, with the proviso that *"the overall environmental costs and benefits outweigh the current costs and benefits associated with South Africa's dependence on coal, or with the alternative of nuclear power."*³⁵

Environmental, ecological and social impacts

Conflicting mandates and regulatory capture

The Minister of Mineral Resources is responsible for granting or refusing permission for oil and gas activities, however, PASA is responsible for evaluating the applications and making recommendations to the Minister. PASA also evaluates and makes recommendations regarding the environmental management plans for proposals.³⁶ As the agency is also in charge of promoting oil and gas development, the process has been seriously criticised because of the conflict of interests.³⁷

There are also potential conflicts of interest between investments made by South Africa's ruling party, the ANC, and its role in decision-making. The ANC owns, through its Batho Batho trust, a major stake in Thebe Investments Ltd, which has a 25% interest in Shell's distribution, marketing and refining operations.³⁸ This has raised serious questions of whether or not all the decisions relating to Shell's operations in South Africa have been made without any self-interest.³⁹

Impacts on sensitive areas

Complex and worldwide unique geology South Africa is a water-scarce country, which depends on a few river basins with limited access to groundwater resources, some of which are already overexploited.⁴⁰ Agriculture plays an important part in South Africa's economy but depends on clean and available water resources.



Landscape near Nieu Bethesda in the Karoo.

© Jose Gil Paris, Stichting Schaliegasvrij

24 <http://sungusungugroup.com/divisions/sungu-sungu-gas/>

<http://www.tni.org/sites/www.tni.org/files/dfig64.pdf>

25 <http://www.sahra.org.za/sites/default/files/casedecisions/sahra%20letter%20PASA%20556%20FS%20june2013.pdf>

26 <http://www.treasurethekaroo.co.za/fracking-facts/applications-for-shale-gas-exploration>

27 <http://www.wallstreet-online.de/nachricht/7132468-south-african-exploration-licence-being-processed-by-petroleum-agency-sa>

28 <http://www.worldenergynews.com/news/shell-pushes-safrica-end-four-year-shale-gas-615728>

29 <http://frackingfreeireland.org/2014/10/29/the-karoo-press-release-and-time-frame-for-shale-gas-development/>

30 <http://s03.static-shell.com/content/dam/shell/static/zaf/downloads/media/karoo-groundwateratlas.pdf>

31 <http://www.karooshalegas.org/news/10053>

32 <http://uk.reuters.com/article/2012/09/07/safrica-gas-idUKL6E8K739020120907>

33 <http://www.sciencedirect.com/science/article/pii/S0140988311002878>

<https://pennbpc.org/sites/pennbpc.org/files/MSSRC-Employment-Impact-11-21-2013.pdf>

34 <https://www.uschamber.com/blog/shale-energy-supply-chain-supports-500000-jobs-more-growth-expected>

35 <http://www.npconline.co.za/medialib/downloads/home/NPC%20National%20Development%20Plan%20Vision%202030%20lo-res.pdf>

36 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

37 <http://www.tni.org/sites/www.tni.org/files/dfig64.pdf>

38 <http://www.shell.com/zaf/aboutshell/who-we-are/our-values-and-principles/bee/index-bak.html>

39 <https://milieudefensie.nl/publicaties/rapporten/shell-dont-frack-the-karoo>
<http://www.fin24.com/Economy/ANC-owns-major-stake-in-Thebe-20100503>

<http://thegreentimes.co.za/anc-trust-stands-to-gain-from-fracking/>

40 http://www.unepfi.org/fileadmin/publications/water/chief_liquidity1_South_Africa.pdf



ENVIRONMENTAL, ECOLOGICAL AND SOCIAL IMPACTS

Environmental, ecological and social impacts / conflicts very likely or already existing **Yes**

SOURCE(S) OF CONFLICTS

Source(s) of existing conflicts / previous incidents: Water scarcity and water use conflicts / Conflict with agriculture / Conflict of interest with regard to political players / Existing environmental impacts because of climate change and overexploitation of groundwater resources.

Source(s) of possible new/further conflicts: Water scarcity and conflicts over water use / Threat of water contamination, further highlighted through complex geology / Threat to transboundary aquifers / Increasing conflicts with agriculture / Conflict with Global Astronomical Project Square Kilometre Array Project / Conflict with unique worldwide biosphere / Conflict with valuable paleontological areas and national parks.

Demand for water already outstrips supply and is expected to grow in the next 10-20 years, with a predicted gap of 17% between demand and supply by 2030, equating to a water shortfall of 2.7 billion cubic metres. The government has said that an estimated R670 billion (€47.90 billion) needs to be invested in the country's water and sanitation infrastructure, but current budget allocations cover just 45% of the amount.⁴¹

The Karoo Basin is one of the world's large aquifer systems,⁴² providing an important transboundary water resource.⁴³ The Karoo Groundwater Expert Group, financially supported by Shell, found that 24% of the groundwater in the area of the Karoo studies is "highly vulnerable" and that approximately 55% of the area has been classified as very complex (analysis includes appearance of dolerite intrusions, faults and folded lithologies).⁴⁴

The unique "dolerite intrusions" found in the Karoo Basin have been described as a "a wild card" by scientists,⁴⁵ who believe they may create a preferential pathway for the fracking fluids, making the Karoo Basin particularly prone to the upward movement of pollutants connected to fracking. Researchers warn that "the chemical and hydrogeological impacts related to well field development cannot be ignored in the Karoo aquifer system, as it has the potential to directly influence human and environmental health".⁴⁶

Given the amount of fresh water needed for shale exploration and exploitation, and the location of shale resources in some of the driest parts of the country, the situation in South Africa poses a potential constraint on development. The mining sector in the country already faces water supply restrictions which do not guarantee sufficient water supply across the life of a mine.⁴⁷ It is likely that shale developments could face similar restrictions.

The Square Kilometre Array (SKA) project⁴⁸ There are also conflicts over land use above ground, with the Karoo desert set to become the home for a major international astronomical project, known as the Square Kilometre Array project (SKA), which aims to build the world's largest radio telescope, scheduled for construction between 2018 and the mid-2020s.⁴⁹

The project is considered to be of considerable importance for South Africa's economy and global prestige and regulations restricting prospecting and mining activities and harmful industrial processes have been introduced in "core astronomy advantage" areas (i.e. a 250 km radius zone around the telescope site). Fracking operations may seriously interfere with this project,⁵⁰ with large areas of Shell and Sungu Sungu's applications for exploration overlapping the core astronomy zone.⁵¹

Paleontological treasures, national parks and a proposed UNESCO world heritage site The Karoo Basin is also home to some of South Africa's most important fossils, according to a new National Fossil Sensitivity Map.⁵² Some of the areas targeted for shale gas development in the basin are highlighted as having significant paleontological potential,⁵³ including important fossils which reveal the evolutionary links between reptiles and mammals.⁵⁴ The South African Heritage Resources Agency is pushing for shale gas applicants to carry out Heritage Impact Assessments before drilling takes place.⁵⁵

41 <http://www.pmg.org.za/briefing/20130521-minister-water-and-environmental-affairs-2013-budget-speech-and-responses-anc-and-da>

42 http://www.whymap.org/whymap/EN/Downloads/Global_maps/whymap_largeaquifers_pdf.pdf?__blob=publicationFile&v=3

43 http://www.whymap.org/whymap/EN/Downloads/Continental_maps/gwrm_africa_pdf.pdf?__blob=publicationFile&v=2

44 http://gwd.org.za/sites/gwd.org.za/files/01_Peter%20Rosewarne_Recent%20Developments%20in%20the%20Understanding%20of%20Karoo%20Aquifers.pdf

45 http://gwd.org.za/sites/gwd.org.za/files/04_G%20vTonder_Potential%20%20Impacts%20of%20Fracking%20on%20Groundwater.pdf

46 http://gwd.org.za/sites/gwd.org.za/files/04_G%20vTonder_Potential%20%20Impacts%20of%20Fracking%20on%20Groundwater.pdf

47 <http://www.miningweekly.com/print-version/mining-sector-further-stressed-by-water-supply-restrictions-astronomical-demands-on-surrendering-of-water-licences-2012-11-23>

48 http://www.aerap.org/archivos_subidos/central_astronomy_advantage_area_south_africa.jpg

49 <https://www.skatelescope.org/project/>

50 <http://www.nortonrosefulbright.com/knowledge/publications/74157/potentially-astronomical-impact-of-the-astronomy-geographic-advantage-act>

51 <http://www.grafika24.com/wp-content/uploads/2012/09/ExplorationSA.jpg>

52 <http://www.sahra.org.za/about/news/sahra-has-released-version-2-south-african-fossil-sensitivity-map>

53 <http://www.sahra.org.za/map/palaeo>

54 <http://www.nasmus.co.za/departments/palaeontology/introduction>

55 <http://www.sahra.org.za/sites/default/files/casedecisions/sahra%20letter%20PASA%20556%20F5%20June2013.pdf>



The development in the targeted shale areas⁵⁶ in South Africa might also - either directly or through the construction of infrastructure - have an impact on some of the country's national parks, including the Karoo, Cambedoo, Mountain Zebra, Mokola and Golden Gate Highlands National Park,⁵⁷ which either partly or completely overlap the shale gas fields.⁵⁸

The Succulent Karoo biome is on UNESCO's list of potential World Heritage sites because of its "Outstanding Universal Value". It is an internationally recognised biodiversity hotspot, and the world's only arid hotspot, with exceptionally diverse and endemic rich flora, especially succulents and bulbs.⁵⁹

Disregarding indigenous people's rights? The Khoi-San, the indigenous inhabitants of Southern Africa may also be affected by the shale gas development plans in the Karoo. Under ILO 169⁶⁰, they should be consulted prior to the establishment of shale gas development projects, but South Africa has not ratified this Indigenous and Tribal Peoples Convention.⁶¹ However under South African law, landowners must also be notified and consulted before prospecting can go ahead (MPRDA, Chapter 2, Article 5 (4) c), but no consultation has taken place with the Khoi-San community, who are considering raising the issue with the UN. The head of the Khoi Inqua community told media: *"You will get a big no from us as Khoi people to fracking. You never even consulted us. We will ask to go before the United Nations, because this oil and gas business means we will never see our land again."*⁶²

Experts have also recognised that the early stages of developing the fracking industry are unlikely to bring much economic benefit for local people as specialists will be brought in from other countries. As a result, the impact on the local economy will be "slight".⁶³ Some companies also appear to be wary of the economic costs of exploration in the Karoo.⁶⁴



Anti-fracking in the Karoo mobilization. © Marilyn Lilley, TKAG.

OPPOSITION TO THE DEVELOPMENT

Opposition to the development of shale gas / oil

Yes

Opposition to the development of shale gas & oil

Anti-fracking activism in South Africa is considered to be significant while the political and security risks are considered to be moderate.⁶⁵

The Treasure the Karoo Action Group (TKAG) is among the most influential groups active against shale gas mining in South Africa. Run by volunteers, it works with scientists and legal experts,⁶⁶ and played a decisive role in establishing the fracking moratorium in South Africa from April 2011 to September 2012. South Africa's anti-fracking movement is growing and includes environmental groups and organisations such as Afriforum, Southern Cape Land Committee, Groundwork (Friends of the Earth South Africa), WWF, Greenpeace, the Wilderness Foundation, Endangered Wildlife Trust, African Conservation Trust, the indigenous Khoi-San community and a local billionaire, Johann Ruppert, who is chairman of the luxury goods company Richemont.⁶⁷

TKAG also made a successful complaint to the Advertising Standards Authority (ASA) in July 2011, resulting in an order that Shell withdraw "unsubstantiated" and "misleading" claims made about its use of hydraulic fracturing in its proposed shale gas exploration in the Karoo. The decision was described as *"a scathing rejection of further claims that there has never been a single documented case of groundwater contamination resulting from fracturing"*.⁶⁸

A public consultation on fracking was scheduled to begin in September 2014,⁶⁹ but TKAG has announced that it is taking legal action,⁷⁰ together with social rights group Afriforum,⁷¹ in the form of a written complaint to the Public Protector, whose role is to safeguard democracy. The complaint follows a request from TKAG President Jacob Zuma to reinstate the fracking moratorium because of *"unresolved issues in science and law that require proper action by our Government before fracking can be presented to South Africa as a fait accompli and an economic game-changer"*.⁷²

56 <http://assets.geoexpro.com/uploads/92d22cbe-b26c-41c4-bee7-09418a9a39a7/map.jpg>
 57 <http://www.safaribookings.com/images/maps/map-of-south-africa.jpg>
 58 <http://www.grafika24.com/wp-content/uploads/2012/09/ExplorationSA.jpg>
 59 <http://whc.unesco.org/en/tentativelists/5458/>
 60 http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C169
 61 http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C169
 62 <http://www.upstreamonline.com/hardcopy/features/article1348500.ece>
 63 <http://www.dmr.gov.za/publications/summary/182-report-on-hydraulic-fracturing/852-executive-summary-investigation-of-hydraulic-fracturing-in-the-karoo-basin-of-south-africa.html>
 64 <http://www.miningweekly.com/article/new-conventions-in-shale-gas-exploration-can-lead-to-capital-return-2014-08-22>

65 http://www.controlrisks.com/~media/Public%20Site/Files/Oversized%20Assets/shale_gas_whitepaper.pdf
 66 <http://newswatch.nationalgeographic.com/2013/05/13/south-african-anti-fracking-activist-calls-for-global-alliance/>
 67 E-mail correspondence with Jeanie le Roux from the TKAG
 68 <http://mg.co.za/article/2013-08-27-fracking-shell-south-african-shale-drive-riles-farmers>
 69 <http://www.sowetanlive.co.za/news/2011/07/07/shell-ordered-to-withdraw-misleading-ads>
 70 <http://www.timeslive.co.za/scitech/2014/08/27/public-consultation-on-fracking-to-begin-in-september>
 71 <http://www.treasurethekaroo.co.za/news/press-statements>
 72 <http://www.polity.org.za/article/anti-fracking-alliance-takes-fight-to-public-protector-2014-08-25>
 72 <http://www.treasurethekaroo.co.za/news/press-statements>



One of many anti-fracking protest posters. Nieu Bethesda, Karoo.
© Jose Gil Paris, Stichting Schaliegasvrij

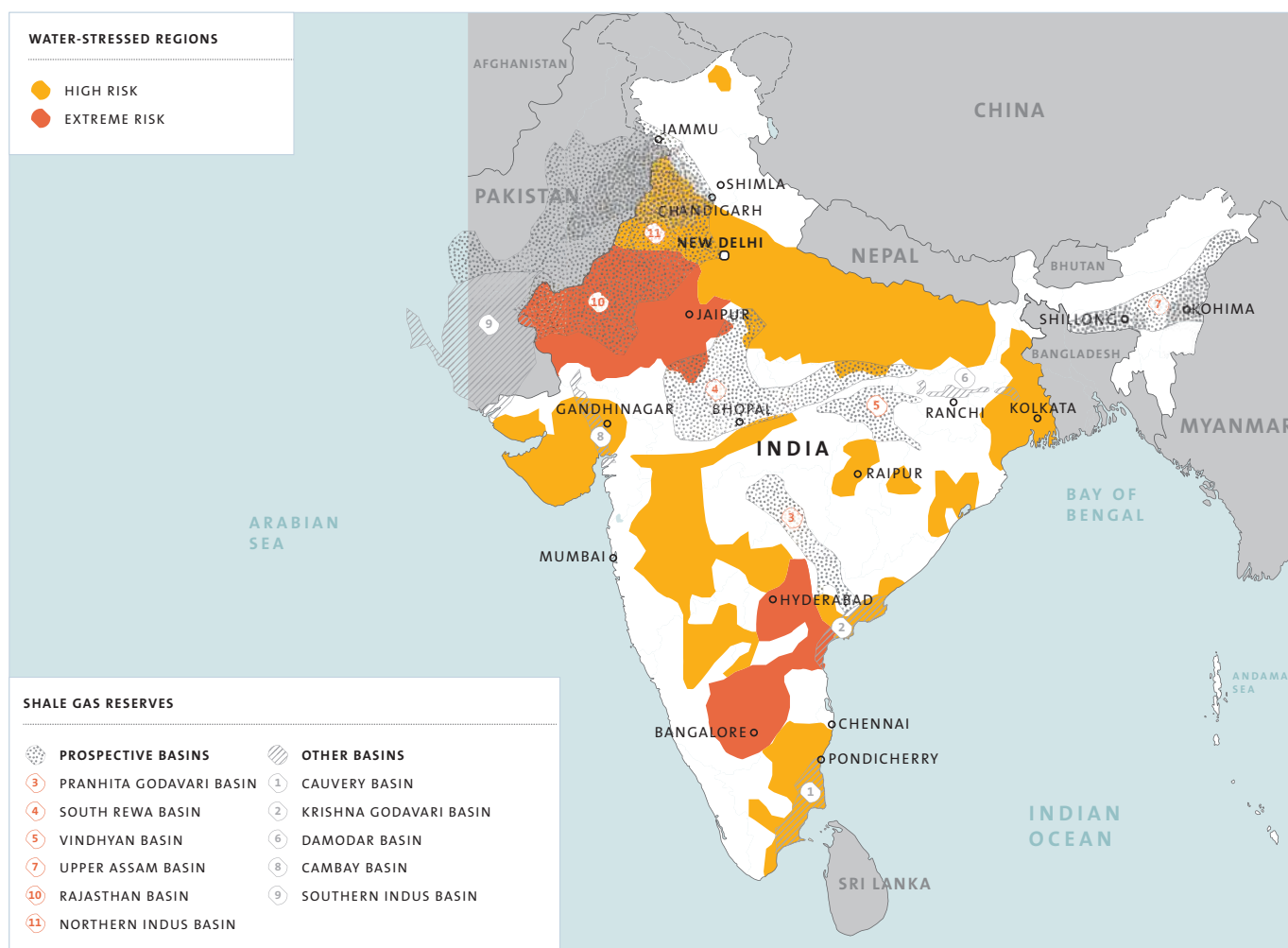


6

INDIA

India is the world's fourth largest energy consumer, but despite having conventional oil and gas resources, it is increasingly dependent on energy imports.¹ It also has considerable shale resources and is keen to develop these. However the industry has seen initial teething problems, including some as a result of the shortage of available water in parts of the country. There are also concerns about the security of drilling operations

INDIA SHALE GAS RESERVES & WATER-STRESSED REGIONS



Source: US EIA, Advanced Resources International, Maplecroft 2012.

TECHNICALLY RECOVERABLE RESOURCES

Technically recoverable resources ³	Shale gas (tcf)	Shale gas (bcm)	Shale oil (billion barrel)
	96	2,718	3.8
World ranking ⁴	Shale gas	Shale oil	
	18	18	

Technically recoverable resources & world ranking

The EIA estimates that India has some 96 tcf (2,718 bcm) of technically recoverable shale gas resources – equivalent to about 26 years of its gas demand² – and some 3.8 billion barrels of technically recoverable shale oil, putting India in 18th place in the world rankings for both oil and gas.

Targeted by UGTEP

India is listed as a UGTEP partner and is seen as “a strategic target for improved relations by the U.S. government”. “The US has had a special interest in for India’s geostrategic position since the George W. Bush administration, and this has included a strong focus on energy matters. The relationship has become even closer in recent years, with close cooperation over plans to develop shale: a Memorandum of Understanding (MoU) on shale

UGTEP - TARGETED BY / LISTED AS PARTNER⁵

Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP)	Yes

gas signed by the two governments in 2010. As a result of this agreement, the US Commercial Law Development Program (CLDP) led a two-day workshop on US-India cooperation on shale gas in November 2012.⁷ CLDP was invited to comment on India’s draft Shale Oil and Gas Policy, advising on a range of issues from foreign investment to exploration and production contracts.

Officials from India also made a week-long visit to the US to consider “regulatory and environmental issues associated with unconventional gas development”. The trip was organised through UGTEP and funded by USAID.⁸

The US-India Joint Fact Sheet on Sustainable Growth, Energy and Climate Change from June, 2013, highlights ongoing engagement around shale gas development, and refers to two grant agreements signed by the US Trade and Development Agency (USTDA) with Essar Oil Ltd. and Deep Industries Ltd. to search for shale deposits in India’s coal bed methane and conventional oil and gas licensed areas. UGTEP has also funded an assessment of India’s tight gas and shale oil resources.⁹



Collecting water in Rajasthan.
© Antoine Simon

- <http://www.eia.gov/countries/cab.cfm?fips=in>
- <http://www.thehindubusinessline.com/industry-and-economy/between-a-rock-and-a-hard-place/article5335576.ece>
- <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
- <http://www.eia.gov/analysis/studies/worldshalegas/>
- <http://www.state.gov/s/ciea/ugtep/>, <http://www.doi.gov/intl/itap/ugtep.cfm>
<http://www.eia.gov/analysis/studies/worldshalegas/#3>
- “Other U.S. government agencies that participate in the UGTEP include: the U.S. Department of Energy’s Office of Fossil Energy (DOE/FE); the U.S. Agency for International Development (USAID); the U.S. Department of Interior’s U.S. Geological Survey (USGS); U.S. Department of Interior’s Bureau of Ocean Energy Management (BOEM); the U.S. Department of Commerce’s Commercial Law Development Program (CLDP); and the U.S. Environmental Protection Agency (EPA). The U.S. Department of the Interior’s (DOI) International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops”
- http://cdp.doc.gov/publication/120824_Nakano_ProspectsShaleGas_Web.pdf
- <http://cloud.foeeurope.org/public.php?service=files&t=ea5d6ef8ca4029ee7a4e354f64831ffe>
- <http://www.state.gov/r/pa/prs/ps/2013/06/211017.htm>



MAIN COMPANIES INVOLVED¹⁰

NOC (National Oil/ Gas Companies)

ONGC Ltd. (Oil and Natural Gas Company),
OIL Ltd. (Oil India),
GAIL

IOC (International Oil/ Gas Companies)

Essar Oil Ltd.,
Schlumberger,
ConocoPhillips,
Reliance Industries

RESOURCE OWNERSHIP¹¹

State	Private	License required		Bidding procedure	
		Yes	No	Yes	No
X		X		X	

Resource ownership

According to Rule No. 5 (i) of the Petroleum and Natural Gas Rules, a licence or lease in respect of any land or mineral in Indian territory (on- and offshore) can be granted by the Central Government. Where a State Government has powers over certain lands, it can grant licences too, provided that the previous approval of the Central Government is given [Rule 5 (ii)]. Section 6 (1) of the Oilfields Regulation and Development Act gives the Central Government the power to make rules for the conservation and development of mineral oils (including natural gas).

New legislation & legal framework

The Petroleum Act, established in 1934, sets the framework for controlling the import, transport, storage, production, refining and blending of petroleum. Domestic exploration and production of oil and gas are regulated under the Petroleum and Natural Gas Rules of 1959.

In 1997/1998, a New Exploration Licensing Policy (NELP) was established, opening the Indian market for private companies. Before this, oil and gas exploration was primarily carried out by the state-owned Oil and Natural Gas Company Ltd (ONGC) and Oil India Ltd (OIL). Under NELP, India offers concessions through an open international competitive bidding procedure.

NEW LEGISLATION / LEGAL FRAMEWORK¹²

New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general	Yes	No	Date	Relevant legislation/tax incentives
	X		1934	The Petroleum Act
			1948	Oilfields Regulation and Development Act
			1959	Petroleum and Natural Gas Rule
			1997/1998	New Exploration Licensing Policy (NELP)
			2006	Petroleum and Natural Gas Regulatory Board Act
			2013	Policy on Shale Gas and Oil Exploration and Exploitation

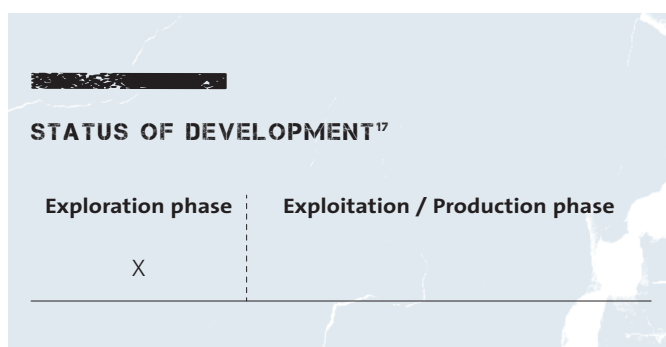
10 <http://www.ogj.com/1/vol-109/issue-49/drilling-production/india-starts-testing-full.html>
<http://www.thehindu.com/business/Industry/shale-gas-ongc-to-drill-more-wells-in-cambay/article5526061.ece>
http://www.steelguru.com/indian_news/Essar_Energy_to_lead_shale_gas_exploration_business_in_India/347450.html
<http://www.naturalgasasia.com/obgc-likely-to-start-commercial-shale-drilling-next-year-13390>
<http://www.naturalgasasia.com/indias-reliance-plans-2-bn-investment-in-its-us-shale-assets-13280>

11 <http://www.manupatrafast.com/articles/PopOpenArticle.aspx?ID=3b9928f3-1807-4916-b783-33b3c38992db&txtsearch=Subject:%20Oil%20And%20Gas>
<http://petroleum.nic.in/pngrules.pdf>, <http://petroleum.nic.in/ordact.pdf>
 12 <http://www.manupatrafast.com/articles/PopOpenArticle.aspx?ID=3b9928f3-1807-4916-b783-33b3c38992db&txtsearch=Subject:%20Oil%20And%20Gas>
<http://petroleum.nic.in/ordact.pdf>
<http://petroleum.nic.in/pngrules.pdf>

The Indian Directorate General of Hydrocarbons is responsible for the NELP tender procedures, granting Production Sharing Contracts between the Government of India and state-owned or private companies. According to Rule 10 of the Petroleum and Natural Gas Rules an exploration license is valid for a period of four years (with possible extensions). But according to Article 3.1 of the Model of Production Sharing Contract for the 8th round of NELP,¹³ exploration contracts can be granted for up to seven years. If no commercial discovery has been made by the end of the exploration period, the contract will be terminated (Article 3.8). A mining lease for the exploitation is granted for an initial period of 20 years (Article 11.5), with possible extensions for 5 - 10 years (Article 11.5 b). However, the Model of the Production Sharing Contract explicitly excludes the exploration and exploitation of coal bed methane. It is questionable if the terms will apply to unconventional fossil fuels at all.

In 2006, the government established the Petroleum and Natural Gas Regulatory Board with a remit to protect the interests of consumers and those engaged in oil and gas activities and promote competitive markets for oil and gas activities.

In September 2013, the Indian Cabinet Committee on Economic Affairs approved a special policy on exploration and exploitation of shale gas and oil. The new policy allows companies to apply – without a bidding procedure – to explore and exploit shale gas and oil in blocks or fields where they already hold a licence for conventional hydrocarbons. Companies have the right to assess their fields for shale gas and oil in three phases for a maximum period of three years each.¹⁴ This will effectively restrict shale gas and oil exploration to five onshore basins (Cambay, Krishna-Godavari, Cauvery, Assam-Arakan and Damodar). Since ONGC and Oil India are already active in 176 blocks in these basins, the policy gives the state-owned companies a clear advantage with regard to shale gas and oil development.¹⁵



Status of development

India's first attempt to drill for shale gas was carried out in September 2010 by ONGC with the help of Schlumberger in Ichapur village, near Durgapur, West Bengal. The well was shut down later the same month due to casing failures, high water-cut production and high surface pressure.¹⁶

The first successful Indian shale gas exploratory well was drilled in October 2013 near Jambusar in the Cambay basin. ONGC has reportedly so far spent some Rs 2,000 crore (€257 million) per annum on the exploration of oil and gas in the region and plans to drill a further 30 shale gas exploratory wells across the country by 2014-15, in partnership with the US company ConocoPhillips, at a cost of Rs 600 crore (€77 million).¹⁷ ONGC wants to explore the Krishna-Godavari, Cauvery and Vindhyan basins for shale gas in the near future¹⁸, and hopes to start commercial drilling in 2015.¹⁹



A flare stack burning off excess gas at the Mathura Refinery near Agra, India.
© Sundeep/Shutterstock

13 <http://www.buylawsindia.com/NELP8%20MPSC.pdf>

14 <http://www.ogj.com/articles/2013/09/india-approves-policy-on-shale-gas-oil.html>

15 http://articles.economictimes.indiatimes.com/2013-09-25/news/42362315_1_shale-recoourses-conventional-oil-and-gas-gas-exploration

16 <http://www.ogj.com/articles/print/volume-109/issue-49/drilling-production/india-starts-testing-p1.html>

17 <http://www.thehindu.com/business/Industry/shale-gas-ongc-to-drill-more-wells-in-cambay/article5526061.ece>

18 <http://www.thehindu.com/business/Industry/shale-gas-ongc-to-drill-more-wells-in-cambay/article5526061.ece>

19 <http://www.naturalgasasia.com/obgc-likely-to-start-commercial-shale-drilling-next-year-13390>



ONGC and Oil India are also reported to have identified some 56 potential shale gas blocks for exploration in Uttar Pradesh²⁰, Assam (7 blocks), Arunachal Pradesh (1 block), Gujarat (28 blocks), Rajasthan (1 block), Andhra Pradesh (10 blocks) and Tamil Nadu (9 blocks).²¹

The international company Essar Energy, is also interested in developing shale in India and has received USDA grants in order to conduct shale gas studies. The company wants a licence to explore shale gas blocks in the Gondwana region, where it already has coal bed methane concessions. Essar Energy is also pushing for a review of India's gas price by the Indian Government, arguing that a price of around US\$ 8 per million units (Btu) would make shale gas viable.²²

Indian companies are also keen to invest in US shale assets. Reliance Industries Ltd. (RIL), one of India's biggest private companies, has invested some US\$ 7.3 billion in US shale and oil business since 2010, including joint ventures with Chevron, Pioneer and Carrizo in the Marcellus and Eagle Ford Shale fields.²³ RIL reportedly plans to invest a further US\$ 2 billion in its US shale gas assets.²⁴

The state-owned gas pipeline company, GAIL, is also seeking to invest US\$ 500-700 million in US shale assets and some conventional hydrocarbon projects in Africa.²⁵ The company already holds a 20% stake in Houston-based Carrizo Oil and Gas' Eagle Shale Ford worth US\$ 95 million.²⁶ In 2013, GAIL signed a 20-year agreement to import US gas.²⁷

It has been reported that India is seeking a big gas deal with the US to strengthen the existing special arrangement with GAIL allowing the US to export its surplus shale gas to India.²⁸ In September 2014, Dominion Resources Inc. received the approval of the US Federal Energy Regulatory Commission to export liquefied natural gas worldwide from the Cove Point terminal in Maryland.²⁹ GAIL is also in talks to buy a further 2-2.5 million tonnes of LNG (on top of already contracted 3.5 million tonnes),³⁰ but Indian government plans to build their own carriers to ship the gas are struggling because shipbuilders in South Korea and Japan are reluctant to share their technology with Indian ship yards.³¹ Falling oil prices (a 26% price slide since June 2014) are also threatening the attractiveness of US exports of LNG.³²

While India is keen to import shale gas to meet its energy demands, it also benefits from the arrangement by exporting guar gum to the US for use in the fracking process. The gum, which is used to improve the viscosity and the flow of water, is extracted from the "guar ki phalli" plant, grown by farmers on arid lands in Rajasthan and Haryana. India's Energy and Resources Institute (TERI) estimates that the production of guar gum for the fracking industry earned almost US\$ 5 billion from April 2012 - January 2013.³³

ENVIRONMENTAL, ECOLOGICAL AND SOCIAL IMPACTS

Environmental, ecological and social impacts / conflicts very likely or already existing	Yes
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SOURCE(S) OF CONFLICTS

Source(s) of existing conflicts / incidents:	Water scarcity to high water stress / Water pollution / Land use conflict (competition with farmland).
Source(s) of new/ further possible conflicts:	Water scarcity to high water stress / Further water pollution / Increase of greenhouse emissions through methane leakages / Threat of deforestation and/or negative impact on sensitive areas / Earthquakes.



Rajasthan landscape.
© Antoine Simon

- 20 <http://www.thehindubusinessline.com/industry-and-economy/between-a-rock-and-a-hard-place/article5335576.ece>
- 21 <http://www.naturalgasasia.com/obgc-likely-to-start-commercial-shale-drilling-next-year-13390>
- 22 http://www.steelguru.com/sftCPDF/getPDF/MzQ3NDUw/Essar_Energy_to_lead_shale_gas_exploration_business_in_India.html
- 23 http://www.steelguru.com/indian_news/Essar_Energy_to_lead_shale_gas_exploration_business_in_India/347450.html
- 24 <http://www.naturalgasasia.com/indias-reliance-plans-2-bn-investment-in-its-us-shale-assets-13280>
- 25 <http://www.livemint.com/Companies/1ZGLXJjKJeMfoS8VEygptK/RIL-plans-to-invest-2-billion-in-US-shale-gas-assets.html>
- 26 <http://www.financialexpress.com/news/securing-supply-behind-gail-s-shale-gas-push/1249796/0>
- 27 <http://www.financialexpress.com/news/securing-supply-behind-gail-s-shale-gas-push/1249796/0>
- 28 http://www.telegraphindia.com/1140804/jsp/business/story_18684449.jsp#VGTzmcmaoay
- 29 <http://www.bloomberg.com/news/2014-09-30/u-s-gas-boom-turns-global-as-lng-exports-set-to-shake-up-market.html>
- 30 <http://www.thehindubusinessline.com/companies/hurdles-cleared-for-gail-to-import-lng-from-us/article6466410.ece>
- 31 http://www.business-standard.com/article/pti-stories/gail-in-talks-to-buy-2-2-5-mt-lng-from-us-114100100824_1.html
- 32 <http://www.livemint.com/Industry/VfVtERi6Pv912jg8xKMxM/Indias-LNG-shipbuilding-plans-turn-uncertain.html>
- 33 <http://www.reuters.com/article/2014/10/21/oil-price-Ing-idUSL6N05948BP20141021>
- 34 http://www.teriin.org/policybrief/docs/Shale_gas.pdf

Environmental, ecological and social impacts

Water scarcity and water crisis

India is the world's second most populated country and its growing demand for water means that it is likely to face a gap of some 50% between existing supply and projected demand in 2030.³⁴ Water has been described as *"intricately intertwined with the cultural fabric of the country, which means that it has economic and social connotations"*.³⁵

According to TERI, *"potential shale gas bearing areas, such as Cambay, Gondwana, Krishna-Godavari, and the Indo-Gangetic plains are also areas that will experience severe water stress by 2030"*. The institute has also highlighted potential conflicts over land as a result of fracking,³⁶ with land already under pressure from other demands in the affected areas.³⁷

Water quality is also an issue in India, with many water sources contaminated by bio and chemical pollutants.³⁸ The Indian Ministry of the Environment has raised concerns that the exploitation of shale resources could lead to a water crisis in the country.³⁹

Affecting sensitive areas

The development of shale gas and oil in the proposed prospective basins,⁴⁰ including the construction of the related infrastructure, could affect a number of wildlife sanctuaries and national parks in the country, threatening their unique biodiversity.⁴¹

Threat of induced earthquakes

India is situated at the intersection between two very active plates (the Indo-Australian plate and the Eurasian plate) whose collision has created the Himalayas. As this convergence is still ongoing, it places India at the heart of a highly earthquake-prone region, which raises serious question about the risks taken by allowing fracking operations in the region. The licences granted in Uttar Pradesh (North), Assam and Arunachal Pradesh (North East) are located at the foot of the Himalayas. Gujarat, situated on the border with Pakistan⁴², is considered to be one of the most earthquake-prone regions of the country.⁴³

The fracking experience in the US, which reveals a long record of induced earth tremors up to more than five on the Richter scale, including in seismically inactive regions⁴⁴, raises concerns about the wisdom of allowing fracking operations and particularly the re-injection of waste water in some of the most earthquake-intensive regions of the world.



Opposition to the development of shale gas & oil

Although there is little, if any, evidence of anti-fracking activities in India, the global assessment warns that "community activism has long been a major operational risk concern for business" in India and that *"one of the main concerns is land access in heavily populated basins, a routine source of community tensions and protests because of policies of 'forcible acquisition' and inadequate compensation"*.⁴⁵

Protests over land conflicts have previously turned violent, with more than a dozen people killed following protests against the appropriation of agricultural land in West Bengal in 2007.⁴⁶ The Chairman and Managing Director of ONGC is reported to have highlighted the risk of resistance from local people to the Bengal Chamber of Commerce and Industry in 2013 in a speech about shale gas potential in the Damodar basin. He also warned that access to water presented a great challenge.⁴⁷ Drill sites need to be protected by security personnel because of the risk of theft of equipment.⁴⁸

Other challenges include a lack of skilled engineers, and a lack of detailed knowledge of the field among developers, the population density, and uncertainty created by local politics.⁴⁹

34 http://www.unicef.org/india/Final_Report.pdf

35 http://www.unicef.org/india/Final_Report.pdf

36 http://www.teriin.org/policybrief/docs/Shale_gas.pdf

37 <http://www.voanews.com/content/india-witnesses-growing-conflict-over-land-101293609/124357.html>

38 <http://thewaterproject.org/water-in-crisis-india>

39 http://articles.economictimes.indiatimes.com/2013-09-25/news/42362315_1_shale-recourses-conventional-oil-and-gas-gas-exploration

40 <http://3.bp.blogspot.com/-Dbn3ws-SmLg/TdE0Sbm8cgI/AAAAAABIIY/7EvUafPfvZc/s1600/india+shale+gas+basins+eia.jpg>

41 <http://www.vimlapatil.com/vimlablog/wp-content/uploads/2012/05/1.-Sanctuaries-Map-of-India-showing-sanctuaries-and-national-parks2.gif>
<http://www.kolkatabirds.com/hotspotmap8kb.jpg>

42 <http://www.thehindubusinessline.com/industry-and-economy/between-a-rock-and-a-hard-place/article5335576.ece>

43 <http://www.iitk.ac.in/nicee/EQTips/EQTIP04.pdf>

44 <http://pubs.er.usgs.gov/publication/70126809>

45 http://www.controlrisks.com/~media/Public%20Site/Files/Oversized%20Assets/shale_gas_whitepaper.pdf

46 http://csis.org/files/publication/120824_Nakano_ProspectsShaleGas_Web.pdf

47 http://www.teriin.org/policybrief/docs/Shale_gas.pdf

48 <http://www.ogj.com/1/vol-109/issue-49/drilling-production/india-starts-testing-full.html>

49 <http://www.ogj.com/1/vol-109/issue-49/drilling-production/india-starts-testing-full.html>

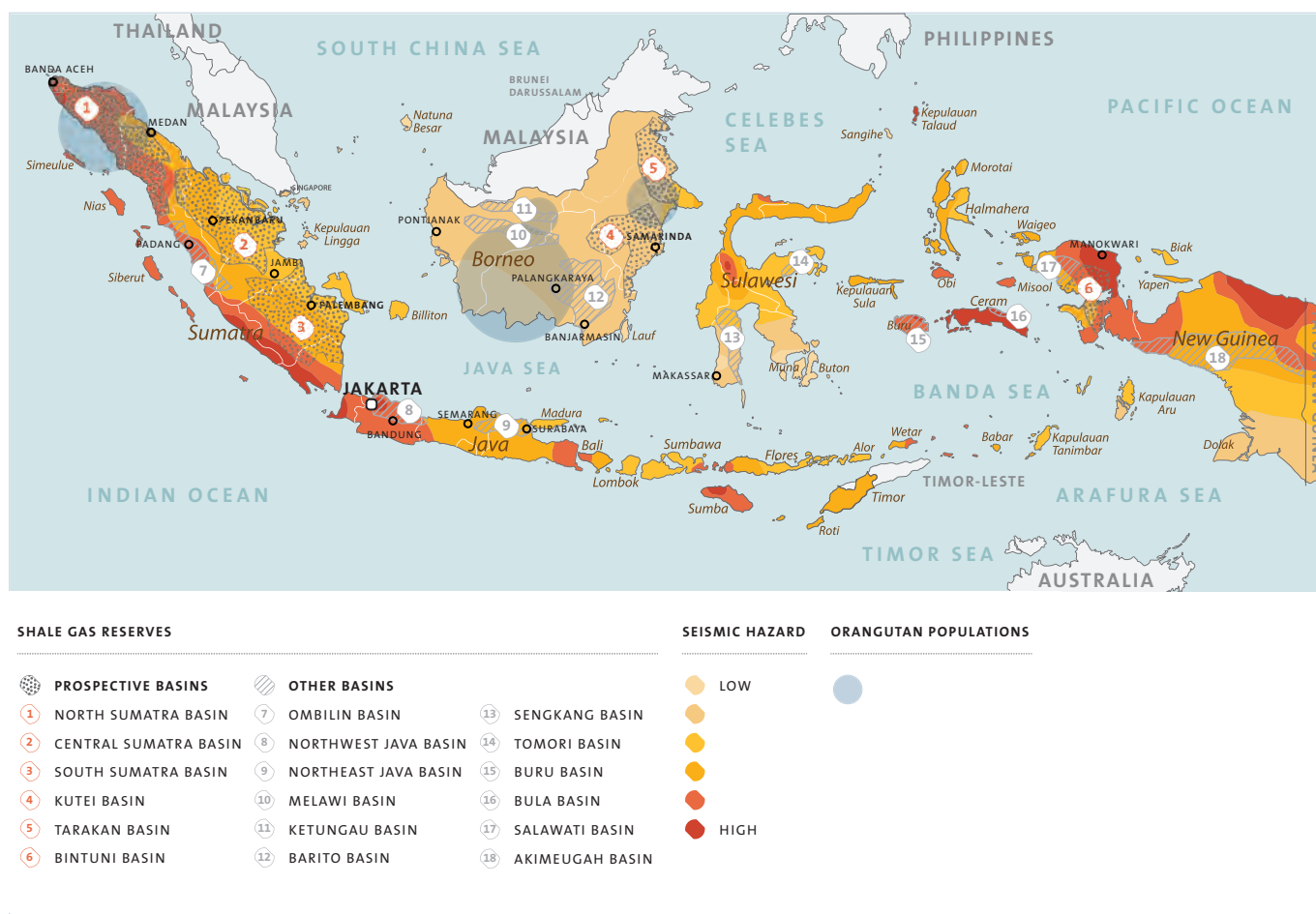


7

INDONESIA

Indonesia is a major producer of conventional fossil fuels and has significant estimated reserves of shale oil and gas, as well as coal-bed methane. Development of these shale resources remains in its infancy, with the government prioritising the development of coal-bed methane. There are significant reasons for concern over the development of fracking in Indonesia, given the high risks of earthquakes in the country, and there are also concerns about the impacts on the country's valuable rainforests.

INDONESIA SHALE GAS RESERVES & WATER STRESS REGIONS



Sources: Indonesia Geological Agency, 2011, US EIA, 2013, USGS, Revue de primatologie.

TECHNICALLY RECOVERABLE RESOURCES

Technically recoverable resources²

	Shale gas		Shale oil	
	(tcf)	(bcm)	(billion barrel)	
	US EIA	Indonesian gvt	US EIA	Indonesian gvt
	46	574	1,303	16,254
				7.9

World ranking³

	Shale gas		Shale oil	
	US EIA	Indonesian gvt		
	23	26		11

Technically recoverable resources & world ranking

According to the EIA, Indonesia has an estimated 46 tcf (1,303 bcm) of shale gas and 7.9 billion barrels of shale oil, putting the country 23rd in the global ranking for shale gas and 11th for shale oil. The Indonesian Government has however claimed that the country has 574 tcf (16,254 bcm) of shale gas reserves¹, which would place the country 6th in the globally.

According to the definition given by the EIA, reserves refer to deposits that are proven and readily producible, and so are a subset of the technically recoverable resource estimate. Since exploration for shale gas and oil is only just getting underway in Indonesia, there are questions about the reliability of the figure given by the EIA, let alone the higher estimate given by the government.

Targeted by UGTEP

Indonesia is listed as a UGTEP partner and is one of the countries which— appears to make considerable use of the programme. In May 2013, UGTEP organised a Regional Workshop in the Indonesian capital, Jakarta, hosted by the US Department of State with the Indonesian Ministry of Energy and Mineral Resources. The event attracted participants from the Association of Southeast Asian Nations (ASEAN), the Asia-Pacific Economic Cooperation (APEC), USAID and the US Department of the Interior.⁵

Indonesia is likely to also make use of the UGTEP funds available to support bilateral and regional engagement, including visits, briefings and workshops concerning regulatory or technical aspects.⁶

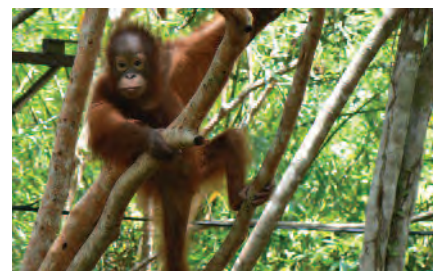
UGTEP - TARGETED BY / LISTED AS PARTNER⁴

Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP)

Yes

Orangutan in the rehabilitation centre of International Animal Rescue (IAR).

© Friends of the Earth, Anouk van Baalen



- <http://www.esdm.go.id/news-archives/oil-and-gas/47-oilandgas/6727--non-conventional-oil-and-gas-reserves-reached-1037-tcf.html>
 - <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
 - <http://www.esdm.go.id/news-archives/oil-and-gas/47-oilandgas/6727--non-conventional-oil-and-gas-reserves-reached-1037-tcf.html>
 - <http://www.eia.gov/analysis/studies/worldshalegas/>
 - <http://www.state.gov/s/ciea/ugtep/>
 - <http://www.doi.gov/intl/itap/ugtep.cfm>
 - <http://www.eia.gov/analysis/studies/worldshalegas/#3>
- "Other U.S. government agencies that participate in the UGTEP include: the U.S. Department of Energy's Office of Fossil Energy (DOE/FE); the U.S. Agency for International Development (USAID); the U.S. Department of Interior's U.S. Geological Survey (USGS); U.S. Department of Interior's Bureau of Ocean Energy Management (BOEM); the U.S. Department of Commerce's Commercial Law Development Program (CLDP); and the U.S. Environmental Protection Agency (EPA). The U.S. Department of the Interior's (DOI) International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops"
- <http://www.doi.gov/intl/itap/ugtep-jakarta.cfm#>
 - http://www.securityassistance.org/sites/default/files/FY2015_CBJ.pdf



MAIN COMPANIES INVOLVED⁷

NOC (National Oil/ Gas Companies)

Pertamina

IOC (International Oil/ Gas Companies)

Bukit Energy Inc., New Zealand Oil & Gas (NZOG), Pacific Oil & Gas Ltd, Talisman Energy Inc., Lion Energy Ltd.

RESOURCE OWNERSHIP⁹

State	Private	License required		Bidding procedure	
		Yes	No	Yes	No
X		X		X	

Resource ownership

Under Indonesian Law No. 22/2001, petroleum and natural gas are controlled by the state and, as non-renewable strategic natural resources, they must be exploited in such a way as to provide the maximum benefit to the people of Indonesia's prosperity and welfare. According to Article 1 of the Presidential Regulation No. 9 (March 2013), the role of the Minister of Energy and Mineral Resources is to provide *"guidance, coordinate and supervise the implementation of management of natural oil and gas upstream business activities"*.⁸

In order to explore and/or exploit oil or gas resources, a company has to sign a production-sharing contract (PSC) with the Indonesian Government. Sometimes, preliminary joint studies may be carried out before the actual bidding procedures for the PSCs. During this process, oil and gas companies work with the government to gather data on possible exploration areas.¹⁰

New legislation & legal framework

According to the Petroleum Law (No. 22/2001), the Indonesian Government holds the rights for oil and gas exploration and exploitation, but can grant these to a company through a production-sharing contract (PSC), which is signed by the Minister of Energy and Mineral Resources.

Production-sharing contracts grant exclusive development rights (exploration and exploitation) to the company for up to 30 years. The oil and gas extracted is shared between the company and the government, under the terms agreed in the PSC, which can be extended for up to further 20 years. The exploration phase is contracted to last six years and may be extended by a maximum of four further years.

NEW LEGISLATION / LEGAL FRAMEWORK¹¹

New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general

Yes	No	Date	Relevant legislation
X		November 2001	Law No. 22/2001 (Petroleum and Natural Gas Law)
		January 2012	
		March 2013	Regulation No. 5/2012 on Procedures and Steps for Offering Non-Conventional Working Areas
			Regulation No. 9 (Presidential Regulation)

7 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
https://www.rigzone.com/news/oil_gas/a/131234/Lion_Energy_Moves_into_Indonesias_Unconventional_Oil_Gas_Industry/?all=HG2
http://business.financialpost.com/2013/05/17/pertamina-looks-to-talismans-expertise-in-indonesian-shale-gas-block/?__lsa=70a8-062b
<http://af.reuters.com/article/energyOilNews/idAFL4N0P43L920140623>
8 http://www.ipa.or.id/download/report/Presidential_Regulation_No_9_Year_2013_re-Implementatin_of_Management_of_national_oil_gas_upstream_business_activites_31.pdf

9 http://www.ipa.or.id/download/report/law_petroleum_natural_gas_4.pdf
http://www.ssek.com/download/document/indonesia_legal_review_2013-14_web_86.pdf
10 http://www.rigzone.com/news/oil_gas/a/133248/Indonesia_Offers_21_Conventional_And_Shale_Oil_And_Gas_Blocks
11 http://www.ipa.or.id/report.php?page_id=11&page_category_id=3&event_category_id_send=0&report_category_id_send=2&news_category_id_send=0
<http://www.doi.gov/intl/itap/upload/Session-03-03-Policy-2nd-day-RI-USA-Mr-Darwin-2013-ok.pdf>
http://www.ssek.com/download/document/indonesia_legal_review_2013-14_web_86.pdf

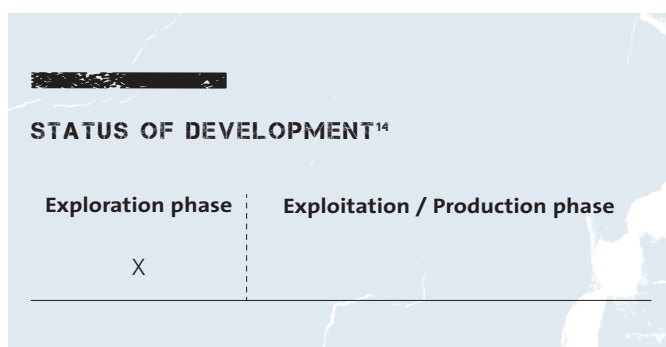
Regulation No 05/2012 provides an extra legal framework with regard to the PSC's tender procedures for the exploration and exploitation of unconventional resources, including shale gas and shale oil, tight gas and coal bed methane, extracted by using fracking.¹² Existing oil, gas, and coal bed methane concessions are given first priority during the tender procedures for new shale gas development sites.¹³

Status of development

A former member of OPEC,¹⁵ Indonesia is an important producer of coal, oil and natural gas, but production rates are declining while domestic consumption and demand are growing. Currently the world's third largest exporter of liquefied natural gas, Indonesia is predicted to be importing fuel by 2018 to meet increasing domestic demand.¹⁶ The government is therefore keen to develop its shale resources, although its main current focus is on the coal bed methane and the shale gas industry has been described as being "still in its infancy".¹⁷

According to the EIA, the greatest potential for shale gas and oil is in Central and South Sumatra, and in the Kutei and Tarakan basins in Kalimantan. The Central Sumatra basin, an existing hot spot for conventional fossil fuels (mainly oil), promises to also have the best shale resources as well. It is estimated to have 3.3 tcf of technically recoverable shale gas and 2.8 billion barrels of shale oil.

In March 2012, Indonesia's Ministry of Energy and Mineral Resources gave permission for four joint studies on the shale gas potential in a 5,000 km² area of the Central Sumatra basin. Canadian Bukit Energy Inc. and New Zealand Oil & Gas are among the companies evaluating the site.



The state-owned oil company Pertamina, signed the first PSC for unconventional oil and gas in 2013, announcing that it intended to spend more than US\$ 28 million over the next three years in order to kick-start exploration in the Sumbagut shale gas block in North Sumatra. The exploration phase is expected to last six years, with production starting immediately after. Pertamina wants to partner with the Canadian company Talisman Energy for the project, which will cost an estimated US\$ 8 billion over 30 years.¹⁸

The Australian company, Lion Energy Ltd. announced in 2014 that it has secured the rights to carry out four joint studies for shale oil and gas in North and Central Sumatra, covering a total area of 17,000 km².¹⁹ The government also started bidding procedures for 21 conventional and unconventional oil and gas blocks in 2014, eight of which are for shale development.²⁰

A second concession was awarded to a consortium of New Zealand Oil & Gas Ltd., Pacific Oil and Gas Ltd. (Hong Kong) and Bukit Energy (Canada) in June 2014, with initial expenditure of more than \$11.5 million for geological studies, seismic surveys and at least one exploration well.²¹

More than 50 PSCs were signed for the development of coal bed methane between 2008 and 2013,²² but questions remain about the economic feasibility of developing shale gas.



Drilling rig working in Indonesia.
© Ribeiroantonio/Dreamstime

12 <http://www.lionenergy.com.au/irm/content/unconventional-joint-study-applications.aspx?RID=308>
13 <http://www.doi.gov/intl/itap/upload/Session-03-03-Policy-2nd-day-RI-USA-Mr-Darwin-2013-ok.pdf>
14 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
15 <http://www.ft.com/cms/s/0/d0e346fe-2c87-11dd-88c6-000077b07658.html#axzz3Ce3NIY2m>
16 <http://www.bloomberg.com/news/2013-03-06/indonesia-to-import-lng-by-2018-as-demand-rises-regulator-says.html>

17 <http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/shale-gas/Documents/shale-development-global-update.pdf>
18 <http://www.energy-pedia.com/news/indonesia/new-154695>
19 <http://www.lionenergy.com.au/irm/content/unconventional-joint-study-applications.aspx?RID=308>
20 https://www.rigzone.com/news/oil_gas/a/131234/Lion_Energy_Moves_into_Indonesias_Unconventional_Oil_Gas_Industry/?all=HG2
21 <http://af.reuters.com/article/energyOilNews/idAFL3N00931B20140523>
22 <http://af.reuters.com/article/energyOilNews/idAFL4N0P43L920140623>
23 <http://www.doi.gov/intl/itap/upload/Session-03-03-Policy-2nd-day-RI-USA-Mr-Darwin-2013-ok.pdf>



Environmental, ecological and social impacts

Threat of further deforestation and loss of precious habitats for endangered species:

Indonesia has already the 2nd highest deforestation rate worldwide, with 70% of land in Sumatra converted from forest between 1990 and 2010.²³ Deforestation is the second largest source of man-made greenhouse gas emissions worldwide, after fossil fuel combustion.²⁴

A number of Indonesia's potential shale gas basins²⁵ overlap with areas of forest which are already put under serious environmental pressure. Considering how land-intensive the shale oil, gas and coal bed methane industry can be, any potential large-scale development is likely to result in further deforestation, not least because of the need to develop new infrastructure for the industry. This would exacerbate the situation for species such as the Sumatran and Bornean orangutans which are already in danger.²⁶

According to the IUCN Red List of endangered species, the Sumatran orangutan is critically endangered, suffering from an estimated population decline of 80% over the last 75 years.²⁷ The Bornean orangutan (found on Kalimantan) is classified as endangered, with an estimated population decline of 50% over the last 60 years.²⁸

Threat of inducing earthquakes with significant consequences

In May 2006, a major eruption of mud led to a large mudflow, triggered by oil exploration in the Sidoarjo District of East Java province, Indonesia. The on-going eruption buried 12 villages and forced some 40,000 people to relocate, with the mud expected to continue flowing for up to 30 years.²⁹

The exact cause of the eruption is disputed, with debates focused on whether there was a drilling problem, causing hydro-fracturing of the formation, or whether it was due to fault reactivation (indicating a natural event) or a geothermal process.³⁰

According to the EIA, 50-90% of the faults in the South Sumatran basin are potentially active, which means the area is prone to earthquakes, which could be triggered by hydraulic fracturing or the injection of waste water from oil and gas operations on a large scale.³¹ A recent study showed that earthquakes of up to a magnitude of 5.7 on the Richter Scale could be triggered as a result.³² This raises serious concerns about the consequences of the potential development of this industry in the country.

ENVIRONMENTAL, ECOLOGICAL AND SOCIAL IMPACTS

Environmental, ecological and social impacts / conflicts very likely or already existing Yes

SOURCE(S) OF CONFLICTS

Source(s) of existing conflicts / incidents: Deforestation of primary forests / Endangerment of orangutan population / Sidoarjo mud flow / earthquake-prone region.

Source(s) of new/ further possible conflicts: Further deforestation of primary forests / Further endangerment of orangutan population / earthquakes.

- 23 <http://iopscience.iop.org/1748-9326/7/3/034010>
http://ej.iop.org/images/1748-9326/7/3/034010/Full/erl428965f4_online.jpg
- 24 http://iopscience.iop.org/1748-9326/7/3/034010/pdf/1748-9326_7_3_034010.pdf
- 25 <http://www.doi.gov/intl/itap/upload/Session-01-02-Unconventional-Oil-and-Gas-Potential-GA-edited-OA-06Mei2013.pdf>
- 26 <http://www.biomedcentral.com/content/figures/1471-2164-15-16-1-l.jpg>
<http://www.sumatranorangutan.org/wp-content/uploads/2013/07/project-site-SOCP3-860x1024.jpg>
- 27 <http://www.iucnredlist.org/details/39780/0>
- 28 <http://www.iucnredlist.org/details/17975/0>
- 29 <http://www.jahss.org/2012/papers/2-A-4.pdf>
- 30 http://en.wikipedia.org/wiki/Sidoarjo_mud_flow
- 31 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
- 32 http://therealnews.com/t2/index.php?option=com_content&task=view&id=31&Itemid=74&jumival=11413
<http://www.ibtimes.com/ohio-says-fracking-caused-earthquakes-will-require-drilling-companies-monitor-seismic-1571443>

Opposition to the development of shale gas & oil

While civil society activism is strong in the country, (notably with an existing anti-mining network, JATAM, which protested about the Sidoarjo/Lapindo mud flow)³³, there does not seem to be any active anti-fracking movement in the country at the moment.

OPPOSITION TO THE DEVELOPMENT

Opposition to the development
of shale gas / oil

Unclear



The Sidoarjo mud flow or Lapindo mud is the result of an erupting mud volcano in East Java, Indonesia that has been in eruption since May 2006. Responsibility for it was credited to the blowout of a natural gas well drilled by PT Lapindo Brantas.

© Hugh e82/wikipedia

33 <http://www.wdm.org.uk/fossil-fuels/report-lapindo-mud-flow>

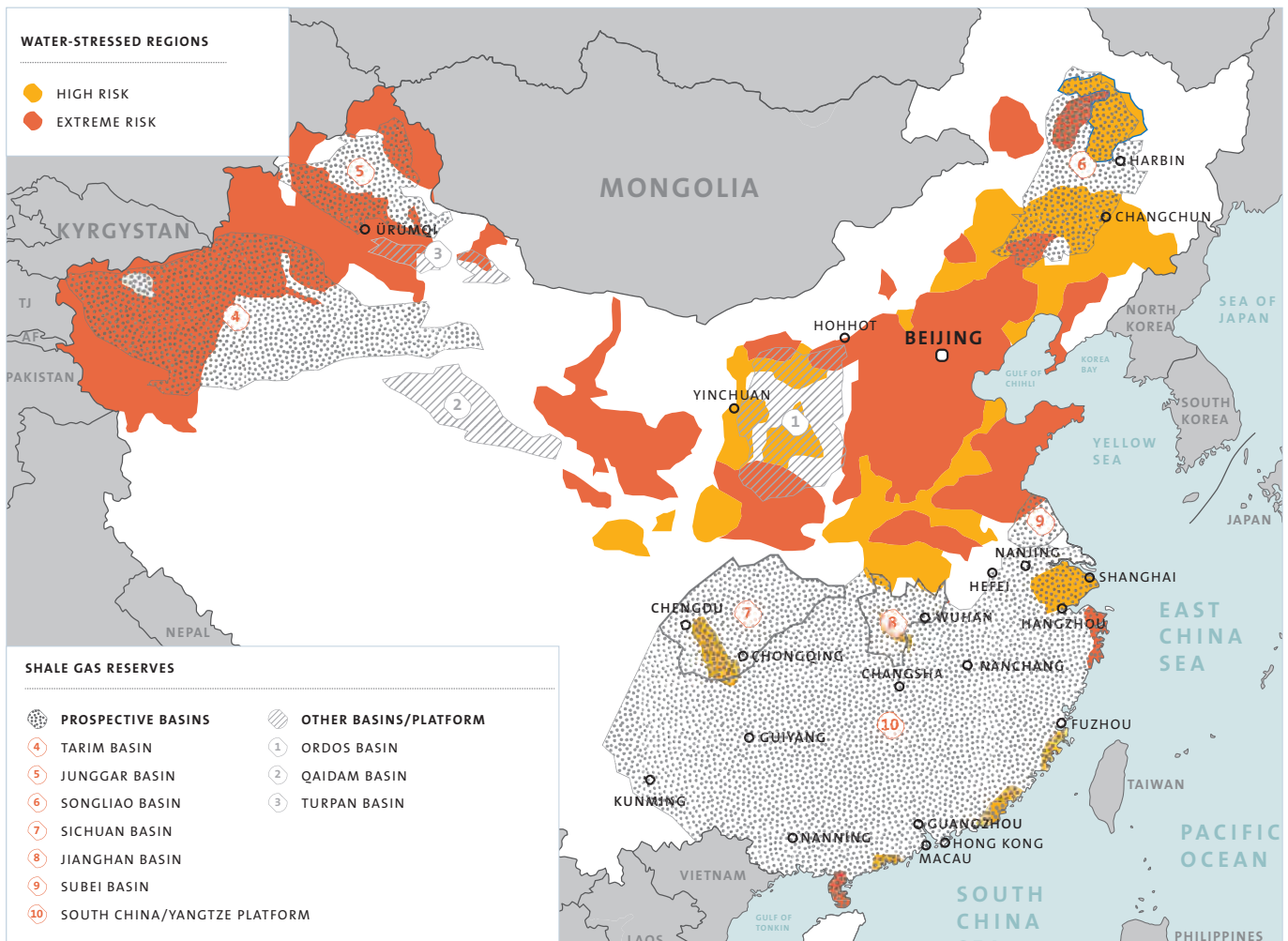


8

CHINA

China is estimated to have the world's largest shale gas resources and the third largest estimated potential for shale oil. The country is also keen to move away from its current reliance on coal which has led to severe problems with air pollution in some parts of the country. But shale gas development in China faces a number of challenges, with limited water availability and high levels of seismic activity, particularly in shale development regions.

CHINA SHALE GAS RESERVES & WATER-STRESSED REGIONS



Sources: Advanced Resources International, World Resource Institute, 2014, US EIA, 2013.

TECHNICALLY RECOVERABLE RESOURCES				
Technically recoverable resources ¹	Shale gas		Shale oil	
	(tcf)		(bcm)	(billion barrel)
	US EIA	Chinese MLR*	US EIA	Chinese MLR
	1,115	885	31,573	25,060
World ranking ²	Shale gas			Shale oil
	1			3
*Chinese Ministry of Land and Resources				

Technically recoverable resources & world ranking

According to the US Energy Information Administration China has 1,115 tcf (31,573 bcm) of technically recoverable shale gas and 32 billion barrels of shale oil. However, the Chinese Ministry of Land and Resources estimates that the reserves of shale gas are smaller, with 885 tcf (25,080 bcm). This would still put China number 1 globally.

UGTEP - TARGETED BY / LISTED AS PARTNER ³	
Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP)	Yes

Targeted by UGTEP

China and the US have very close links over shale gas development, dating back to September 2009 when it was discussed at the US-China Oil and Gas Industry Forum (OGIF).⁴ In November 2009, US and Chinese presidents “welcomed the launch of a US-China Shale Gas Resource Initiative to accelerate the development of unconventional natural gas resources in China”.⁵ UGTEP was officially launched in April 2010, with China hosting a US Department of Energy workshop as one of the selected partner countries.⁶

In May 2012, the US and China agreed to strengthen cooperation on shale gas development.⁷ The International Fund for China's Environment (IFCE), the National Center for Climate Change Strategy and International Cooperation (NCSC) together with the US Department of Energy invited industrial leaders in shale gas and supplementary services to take part in an executive shale gas mission to China.⁸ The US Trade and Development Agency (USTDA) offered a US\$ 378,000 contract for supporting the US-China Shale Gas Training Program.⁹

So far, USTDA and China's National Energy Administration (NEA) have organized four technical training workshops in China on shale gas technology and development.¹⁰ A shale gas study tour, funded by USTDA, provided the opportunity to highlight to Chinese officials the development in shale gas in the US.¹¹

1 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
http://www.adv-res.com/pdf/00_EIA_ARI_Exec_Sum_Results%20June%2010_2013.pdf
<http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>

2 <http://www.eia.gov/analysis/studies/worldshalegas/>

3 <http://www.state.gov/s/ciea/ugtep/>
<http://www.doi.gov/intl/itap/ugtep.cfm>
<http://www.eia.gov/analysis/studies/worldshalegas/#3>

*Other U.S. government agencies that participate in the UGTEP include: the U.S. Department of Energy's Office of Fossil Energy (DOE/FE); the U.S. Agency for International Development (USAID); the U.S. Department of Interior's U.S. Geological Survey (USGS); U.S. Department of Interior's Bureau of Ocean Energy Management (BOEM); the U.S. Department of Commerce's Commercial Law Development Program (CLDP); and the U.S. Environmental Protection Agency (EPA). The U.S. Department of the Interior's (DOI) International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops, some of them in China, with regard to the issue.

4 http://www.uschinaogf.org/Forum9/Agenda9_eng.pdf

5 <http://www.whitehouse.gov/the-press-office/us-china-joint-statement>

6 http://csis.org/files/publication/120911_Nakano_ProspectsShaleGas_Web.pdf

7 http://csis.org/files/publication/120911_Nakano_ProspectsShaleGas_Web.pdf

8 <http://www.ifce.org/Shale-Gas/Shale-Gas-Mission-Flyer.pdf>

9 https://www.fbo.gov/index?s=opportunity&mode=form&id=ebc895f31c1334e3b0c9589b9cca9c14&tab=core&_cview=0
<http://www.breitbart.com/Big-Peace/2012/12/17/Govt-Offering-378-000-To-Teach-Chinese-Firms-U-S-Shale-Gas-Technologies>

10 <http://www.gastechnology.org/Training/Pages/USTDA-China-Shale-Gas-Training-Workshops.aspx>

11 <http://www.state.gov/r/pa/prs/ps/2014/07/229239.htm>



MAIN COMPANIES INVOLVED¹²

NOC (National Oil/Gas Companies)

China National Petroleum Corporation (CNPC)/PetroChina, Sinopec, China National Offshore Oil Corporation (CNOOC), Shaanxi

IOC (International Oil/Gas Companies)

Royal Dutch Shell Plc., British Petroleum (BP), Total S.A., Chevron Corp., ExxonMobil, ConocoPhillips, Baker Hughes, ENI, Halliburton, Schlumberger, Statoil, Hess Corporation

RESOURCE OWNERSHIP¹³

State	Private	License required		Bidding procedure	
		Yes	No	Yes	No
X		X		X	

Resource ownership

According to China's Constitution and its Property Rights Law (16 March 2007), all minerals (including hydrocarbons) are owned by the state. Exploration licences can be granted, usually for a period of three years. Exploitation licences are given for 10–30 years.

Foreign companies cannot directly obtain shale gas licences, but must enter into a partnership with a Chinese company. Prior to the production sharing contract (PSC) the foreign company may enter into a joint study agreement (JSA) in order to assess the potential of a shale gas block.

New legislation & legal framework

According to the Chinese government's Foreign Industry Investment Guidance Catalogue, foreign investments in shale gas/oil exploration and development are "encouraged".

The *Notice* (legislation introduced by the government in 2012) sets out the requirements concerning exploration and exploitation rights and activities. Holders of existing oil, natural gas and mining rights may apply for these to be extended to include shale gas deposits located in the already licensed areas (blocks). But holders can also be forced to quit these blocks so that a shale gas exploration block can be established in their place. Shale gas exploration rights have been licensed via public bidding so far. However, only Chinese or Chinese-controlled joint ventures with foreign companies can obtain shale gas licences.

NEW LEGISLATION / LEGAL FRAMEWORK¹⁴

New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general	Yes	No	Date	Relevant legislation
	X		30/01/12	Foreign Industry Investment Guidance <i>Catalogue</i>
			26/10/12	<i>Notice</i> Regarding the Strengthening of Shale Gas Exploration, Prospecting, Supervision and Administration
			30/10/13	Shale Gas Industry <i>Policy</i>

12 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://blogs.law.harvard.edu/ellachou/files/2013/07/Shale-Gas-in-China-Draft.pdf>
http://www.gastechnology.org/Training/Documents/LNG17-proceedings/13-2-Raj_Rattanavich.pdf
<http://www.ccifc.org/fr/single-news/n/halliburton-in-fracking-joint-venture-in-china>
<http://www.investingdaily.com/19304/drilling-for-profits-in-chinas-new-energy-frontier>
<http://bakerinstitute.org/media/files/Research/c5cd9d90/CES-pub-GeoGasChinaLewis-102913.pdf>

<https://cloud.foeeurope.org/public.php?service=files&t=f7043b525bb1cb8fdc581f7d6df42ede>
13 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
14 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

The bidders must possess oil or gas exploration qualifications or must be in a partnership with a company with such qualifications. They must also have registered capital of more than RMB300 million (US\$ 48.72 million / €36.45 million).

The *Policy* (legislation introduced in 2013) contains general principles on industry regulation and policies on industry technology, and also encourages Chinese companies to co-operate with international companies with shale gas development knowledge. Both the Notice and Policy mention a required framework for environmental protection, including measures for water conservation, recycling of fracturing fluids and the avoidance of water pollution. Given the massive challenges and the Chinese government's enthusiasm for shale gas development, there are some questions as to whether this framework will be enforced.¹⁵

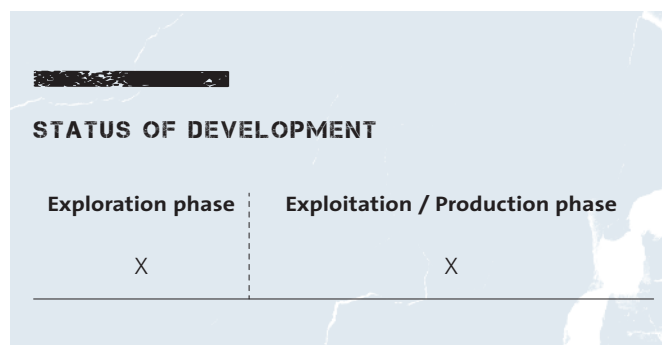
Status of development

China's rapid growth in recent years has inevitably driven growing demand for energy. Its heavy use of coal-fired power for electricity generation has caused serious problems with air pollution, and this has reached highly critical levels in some areas.¹⁶ China is desperately seeking alternatives and, encouraged by the US, it is keen to develop its shale gas resources to become one of the major countries producing shale gas on a large scale.

China started preliminary studies on shale deposits in 2004 and a comprehensive comparative geological study concerning US and Chinese shale deposits was carried out in 2008. This was followed by a list of priority blocks for development, with the first shale frack using US technology carried out in 2010.¹⁷

There were two bidding rounds for shale gas exploration between 2011 and 2012 with a third round expected in 2014.¹⁸ According to China's 12th five-year-plan, the country says it wants to extract 6.5 bcm per year and 60–100 bcm by 2020.¹⁹ Some 177 shale-bearing zones have been identified across the country.²⁰

In March 2014 CNPC/Petrochina announced that they had drilled their first shale gas well in Sichuan province, an area which hosts a cluster of shale development projects.²¹ Petrochina is drilling in a 4,200 km² field in Changning-Weiyuan, and plans 50 wells with a target of producing 1 bcm/year.²² One of the attractions of drilling in Sichuan province is that the area has more water than other potential shale areas.²³



The Fuling field in Sichuan, which is being developed by Sinopec, was verified in July 2014 as the largest shale gas basin in the country.²⁴ Some 80% of production from the field will be used to satisfy gas demand at Sinopec's Vinylon Factory, the biggest natural gas based chemical industry manufacturer in China.²⁵ Zhaotong in Yunnan province, which neighbours the Sichuan field, is the country's second demonstration area.²⁶

Shell has also been involved in drilling shale gas wells in the Sichuan Basin, with CNPC/Petrochina, for several years. Exploration revealed the basin had good potential but that the geology was very complex, with significant fault-related problems that complicate well completion.

Such challenges have led to large financial losses of close to US\$ 1 billion for the two shale gas development leaders Sinopec and CNPC/Petrochina.²⁷ The industry is keen to reduce drilling costs per well to under US\$ 8 million (from current costs of around US\$ 16 million).²⁸ This is however raising questions about how these cost savings will be made, and whether they will have an impact on environmental standards.

Original plans to include increased shale gas development in the 13th Five-Year-Plan (2016–2020)²⁹ have been scaled back after the head of China's National Energy Administration reported in August 2014 that the country had halved the amount of shale gas expected to be extracted by 2020 to 30 bcm.³⁰ Some 20,000 wells would be needed to meet these production targets.³¹ The New York Times reported "serious doubts" concerning China's ability to make shale gas development economically viable.³²

In September 2014, Shell announced that the company will cut back its shale gas development project in Sichuan because of problems with the difficult geology and the challenges of operating in a very highly populated agricultural region.³³

15 <http://asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
<http://blogs.law.harvard.edu/ellachou/files/2013/07/Shale-Gas-in-China-Draft.pdf>
 16 <http://aqicn.org/map/china/>
 17 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
 18 http://fdatasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
 19 http://www.xportreporter.com/wp-content/uploads/2014/02/Shale_Gas_Industry_Report.pdf
<http://www.chinagasmap.com/downloads/brochure/appendix/A04%20List%20of%20China%2075%20Shale%20Gasfields%20and%20Shale%20Mine%20Zones%20%5B2014-6-11%5D.pdf>
 20 <http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/shale-gas/Documents/shale-development-global-update.pdf>
 21 <http://www.chinagasmap.com/theprojects/shalegas.htm#>
 22 <http://www.naturalgasasia.com/cnpc-jv-starts-drilling-first-shale-gas-well-in-sichuan-province-12043>

23 http://fdatasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://blogs.law.harvard.edu/ellachou/files/2013/07/Shale-Gas-in-China-Draft.pdf>
 24 <http://www.naturalgasasia.com/china-verifies-sinopecs-fuling-shale-gas-field-as-countrys-largest-12998>
 25 http://www.cs.com.cn/english/com/201405/t20140512_4387469.html
<http://www.svwpc.com.cn/scw/72339069014638592/>
 26 <https://cloud.foeeurope.org/public.php?service=files&t=f7043b525bb1cb8fd581f7d6df42ede>
 27 <http://www.rff.org/RFF/Documents/RFF-DP-14-18.pdf>
 28 <http://uk.reuters.com/article/2014/04/18/petrochina-shale-idUKL3N0NA1JE20140418>
 29 http://csis.org/files/publication/120824_Nakano_ProspectsShaleGas_Web.pdf
 30 <http://www.reuters.com/article/2014/08/07/us-china-shale-target-idUSKBN0G70GS20140807>
 31 <https://cloud.foeeurope.org/public.php?service=files&t=f7043b525bb1cb8fd581f7d6df42ede>
 32 http://www.nytimes.com/2014/08/22/business/energy-environment/chinas-effort-to-produce-natural-gas-falls-far-short.html?ref=energy-environment&_r=1
 33 <http://www.bloomberg.com/news/2014-09-05/shell-trims-china-shale-venture-on-sichuan-population-challenges.html>



Environmental, ecological and social impacts

There are clear environmental risks from shale gas development in China, as highlighted in a presentation by CNPC/Petrochina:

*"China shale gas mostly concentrates in [...] mountain areas, such as Changning-Weiyuan, [...] in environmentally sensitive farm areas with a dense population. [...] A majority of exploration fields distribute in the hilly lands that have complex geological conditions in China, the exploration may accordingly cause surface subsidence, and create landslides. Meanwhile, the earthquake induced by exploration can also lead to a slope instability resulting landslides. [...] Geological disaster and groundwater (deep, shallow) pollution risks of hydro-fracture cannot be effectively evaluated at present."*³⁶

Poisonous Gas

In some basins, Chinese shale gas has been found to contain high levels of hydrogen sulphide, a toxic and corrosive pollutant,³⁷ posing a risk of exacerbated air pollution as well as causing problems with the corrosion of drilling equipment, which in turn increases the risk of incidents. In December 2003, 243 people died from inhaling the toxic hydrogen sulphide fumes after a gas well blowout in Chongqing, Sichuan. Some 9,000 people were injured.³⁸

Earthquakes

In May 2008, 69,197 people died following an earthquake in Sichuan.³⁹ 374,176 people were injured and 18,222 listed as missing. Some 4.8 million people were left homeless. More than 80 people were killed and more than 800 injured following an earthquake in September 2012 in Zhaotong, Yunnan province – where shale gas is also being developed.⁴⁰

A sequence of earthquakes, including a magnitude 7 quake at Lushan⁴¹ and a 4.8-magnitude quake near Changning, occurred across Sichuan province over five days in April 2013. The Changning quake left 61 people injured and destroyed some 29,000 homes. Economic losses were estimated at US\$ 46.7 million.⁴² 203 people were killed and 11,492 injured in the Lushan quake, with more than 1.5 million people affected.⁴³ CNPC/Petrochina and Sinopec donated about US\$ 1.6 million each to the disaster area.⁴⁴

The Seismological Society of China investigated the event at Changning and found that the earthquakes in the Sichuan basin may have been man-made:

ENVIRONMENTAL, ECOLOGICAL AND SOCIAL IMPACTS

Environmental, ecological and social impacts / conflicts very likely or already existing **Yes**

SOURCE(S) OF CONFLICTS

Source(s) of existing conflicts / incidents: Water contamination, scarcity and/or use conflicts. / Land use conflicts / Competition with agriculture / High risk earthquake areas targeted³⁴ / Shale gas basins coincide with densely populated regions / Risk of explosions at a fracking rig.³⁵

Source(s) of new/further conflicts: Water scarcity and/or use conflicts / Land use conflicts / Competition with agriculture / Water, soil & further air contamination / Further devastating earthquakes / Destruction of fracking rigs through earthquakes with further unforeseeable impacts for the environment and the population

"...Many shallow earthquakes occurring in sediment were regarded as induced events. In Sichuan basin, gas industry and salt mining are dependent on fluid injection technique that triggers microseismicity..."

*It is close to the depth of fluid injection of salt mining, which may imply that this event was triggered by the industrial activity".*⁴⁵

Another 6.1 magnitude earthquake in Zhaotong in 2014 killed more than 500 people and destroyed some 80,000 houses, affecting more than 1.08 million people.⁴⁶

Though the links have not yet firmly been established scientifically, these major seismic events could have been directly triggered by oil and gas extraction activities in this high risk earthquake region. The most recent scientific evidence gathered in the US has shown that high-magnitude earthquakes and aftershocks can result from oil and gas wastewater injection, including in regions where there was no previous evidence of seismic activity.⁴⁷ Shale gas development can therefore be seen as creating a serious risk of further potentially devastating earthquakes in these already vulnerable regions.

34 <http://www.businessweek.com/news/2013-07-31/china-fracking-quake-prone-province-shows-zeal-for-gas-energy>
<http://www.chinatopix.com/articles/1762/20140414/sinopec-continue-gas-field-operation-sichuan-province.htm>
 35 http://www.nytimes.com/2014/04/12/business/international/china-takes-on-big-risks-in-its-push-for-shale-gas.html?_r=0
 36 <http://www.uschinaoig.org/Forum12/pdf/25%20-%20Weidong%20-%20CNPC-EN.pdf>
 37 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
 38 <http://www.unep.fr/scp/xsp/disaster/casestudies/china/gaoqiao.htm>

39 http://en.wikipedia.org/wiki/2008_Sichuan_earthquake#cite_note-data-9
 40 <http://uk.reuters.com/article/2012/09/08/uk-quake-china-idUKBRE88702A20120908>
 41 http://www.unicef.org/appeals/files/UNICEF_China_Lushan_Earthquake_SitRep.pdf
 42 http://www.chinahumanrights.org/Messages/Focus/2013/07/11/t20130426_1031699.htm
 43 http://www.unicef.org/appeals/files/UNICEF_China_Lushan_Earthquake_SitRep.pdf
 44 http://usa.chinadaily.com.cn/business/2013-04/25/content_16450429.htm
 45 <http://link.springer.com/article/10.1007%2Fs11589-014-0062-3>
 46 http://german.china.org.cn/china/2014-08/07/content_33172492.htm
<http://www.ibtimes.com/61-earthquake-strikes-chinas-yunnan-province-over-367-dead-1647380>

Water scarcity as well as water and land use conflict

According to CNPC/PetroChina, many of the shale gas resources are found in mountainous regions, where water shortages are already a serious problem, while each well would require 20,000m³ of water.⁴⁸ The Chinese company estimates that shale gas development will require water consumption of 19-24 million m³/year by the end of 2020.⁴⁹

Water scarcity is not only a problem in China's mountainous areas.⁵⁰ China has 21% of the world's population but only 6% of its freshwater. Since 1950 China has lost more than half of its rivers.⁵¹ More than 400 cities are short of water and nine provinces are suffering from extreme water scarcity.⁵² There are also problems with water contamination, which has been described as reaching a critical point, leading to a reduction in the official standards for drinking water.⁵³

To help alleviate the problems, China is seeking to implement a massive South-to-North Water Transport Project, which will transfer more than 44 billion m³ of water per year to help combat the severe levels of water shortage experienced in the north of the country.⁵⁴

More than 60% of China's shale resources are in areas of high to extremely high baseline stress or arid conditions.⁵⁵ Sichuan province, while having more water than many areas of China, has – within its industrial and agricultural areas – less than 1,000 m³ per capita. Agriculture consumes 80% of the total water resources in the province⁵⁶, which is known as the “land of fish and rice”.⁵⁷

Sichuan's crops not only feed the provinces' rural population, they also provide an important source of food for other parts of China. Shale gas development not only competes with farming for water, but also for land.⁵⁸

Villagers are already complaining of fouled streams and polluted fields as a result of shale gas developments.⁵⁹ Given that the government seems very eager to push for shale gas development no matter what, land use conflicts with farmers who live from the land is likely to become another problem.

Quote CNPC: “Therefore shale gas exploration appears contrary to water resources, the shale gas exploration faces a great environmental pressure.”⁶⁰

Quotes from villagers:⁶¹ “It still pains my heart to talk about that land. / There's been a layer of white stuff floating on top of the water now. You tell me if there's been an impact. / Apparently there was a leak in the well and it polluted our ground water. / This made our water undrinkable. / Now we can't use it to cook rice anymore.”

There are also risks for the workers involved in shale gas drilling, with eight workers reported to have been killed when a fracking rig exploded in Jiaoshizhen, Fuling, Sichuan.⁶² This raises questions about the level of environmental and safety standards applied to China's shale gas developments – and about the willingness and capacity for any standards to be monitored or applied.

Opposition to the development of shale gas & oil

According to the Control Risk 2012 study, there are minor levels of anti-fracking activism in China, the political risk is considered low and the security risk is medium.⁶³ China's environmental movement is developing and there is likely to be a growing awareness of the risks of fracking.⁶⁴



47 Katie M. Keranen, Heather M. Savage, Geoffrey A. Abers et al, "Potentially induced earthquakes in Oklahoma, USA: Links between wastewater injection and the 2011 Mw 5.7 earthquake sequence", March 2013 (<http://dx.doi.org/10.1130/G34045.1>).
 48 Nicholas J. van der Elst, Heather M. Savage, Katie M. Keranen et al, "Enhanced Remote Earthquake Triggering at Fluid-Injection Sites in the Midwestern United States", July 2013 (<http://dx.doi.org/10.1126/science.1238948>).
 49 William L. Ellsworth, USGS, "Injection-Induced Earthquakes", July 2013 (<http://dx.doi.org/10.1126/science.1225942>).
 50 Danielle F. Sumy, Elizabeth S. Cochran, Katie M. Keranen et al, "Observations of static Coulomb stress triggering of the November 2011 M5.7 Oklahoma earthquake sequence", March 2014 (<http://dx.doi.org/10.1002/2013JB010612>).
 51 <http://www.uschinaogf.org/Forum12/pdf/25%20-%20Weidong%20-%20CNPC-EN.pdf>
 52 <http://www.uschinaogf.org/Forum12/pdf/25%20-%20Weidong%20-%20CNPC-EN.pdf>
 53 <http://ftalphaville.ft.com/files/2013/07/China-water-HSBC.png>
 54 <http://www.theatlantic.com/china/archive/2013/04/28-000-rivers-disappeared-in-china-what-happened/275365/>
 55 <http://www.pwc.com/gx/en/capital-projects-infrastructure/assets/chinas-war-on-water-scarcity.pdf>

56 <http://www.taz.de/1/archiv/digitaz/artikel/?ressort=sw&dig=2014%2F07%2F25%2Fa0076&cHash=8e0d2364739fd019d537c0c1797b1e79>
 57 http://graphics8.nytimes.com/images/2007/09/27/world/china_map.full.jpg
 58 http://www.wri.org/sites/default/files/wri14_report_shalegas.pdf
 59 http://sri.cifad.cornell.edu/countries/china/ChSichuan_AgricWaterSavings_Zheng11.pdf
 60 http://www1.chinaculture.org/library/2008-01/08/content_22059.htm
 61 <http://www.nortonrosefulbright.com/files/norton-rose-fulbright-shale-gas-handbook-108992.pdf>
 62 http://www.nytimes.com/2014/04/12/business/international/china-takes-on-big-risks-in-its-push-for-shale-gas.html?_r=1
 63 <http://www.uschinaogf.org/Forum12/pdf/25%20-%20Weidong%20-%20CNPC-EN.pdf>
 64 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 65 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 66 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 67 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 68 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
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 92 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 93 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 94 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
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 96 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 97 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 98 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 99 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>
 100 <http://www.asiasociety.org/video/fracking-and-chinas-energy-revolution-complete>

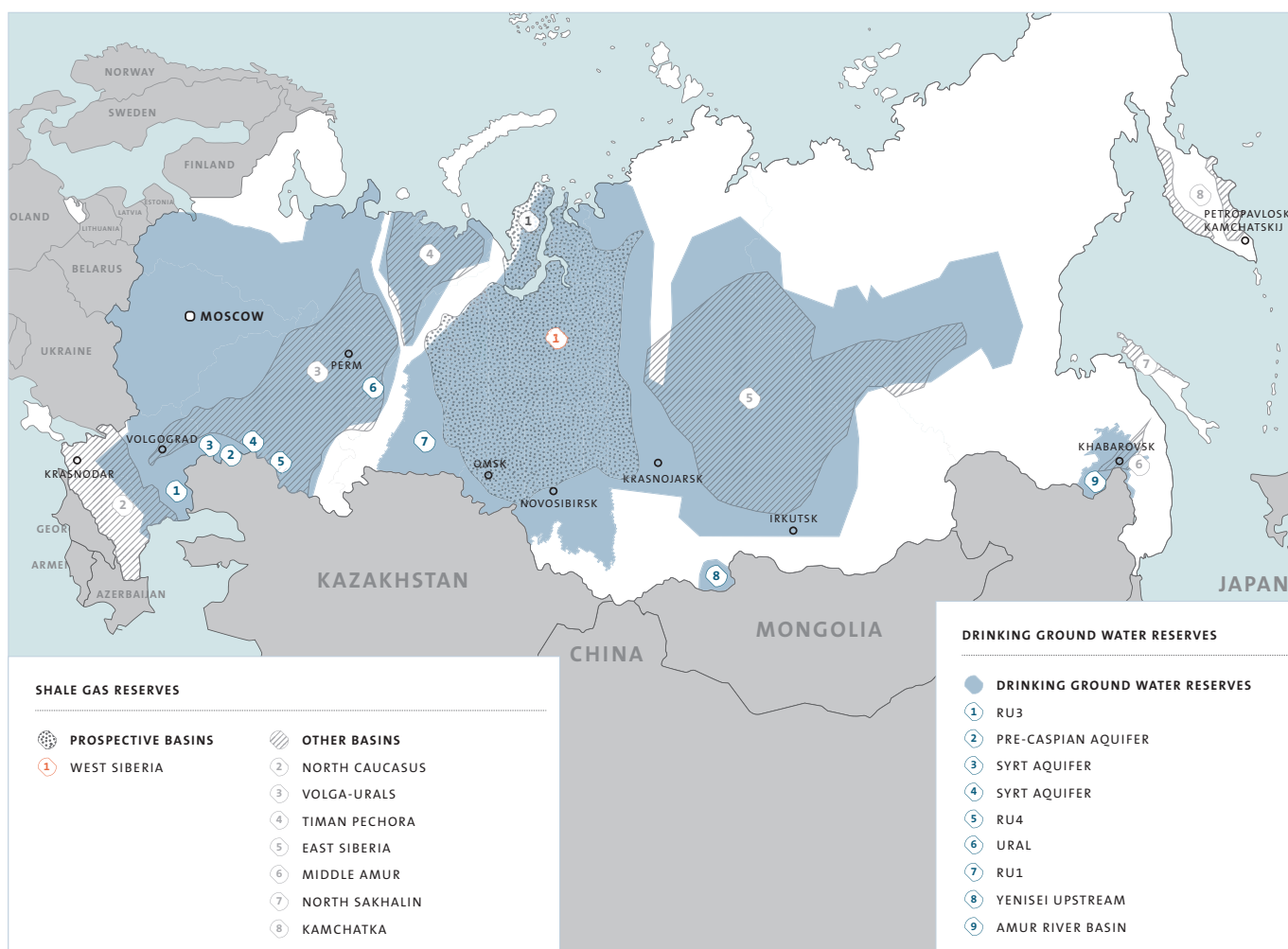


9

RUSSIA

Russia has significant shale resources in the Bazhenov Shale basin in Western Siberia and Russian companies have formed partnerships with a number of international companies keen to exploit them. Russia is also a major player in international gas markets, and has interests in shale developments overseas. There are however concerns about the feasibility of extraction, and about the impacts of the “oil boom” on the environment and culture of the indigenous Khanty people.

RUSSIA SHALE GAS & DRINKING GROUND WATER RESERVES



Sources: US EIA, 2013, International Groundwater Resources Assessment Centre.

TECHNICALLY RECOVERABLE RESOURCES

Technically recoverable resources ²	Shale gas (tcf)	Shale gas (bcm)	Shale oil (billion barrel)
	285	8,070	75
World ranking ³	Shale gas	Shale oil	
	9	1	

Technically recoverable resources & world ranking

The EIA estimates that Russia has some 285 tcf (8,070 bcm) of technically recoverable shale gas resources in the Bazhenov Shale basin in Western Siberia, and some 75 billion barrels of technically recoverable shale oil resources. This places Russia at the top of the global rankings for shale oil, and 9th for shale gas.¹

Targeted by UGTEP

Russia is not listed as a partner of UGTEP and is not expected to join the programme. The Russian International Affairs Council (RIAC) has complained about this exclusion on their website, suggesting that the main aim of UGTEP is to reduce the market for Russian gas. RIAC describes UGTEP as a “missionary force” designed to show “American “best practices” in shale gas fracking to the countries with known presence of natural gas-bearing shale within their borders (Ukraine, Poland, China and India”).⁵

UGTEP - TARGETED BY / LISTED AS PARTNER⁴

Targeted by / Listed as partner of the US Unconventional Gas Technical Engagement Programme (UGTEP)	No

MAIN COMPANIES INVOLVED⁶

NOC (National Oil/ Gas Companies)	IOC (International Oil/ Gas Companies)
Gazprom, Rosneft, Lukoil	BP, Shell, Schlumberger, Exxon, Statoil, Total

Russia has in turn initiated a Gas Exporting Countries Forum (GECF), which RIAC describes as the equivalent of OPEC for gas producers, gathering countries who seek “to fend off” dominance by the US and the West in the global gas trade market.⁶ Member countries include Algeria, Bolivia, Egypt, Equatorial Guinea, Iran, Libya, Nigeria, Qatar, Russia, Trinidad and Tobago, the United Arab Emirates and Venezuela. Observer members include Kazakhstan, Iraq, the Netherlands, Norway and Oman.⁷

Resource ownership

The Russian state owns all minerals and hydrocarbons, and all oil and gas companies must obtain a licence in order to use “subsoil” or extract minerals and/or hydrocarbons. In general, once extracted, hydrocarbons become the property of the licence-holder. However, because each subsoil deposit is considered to be of federal importance, any oil or gas development in Russia must be carried out in cooperation with a Russian partner, such as Rosneft or Gazprom.¹⁰

RESOURCE OWNERSHIP⁹

State	Private	License required		Bidding procedure	
		Yes	No	Yes	No
X		X			X

1 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
2 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>
3 <http://www.eia.gov/analysis/studies/worldshalegas/>

4 <http://www.state.gov/s/ciea/ugtep/>
<http://www.doi.gov/intl/itap/ugtep.cfm>
<http://www.eia.gov/analysis/studies/worldshalegas/#3>

“Other U.S. government agencies that participate in the UGTEP include: the U.S. Department of Energy’s Office of Fossil Energy (DOE/FE); the U.S. Agency for International Development (USAID); the U.S. Department of Interior’s U.S. Geological Survey (USGS); U.S. Department of Interior’s Bureau of Ocean Energy Management (BOEM); the U.S. Department of Commerce’s Commercial Law Development Program (CLDP); and the U.S. Environmental Protection Agency (EPA).

The U.S. Department of the Interior’s (DOI) International Technical Assistance Program (ITAP) is also involved in SGD across the globe and helps to organize workshops”

5 http://russiancouncil.ru/en/inner/?id_4=2942#top

6 http://russiancouncil.ru/en/inner/?id_4=2942#top

7 <http://www.gecf.org/aboutus/about-gecf>

8 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://www.bloomberg.com/news/2014-01-13/shell-venture-starts-fracking-giant-russian-shale-oil-formation.html>

<http://www.telegraph.co.uk/finance/newsbysector/energy/10855891/Russia-joins-global-dash-for-shale-in-policy-volte-face.html>
<http://www.bloomberg.com/news/2014-05-23/total-agrees-to-lukoil-shale-deal-brushing-off-russia-sanctions.html>

9 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

<http://www.nortonrosefulbright.com/files/oil-and-gas-in-russia-ten-things-to-know-75362.pdf>
10 <http://www.nortonrosefulbright.com/files/oil-and-gas-in-russia-ten-things-to-know-75362.pdf>



NEW LEGISLATION / LEGAL FRAMEWORK¹¹

New legislation / legal framework or recent changes of existing legal framework with regard to the exploration and/or exploitation of shale gas/oil or fossil fuels in general	Yes	No	Date	Relevant legislation/tax incentives
	X		21.02.1992	Federal Law No. 2395-1 (Subsoil Law)
			30.12.1995	Federal Law No. 225-FZ (on Production Sharing Agreements)

New legislation & legal framework

There are currently no special regulations in force for the exploration and exploitation of unconventional fossil fuels in Russia.¹²

Subsoil licenses are granted under Law No. 2395-1 (Subsoil Law), which covers the legal regulatory framework for exploration and/or exploitation of fossil fuels. In general, exploration licenses are granted for between five and seven years for onshore fields and for up to 10 years for offshore development. Licences can be extended, and are usually granted for additional periods of five years, depending on the requirements. Exploitation licences are usually granted for 20 years. Combined licenses (exploration and exploitation) can be granted for 25 years. There are no limits on the size of the licensed area.

Russia introduced changes to the law in July 2013 to ease the rules for shale oil and gas developers and to make it easier to attract new investors.¹³ For the next 15 years, no taxes will be paid on oil produced from the Bazhenov basin.¹⁴ From September 2013, other shale and tight oil reserves will face tax reductions of between 20% and 80%.¹⁵

STATUS OF DEVELOPMENT¹⁶

Exploration phase Exploitation / Production phase

X

Status of development

Russia is eager to develop its major shale resources, particularly the vast Bazhenov basin in Western Siberia, but has been a latecomer to the shale game. Shale was on the agenda at the 2012 Asia-Pacific Economic Cooperation (APEC) Energy Ministerial Meeting in St. Petersburg, with the final declaration highlighting a commitment to evaluate the production and trade potential of shale gas and other unconventional natural gas resources.¹⁷

Bazhenov has been described as “the Big One”¹⁸, and Rosneft has signalled its potential could lead to “the New Age of Petroleum”. According to industry estimates, the formation’s resources alone are supposed to represent the equivalent volume of 40% of US total shale oil.¹⁹ But there are concerns that the Bazhenov basin might be over-pressured and that measurements in the Salym oil field have shown “*abnormally high pressures (up to 70% above normal hydrostatic pressure)*”²⁰, which might constrain development.

11 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://www.nortonrosefulbright.com/files/oil-and-gas-in-russia-ten-things-to-know-75362.pdf>

12 http://f.datasrvr.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

13 <http://www.platts.com/news-feature/2013/oil/russia-shale-oil/index>
<http://www.reuters.com/article/2013/09/02/russia-energy-tax-idUSL6N0GV2VH20130902>
http://business.financialpost.com/2014/05/28/russia-shale-energy/?__lsa=a0f3-504e

14 http://www.ruspetro.com/media/123221/thp_conf_pres_nov_2013_final_updated__1_.pdf

15 <http://www.platts.com/news-feature/2013/oil/russia-shale-oil/index>

16 <http://www.worldoil.com/Shell-venture-starts-fracking-giant-Russian-shale-formation.html>
<http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

17 http://www.apec.org/Meeting-Papers/Ministerial-Statements/Energy/2012_energy.aspx

18 <http://uk.reuters.com/article/2014/07/16/russia-shale-kemp-idUKL6N0PR10P20140716>

19 http://www.rosneft.com/attach/0/02/99/cera_week_en.pdf

20 <http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf>

In December 2013, Rosneft and Statoil signed a joint venture to explore the shale potential in 12 licensed blocks in the Domanik formation of the Volga-Urals region within the next three years. The companies also plan to drill at least six wells before the end of 2021.²¹

Royal Dutch Shell has launched a shale joint venture with Russia's Gazprom Neft in the Bazhenov basin.²² Shell and Gazprom have teamed up to establish the Salym Petroleum Development project and are planning to explore the formation's potential by drilling five wells by 2016, using multi-stage hydraulic fracking.²³ The move follows a three year preliminary exploratory phase, which has seen seismic tests and three appraisal wells drilled. Depending on the results of the next two years, Shell and Gazprom will decide on the large-scale shale potential of the Bazhenov formation.²⁴

Exxon Mobil has partnered with Rosneft to develop a US\$ 300 million exploration project in another part of the Bazhenov basin.²⁵ Rosneft is said to have acquired 30% of a Texas tight oil project as part of this deal. The state-owned Russian company hopes to gain direct experience of the fracking technique on the ground in the US.²⁶

However, the Ukraine crisis has recently pushed foreign investors to reconsider their cooperation with Russian companies. In late 2014, Royal Dutch Shell suspended work on its joint venture with Gazprom Neft while ExxonMobil suspended its 10 joint ventures with Rosneft.²⁷

Schlumberger is also working with Gazprom Neft on shale oil development in the Bazhenov formation.²⁸ In August 2013, Gazprom Neft announced that it plans to drill four exploratory shale wells at the Bazhenov-Abalasky complex in 2014.²⁹ Schlumberger has complained that its quarterly earnings would be hurt by sanctions against Russia.³⁰



Oil spill and a dead forest outside Usinsk, Russia.

© Denis Sinyakov / Greenpeace

21 http://f.datasrv.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf
<http://www.rosneft.com/news/pressrelease/06122013.html>
http://www.statoil.com/en/NewsAndMedia/News/2013/Pages/06Dec_Samara.aspx
22 <http://oilprice.com/Energy/Energy-General/Shell-Gazprom-Neft-Eye-Siberias-Bazhenov-as-Next-Bakken.html>
23 <http://salympetroleum.com/technologies/>
24 <http://salympetroleum.com/technologies/newoil/bazhenov/>
25 <http://www.bloomberg.com/news/2014-01-13/shell-venture-starts-fracking-giant-russian-shale-oil-formation.html>

26 <http://oilprice.com/Latest-Energy-News/World-News/Exxon-Signs-Deal-to-Help-Rosneft-Develop-Huge-Bazhenov-Shale-Play-in-Siberia.html>
27 <http://oilpro.com/post/7516/first-exxon-now-shell-suspend-russian-ops>
<http://www.ft.com/intl/cms/s/0/fc99206c-4b10-11e4-b1be-00144feab7de.html#axzz3IHUeisJG>
28 <http://www.gazprom-neft.com/press-center/news/1097430/>
29 <http://www.gazprom-neft.com/press-center/news/1095320/>
30 <http://www.reuters.com/article/2014/08/12/us-schlumberger-russia-idUSKBN0GC14620140812>



In May 2014, the major British oil company BP signed a cooperation contract for shale oil exploration with the Russian state-owned company Rosneft, in the Domanik formation, in the Volga-Urals region.³¹ BP will invest up to US\$ 300 million over the two phases of this pilot exploration project.³²

Another global player, France's Total secured the rights in 2014 to explore the shale oil potential of a 2,700 km² area in the Khanty-Mansi Autonomous District of the Bazhenov formation with Russian Lukoil. The initial investment for the first two years will be between US \$120 million–\$150 million. The first exploratory wells are planned for 2015.³³

More than 200 wells have already been drilled in the Bazhenov basin at the Salym and neighbouring gas fields, but so far no significant breakthrough in shale production has been achieved elsewhere.^{34,35} The “difficult financial and business environment”³⁶ is still a big challenge for Western companies, especially in the current political environment.

Environmental, ecological and social impacts

One of the areas which is likely to be targeted for shale oil development is in the Khanty-Mansi Autonomous District. The region is the home of the semi-nomadic indigenous Khanty people, who gave the land its name. According to the human rights organisation Survival International: “the Khanty were persecuted under the Soviet regime in the 1930s – their children taken and put in boarding schools and their shamans killed – but today it is oil companies which threaten them. Oil exploitation on Khanty land is polluting their forests and sacred lakes, killing the reindeer and scaring off other game.”³⁷

The Russian Nizhnevartovsk State Humanitarian University has been monitoring incidents in the region:

“As of January 20, 2010 (Analysis of the year 2009), the Ecology Department of Khanty-Mansiysk Autonomous Okrug registered 4.979 accidents including 2.417 oil-pipeline failures and 2.380 water passage by reasons of loss of pipelines pressure. The total pollutant mass in the environment amounted to 5.781,4 tons and the pollution area was about 229,6 hectares. [...] “The oil products concentration in rivers and lakes of Samotlor licence area (Active of TNK-BP) exceeds Maximum Permissible Coefficient (MPC) for water-resources basins up to 44.”³⁸

The Environmental Justice Atlas also points to a number of different negative environmental and health impacts in the Khanty-Mansi region, listing oil spills, air pollution, soil contamination and groundwater pollution, combined with a loss of traditional cultures, social problems and violation of human rights.³⁹

The oil boom is expected to transform the area, with media headlines talking about a shift from “Gulags to Glitz”. Traditional wooden houses are to be replaced by “a Siberian equivalent of Texas”, designed by the British architect Sir Norman Foster, who has already drawn up plans for a 280 metre “Diamond Crystal” spire.⁴⁰

Others have called for the area not to be changed:

“When some delegations were coming to Khanty-Mansiysk in the 1990s, they were amazed with the beauty of the nature and the serenity of the place and asked not to change anything here.”⁴¹

Despite all the promises made by the Salym Petroleum Project, it is far from sure that the Khanty people will have any voice at all during this process of “development”. In November 2012, Greenpeace urged President Putin to defend the rights of the indigenous people of Russia, after the Russian Ministry of Justice temporarily suspended the activities of the Russian Association of Indigenous Peoples of the North (RAIPON), which was supporting a call to ban oil production on the Arctic continental shelf.⁴²



ENVIRONMENTAL, ECOLOGICAL AND SOCIAL IMPACTS	
Environmental, ecological and social impacts / conflicts very likely or already existing	Yes
SOURCE(S) OF CONFLICTS	
Source(s) of existing conflicts / incidents:	Water, soil and air contamination / Loss of biodiversity / Deforestation and industrialization of sensitive areas / Ignoring the rights of the indigenous Khanty people.
Source(s) of new/further conflicts:	Further water, soil and air contamination / further deforestation and industrialization of sensitive areas / further disregard of indigenous rights and environmental standards.

31 <http://uk.reuters.com/article/2014/05/24/uk-russia-forum-rosneft-idUKKBN0E40A920140524>

32 <http://www.shale-world.com/2014/05/28/bp-rosnefts-agreement-shale-oil-russia/>

33 <http://www.bloomberg.com/news/2014-05-23/total-agrees-to-lukoil-shale-deal-brushing-off-russia-sanctions.html>

34 <http://uk.reuters.com/article/2014/07/16/russia-shale-kemp-idUKL6N0PR1OP20140716>

35 http://www.pwc.com/en_GX/oil-gas-energy/publications/pdfs/pwc-eum-global-prospective-shale-plays-map.pdf

36 <http://uk.reuters.com/article/2014/07/16/russia-shale-kemp-idUKL6N0PR1OP20140716>

37 <http://www.survivalinternational.org/tribes/khanty>

38 http://www.ogbus.ru/eng/authors/Khodzhaeva/Khodzhaeva_1e.pdf

39 <http://ejatlas.org/conflict/oil-spills-in-khanty-mansi-region-russia>

40 <http://siberiantimes.com/business/casestudy/features/gulags-to-glitz-in-oil-boom-town/>

41 <http://siberiantimes.com/business/casestudy/features/gulags-to-glitz-in-oil-boom-town/>

42 <http://www.cdfai.org/PDF/The%20Case%20for%20RAIPON.pdf>

<http://www.greenpeace.org/international/en/news/Blogs/makingwaves/an-urgent-call-to-president-putin-to-defend-t/blog/42988/>

Opposition to the development of shale gas & oil

Opposing oil and gas development in Russia is a risky business that constrains the level of activism in the country, as illustrated by the arrest in 2013 of 30 Greenpeace activists peacefully demonstrating against Gazprom's plans to drill in the Arctic region. The activists faced charges of piracy and were sent to jail for more than two months.⁴³

There has been some opposition from environmental groups to fracking in Russia, including a Russian version of the report by Friends of the Earth Europe, Friends of the Earth Ukraine and WWF Russia, "Unconventional and unwanted, the case against shale gas" in 2013.⁴⁴ However, there is no evidence of activism against fracking in the country.



Oil spill in Komi Republic, Russia.
© Denis Sinyakov/Greenpeace

⁴³ <http://www.greenpeace.org/international/en/news/Blogs/makingwaves/arctic30-one-year-anniversary/blog/50664/>

⁴⁴ <http://www.foeeurope.org/foee-unconventional-and-unwanted-the-case-against-shale-gas-sept2012>

CLIMATE CHANGE & THE NEED FOR AN ENERGY TRANSITION

The search for unconventional fossil fuel energy sources is taking place against a backdrop of increased awareness of the urgency to act to prevent the worst impacts of climate change. Consistent expert analysis confirms that we are rapidly approaching crucial tipping points and must rapidly decarbonise our energy system for these to be avoided. According to the International Energy Agency (IEA), two thirds of the known fossil fuel reserves need to be left in the ground if we are to avoid the internationally agreed limits of 2°C warming.¹

One of the most common arguments used to promote the development of shale resources is that shale gas could “play a key role in the transition to a greener energy future”.² Unconventional gas is presented as an important low carbon transition fuel. This claim is however deeply misleading as it misrepresents the global warming impacts of natural gas and ignores the consequences for climate change of global development of the fracking industry.

Natural gas – more carbon-intensive than promoted

Natural gas is mostly made of methane which has, according to the IPCC, a global warming potential 86 times higher than CO₂ over a 20-year time-frame.³ While gas may therefore have a lower carbon footprint than many other fossil fuel sources when it is burnt, it can generate high levels of emissions over the course of the production and transportation cycles as a result of methane leakages.⁴

According to independent analysis in the US, despite the existing so-called “best available” technology, up to 12% of the natural gas produced at a number of shale gas production areas can leak directly into the atmosphere.⁵ This figure is of particular concern given that scientific analysis shows that the climate benefit of switching from coal to gas is lost if the level of methane leakage exceeds 3%.⁶

The much higher failure rate of unconventional well drillings (compared to conventional ones) adds to the problem of methane leakage. Recent studies in the US have for instance shown that the failure rate for unconventional wells in the Marcellus basin – where a significant amount of US unconventional gas is currently produced – was at least 6.2% and that unconventional gas wells in north eastern Pennsylvania were found to fail almost three times more than conventional wells in the same area. As a result, it has been predicted that about forty percent of the oil and gas wells in parts of the Marcellus shale region are likely to leak methane into the groundwater or into the atmosphere.⁷

Concerns about methane leakage are particularly acute in countries where environmental standards and monitoring capacities are considered to be low, which is the case in most countries covered in this study.

Even though there is still considerable debate, a number of international agencies have warned that the world-wide development of the fracking industry will not have the climate benefits claimed.⁸

According to the IEA, even in a best case scenario where its “Golden Rules” – principles which would supposedly address the environmental and social impacts of the fracking industry – were respected: “CO₂ emissions on a long-term trajectory [will be] consistent [...] with a probable temperature rise of more than 3.5 degrees Celsius (°C), well above the widely accepted 2°C target”.⁹

- 1 <http://www.iea.org/publications/freepublications/publication/english.pdf>
- 2 <http://shalegas-europe.eu/shale-gas-explained/shale-gas-and-the-energy-mix/>
- 3 <http://www.climatechange2013.org/>
- 4 <http://onlinelibrary.wiley.com/doi/10.1002/2013JD021272/abstract>
<http://www.pnas.org/content/early/2014/04/10/1316546111.abstract>
<http://www.sciencemag.org/content/343/6172/733>
<http://pubs.acs.org/doi/abs/10.1021/es404474x>
- 5 <http://onlinelibrary.wiley.com/doi/10.1002/grl50811/abstract>
- 6 <http://www.pnas.org/content/109/17/6435.full>
<http://www.climatecentral.org/news/limiting-methane-leaks-critical-to-gas-climate-benefits-16020>
- 7 <http://www.pnas.org/content/early/2014/06/25/1323422111>
- 8 <http://www.climatechange2013.org/>
http://www.worldenergyoutlook.org/media/weowebsite/2012/goldenrules/weo2012_goldenrulesreport.pdf
- 9 <http://www.worldenergyoutlook.org/publications/weo-2014/>
http://www.worldenergyoutlook.org/media/weowebsite/2012/goldenrules/weo2012_goldenrulesreport.pdf

While the IEA states that in 2010, the world energy-related CO₂ emissions in the gas sector were around 3,050 million tonnes of CO₂, it estimates that CO₂ emissions from the gas sector, in a context of shale gas expansion, would continue to increase in every part of the world, despite the use of best available technology. In non-OECD countries, the IEA forecasts an increase to almost 5,800 million tonnes of CO₂ in 2035.¹⁰

The climate change impact that a global intensification of the shale oil and gas production could have is therefore significant. This poses a major risk to many countries in the Global South¹¹ which are already feeling the impacts of climate change and which are predicted to experience some of the most severe consequences: By 2030, while the cost of climate change and air pollution combined is expected to represent 3% of global GDP, the world's least developed countries forecast to pay the highest price, restricting growth by up to 11%.¹²

Given the urgent need to reduce emissions, shale gas, and indeed natural gas in general, do not seem suitable as a transition fuel in either the West, or in the rest of the world.

Dirty energy financial support

The Global Commission on the Economy and Climate (GCEC), in its September 2014 “Better Growth, Better Climate” report,¹³ reinforced the message that decisions and investments to seriously fight climate change need to be taken in the next 15 years, concluding that: “countries at all levels of income now have the opportunity to build lasting economic growth at the same time as

reducing the immense risks of climate change. This is made possible by structural and technological changes unfolding in the global economy and opportunities for greater economic efficiency”.

This 15-year timeframe means there is no room for wasting money on more dirty energy sources. The GCEC argues that “future economic growth does not have to copy the high-carbon, unevenly distributed model of the past.”

However, the report also highlights that worldwide subsidies for clean energy amount to around US\$ 100 billion, while subsidies to polluting fossil fuels are estimated to be six times greater at around US\$ 600 billion per year. These findings were supported by the IEA which published comparable figures in their World Energy Outlook 2014.¹⁴

Such figures raise important questions about the frequently heard statements that renewables are too expensive to develop and that new sources of gas are the ideal complement to renewable energies.

Recent studies¹⁵ have highlighted the risk that the creation of a new fossil fuel sector may be dependent on state aid and subsidies, while also diverting private investment from the renewable sector. They conclude that under all the different climate policies that could be put in place, abundant natural gas will decrease the use of renewable energy technologies.¹⁶

Natural gas is therefore not – and has never been – the clean fossil fuel that the industry has tried to claim. It in fact poses an immediate threat to attempts made to fight climate change. The global development of this more polluting, technically challenging and costly unconventional fossil fuel would appear to exacerbate the situation, by releasing more CO₂ into the atmosphere, locking global economies into a new fossil fuel trajectory for a period of at least 40 to 50 years,¹⁷ competing with investments in other cleaner forms of energy, and delaying the much needed transition to a decarbonised economy.



Africa's largest wind farm, the 140 MW Tangiers “Dhar Saadane” facility was inaugurated on June 2010. With a capacity to generate 526.5 GWh a year, resulting in power generation that is equivalent to more than 126,000 tonnes of oil equivalent (TEP) each year and prevents the emission of close to 370,000 tones of CO₂ annually. © Markel Redondo/Greenpeace

10 http://www.worldenergyoutlook.org/media/weowebsite/2012/goldenrules/weo2012_goldenrulesreport.pdf, p.91

11 <http://www.thefreedictionary.com/Global+South>

12 <http://daraint.org/climate-vulnerability-monitor/climate-vulnerability-monitor-2012/report/>

<http://www.theguardian.com/environment/2012/sep/26/climate-change-damaging-global-economy>

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14 <http://siberiantimes.com/business/casestudy/features/gulags-to-glitz-in-oil-boom-town/>

15 <http://iopscience.iop.org/1748-9326/9/9/094008/article>

<http://www.nature.com/nature/journal/vaop/ncurrent/full/nature13837.html>

16 <http://ecowatch.com/2014/09/25/natural-gas-bridge-nowhere/>

17 http://f.datasrv.com/fr1/314/48797/Shale_Gas_an_International_Guide_v3.pdf

CONCLUSION

After a decade of industrial-scale expansion in North America, the destructive nature of the fracking industry is now becoming increasingly apparent to the wider world, with significant damage caused to the environment, to people's health, and also to the climate, to wildlife, public infrastructure, local economies and wider society.

Over the last three years, these impacts have been the subject of almost weekly peer-reviewed academic publications, revealing that the risks generated by the unconventional fossil fuel production (including fracking) are complex, serious, and widespread. This ongoing scientific research is vital to help us understand the range of impacts associated with fracking operations. Gaining a full picture is however hampered due to a lack of transparency in the fracking industry and a political unwillingness in some quarters to establish firm legal obligations for the shale gas industry and to conduct more scientific field studies.

The findings of scientific research raises serious questions about the ability of the fracking industry to preserve the fragile ecosystems found in the areas now targeted for shale development. Even though these developments are in their infancy, the consequences of the likely damage can be anticipated:

- In the case of large and deep transboundary aquifers which represent the only drinking water source for entire regions, their potential contamination could have dramatic effects on health and could result in serious social and economic consequences at regional levels.
- More than a third of the world's shale resources face high to extremely high water stress or arid conditions.¹ Considering the constant high demand for fresh water for fracking, the competition for access to water in already extreme water-stressed countries (in the Maghreb, South Africa, and China for example) could have serious social and economic consequences.

However, water is not the only problem:

- Several existing or potential unconventional drilling zones are located in earthquake-prone regions where populations have recently paid a significant human cost following induced earth tremors. The common earth tremors triggered by the fracking industry in previously seismically inactive states in the US herald the kind of amplified threat that populations living in seismically active countries might face.
- Community rights, particularly for indigenous populations, are already denied or ignored in many of the countries analysed in this report. From Argentina to Russia, oil and gas operators are developing their activities on indigenous lands without consulting or informing local people.
- Natural protected areas are targeted in some countries, representing an additional threat to fragile ecosystems and to already endangered species (such as the guanaco in Argentina or the orang-utan in Indonesia)
- Legislative frameworks are being widely re-written in some countries in order to make them industry-friendly, by-passing basic environmental legislation (on natural protected areas, on environmental impact assessments, etc), extending the duration of licences, exempting industries from substantial taxes, and even increasing the minimum gas price for exports to ensure greater profitability.



Home in Aguada San Roque, inside the Total concession, Auca Mahuida, Argentina
© Carolina García

1 http://www.wri.org/sites/default/files/wri14_report_shalegas.pdf

The problems that have been observed in the US and in Canada, and which are widely anticipated in Europe, are therefore likely to be far greater in other places in the world where the fracking industry is looking to develop, under far weaker scrutiny. It is in fact hard to imagine how such an inherently destructive and water-intensive industry can develop in a safe and environmentally-friendly way in seriously water-stressed, earthquake-prone countries, many of which have suffered from poor governance. The level of environmental protection in countries which enforce higher environmental standards, as in Europe² and in the US³, has failed to mitigate against the inherent impacts of the fracking industry. The impacts of initial activities in countries such as Argentina are already showing the dangers that the local environment and population face from foreign companies (such as Chevron, Total or Shell) who are accused in some cases of operating to lower environmental standards than they would apply in Europe or in the US.⁴

Experience so far also raises fundamental questions about the way in which citizens are being treated in the push for shale gas expansion. Fracking protests in Balcombe (UK)⁵, Pungesti (Romania)⁶, New Brunswick (Canada)⁷, Neuquén (Argentina)⁸ and elsewhere have triggered brutal repression by the police and security forces, raising questions about the democratic legitimacy of the development of this industry.

The climate impacts of the shale gas industry must also be given far greater scrutiny, particularly in developing countries which are already and will be much more directly affected by the consequences of climate change. Gas has never been and never will be a clean fossil fuel. The methane emissions associated with its production, transportation and consumption greatly contribute to a phenomenon we cannot continue to fight with false solutions. This is why gas – and even more so, unconventional gas – cannot be the transition fuel promoted by the industry. The timeframe we now have to avoid a 2°C temperature rise obliges us to urgently look for genuinely sustainable solutions, including much-needed improvements in energy efficiency, incentivised through policy and much higher investments to develop renewables sources of energy. Investing in yet more sources of fossil fuel energy will not deliver on these goals.

The European Union is capable of taking, and should be willing to take, a leading position on the much needed efforts in response to the challenges caused by climate change. The technical innovations created by European engineers and scientists, especially in the fields of renewable energy sources and energy efficiency, could be used, not just to boost Europe's economy and energy independence, but also to provide intelligent and sustainable solutions for countries struggling to find ways out of the energy, climate and economic crises.



Demonstration of a Mapuche group in front of a conventional well owned by Apache in Argentina. © Observatorio Petrolero Sur

- 2 <http://ec.europa.eu/environment/integration/energy/pdf/fracking%20study.pdf>
- 3 http://www.nytimes.com/2009/11/03/opinion/03tue3.html?_r=0
- 4 <http://www.foeeurope.org/heading-south-190614>
- 5 http://en.wikipedia.org/wiki/Balcombe_drilling_protest
- 6 <http://www.aljazeera.com/indepth/opinion/2013/12/pungesti-romania-battlefield-against-chevron-201312117349323363.html>
- 7 <http://www.theguardian.com/environment/2013/oct/21/new-brunswick-fracking-protests>
- 8 <http://www.globalpost.com/dispatch/news/regions/americas/argentina/140528/shale-fracking-oil-gas-drilling-chevron-ypf>

ABBREVIATIONS

tcf	trillion cubic feet ¹
bcm	billion cubic metre
MMBTU	Million British Thermal Unit ²
NOC	National Oil and Gas Company
IOC	International Oil and Gas Company
UGTEP	Unconventional Gas Technical Engagement Programm
DOE	Department of Energy
USTDA	U.S. Trade and Development Agency
DOI	Department of Interior
GEFC	Gas Exporting Countries Forum

1 How many trillion cubic feet in 1 billion cubic metre? The answer is 0.0353146665722. 1 cubic meter is equal to 3.53146665722E-11 trillion cubic feet, or 1.0E-9 billion cubic metre.
2 http://www.energyvortex.com/energydictionary/british_thermal_unit_%28btu%29__mbtu__mmbtu.html



Kudu, one of many endemic grazing species of the Karoo.
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