Central Petroleum - submission to the independent Scientific Inquiry into Hydraulic Fracturing in the Northern Territory.

Central Petroleum is the only onshore gas producer which operates natural gas fields in the Northern Territory. Presently it does not operate, or explore for unconventional shale gas fields, nor does it have any plans to do so. Central makes this submission not from self-interest, but to contribute to an informed and balanced perspective of the issues:

1) the community and the natural gas industry,
2) its importance of natural gas to both the economies of Northern Territory and Australia,
3) socio-economic factors including creating employment in regions with chronic unemployment and enabling local indigenous people a choice of economic opportunities whilst preserving their culture, traditions and attachment to the land, and
4) the science of fracture stimulation.

(1) THE COMMUNITY AND THE NATURAL GAS INDUSTRY

Regional Australia has historically relied on agriculture and the resources sector for its economic existence and development. Agriculture and resources created and justified the development of local infrastructure and a base for other industries such as tourism that follow. As agriculture becomes more efficient, the employment it requires has steadily fallen to a point where it is often insufficient to maintain the critical mass for the survival of the smaller towns in the Territory. This often leads to what is termed the "donutting" of the communities whereby adults between 18-35 years old are obliged to leave to seek employment elsewhere. Communities which have as the in economic mainstay both resources and agriculture (like Mt Isa), invariably enjoy a more stable employment base as well as the benefits of better communications, more essential services (hospitals, schools, banks) and diverse demographics. This has been corroborated by a CSIRO working paper [1] which reported that the CSG industry in the Western Darling Downs contributed to the reduction of poverty, increased employment and family income, and a growing youth population.

A CSIRO survey [2] of the local communities where the much maligned CSG sector operates found a high degree of community acceptance to support (95-98%) the industry, compared to a low degree of opposition (2%-14%). This appears to indicate that the opposition to industry emanates from areas less familiar with the operations or regions where the

benefits of natural gas, such as manufacturing employment, low-cost heating/cooking, fertilizer and plastics can be taken for granted.

Change is also of itself disruptive, making any established community inherently 'change resistant'. Despite the obvious benefits from broadening a community's economic base, inevitably it is accompanied by some loss of economic power and influence by the incumbents, such as having to compete for labour, increased traffic or higher land prices. Change, however, is a concomitant of our higher standards of living and a cleaner environment. Change therefore needs to be managed to ensure community support is maintained.

(2) THE IMPORTANCE OF NATURAL GAS TO THE ECONOMY

Often in the world today, the message can be more compelling than the facts. In our industry we often hear "the future is renewable" slogan followed by a plethora of 140 character tweets. Having access to the NSW statistics it becomes readily apparent how deceptively simplistic this view is. Only 26.9% of the gas consumed in NSW is used for power generation. 49.8% of the gas consumed is used in industry where gas is a primary cost and 12% is consumed by 33,000 small businesses.[3] Overall there are over 300,000 jobs [4] employed in gas dependant industries in NSW with close to 1 million in the four states of NSW, Qld, South Australia and Tasmania. This directly refers to jobs and the final cost of manufactured goods such as glass, bricks, cement, food processing and packaging, fertiliser, explosives, aluminium production and anything that requires heat for manufacturing. Natural gas is vital to the Australian economy as a manufacturing input even if one were to ignore electricity generation.

When a nation has a Prime Minister declaring that there is "a national energy crisis" [5] it is impossible to ignore electricity. Renewables on present technology are an intermittent source of electricity generation. Natural gas is a source of low CO_2 emission electricity when renewables are unavailable. It is true in the residential sector the well-heeled can afford batteries or back up generation but not all Australians are well-heeled nor is the predominant consumption of electricity in the residential sector.

The ACCC Inquiry into the east coast gas market of April 2016 established that there was a natural gas shortage and the COAG communique of August 2016 agreed that "a key issue for gas market reform is to increase the overall supply and the number of suppliers". [6] With the natural decline in production in Bass Strait and the Cooper Basin, the eyes of Australia are turning north in the hope of mitigating the economic carnage that may be visited upon the nation as a result of this shortage. Central's message is quite simple:

"Northern Territory, your country needs your gas"

(3) SOCIO-ECONOMIC FACTORS – LOCAL EMPLOYMENT, INDIGENOUS CHOICE AND THE PRESERVATION OF CULTURE

One third of Central Petroleum's production workforce is local indigenous, one third local non-indigenous and one third is FIFO. We have increased our economic impact on Alice Springs by over $2 million annually. An example of this was the recent replacement of our 4WD fleet. It was cheaper to purchase the new vehicles from Adelaide yet the Company elected to pay slightly more and bought from the local dealer. The Company recognised was economically preferable on the basis of better service, greater access to parts and the necessary accessories that the new vehicles be acquired form a local Alice Springs dealer.

Likewise, with the third of our workforce which is necessarily FIFO, by using scheduled flights to and from Alice Springs (rather than charters) Central increases the load factor on those sectors. The local community as a whole appreciates the importance of regular, sensibly priced air services and our FIFO workers contribute to the viability of such services.

(4) THE SCIENCE OF FRACTURE STIMULATION

Central will leave others to address the science of fracture stimulation, suffice it to say there have been many highly credible enquiries from Royal Academy of Science, the National Academy of Science of America, the Australian Council of Learned Academics, the Chief Scientist of NSW and of course the Hawke Inquiry in the Northern Territory. There is an undisputable scientific consensus at its best, if ever there was one. All scientific inquiries have come to the same conclusion, and so Central will rest its case on those inquiries.

Suffice it to say, fracture stimulation has been used since 1947-48 continuously in the oil and gas sector. 67% of the US natural gas production in 2015 comes from hydraulically fractured wells. [7] Fifty one per cent of US crude oil production came from hydraulically fractured wells. [8] Given its long history and widespread use fracture stimulation the veracity of the apocalyptic messaging from those opposing its use, is easily judged against a wide data set.

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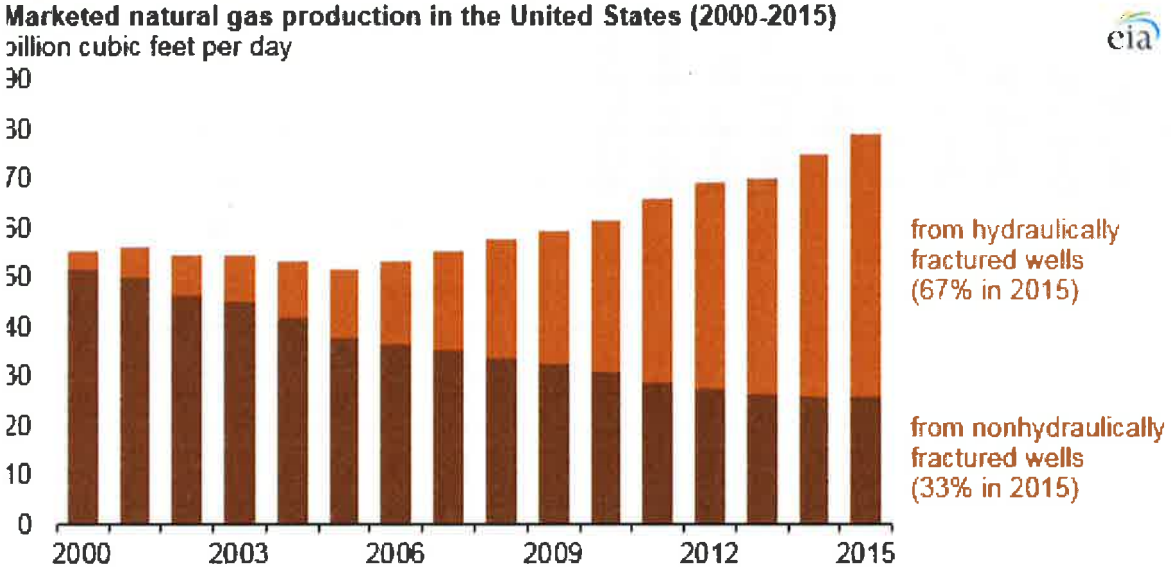
[1] CSIRO working Paper 2013 – Impacts of unconventional gas development
[2] CSIRO "Survey of community well being and responding to change: Western Downs region in Queensland, September 2010
[3] NSW Gas Plan
[4] NSW Gas Plan Common Questions & Answers
[5] AFR 9 March 2017
[6] COAG Energy Council Meeting Communique 19 August 2016
[7] See attachments
[8] See attachments

U.S. Energy Information Administration

Today in Energy

May 5, 2016

Hydraulically fractured wells provide two-thirds of U.S. natural gas production



Source: U.S. Energy Information Administration, based on IHS Global Insight and DrillingInfo Inc.

For decades, hydraulic fracturing had been referred to as an unconventional completion technique, but over the past 10 years it has become the technique by which most natural gas is produced in the United States. Based on the most recent data from states, EIA estimates that natural gas production from hydraulically fractured wells now makes up about two-thirds of total U.S. marketed gas production. This share of production is even greater than the share of crude oil produced using that method, where hydraulic fracturing accounts for about half of current U.S. crude oil production.

Hydraulic fracturing, often in combination with horizontal drilling, involves forcing a liquid (primarily water) under high pressure from a wellbore against a rock formation until it fractures. The fracture lengthens as the high-pressure liquid in the wellbore flows into the formation. This injected liquid contains a proppant, or small, solid particles (usually sand or a manmade granular solid of similar size), that fills the expanding fracture. When the injection is stopped and the pressure is reduced, the formation attempts to settle back into its original configuration, but the proppant keeps the fractures open. This allows hydrocarbons to flow from the rock formation back to the wellbore and then to the surface.

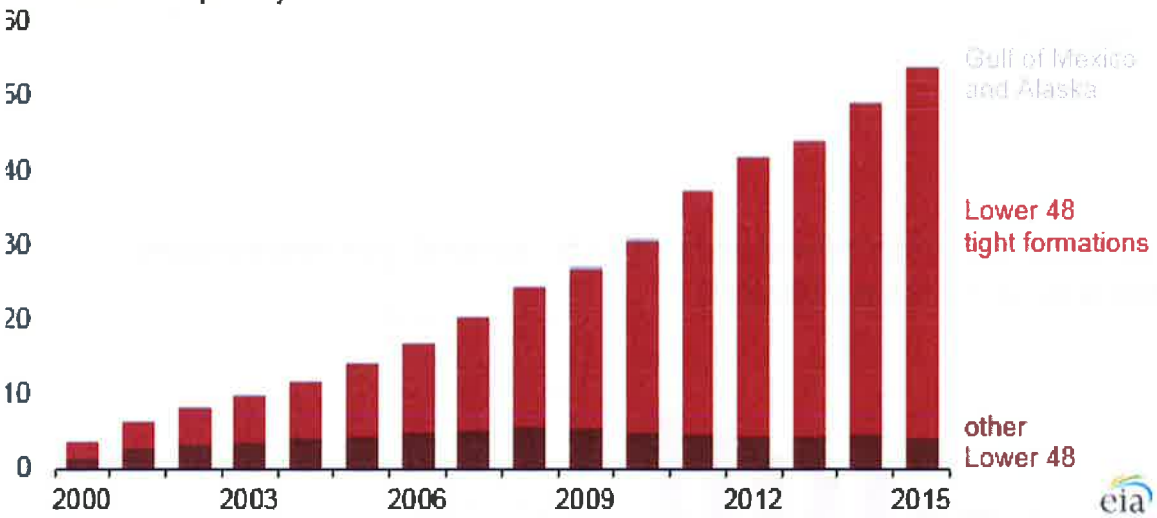
EIA created a profile of marketed natural gas production using well completion and production data from IHS Global Insight and DrillingInfo Inc. that shows a dramatic increase in production associated with hydraulic fracking. In 2000, approximately 26,000 hydraulically fractured wells produced 3.6 billion cubic per day (Bcf/d) of marketed gas in the United States, making up less than 7% of the national total. By 2015, the number of hydraulically fractured wells had grown to an estimated 300,000, and production from those wells had grown to more than 53 Bcf/d, making up about 67% of the total natural gas output of the United States. These results may vary from other sources because of the types of wells included in the analysis, update schedules of source databases, and the specific types of natural gas volumes analyzed.

EIA measures natural gas production in three ways. Gross withdrawals are the full volume of compounds extracted at the wellhead, which includes all natural gas liquids and nonhydrocarbon gases after the oil, lease condensate, and water have been removed. Marketed natural gas production excludes natural gas used for repressuring the well, vented and flared gas, and any nonhydrocarbon gases. Marketed gas is further processed into dry natural gas, also known as consumer-grade natural gas. This process involves not only extracting valuable hydrocarbon gas liquids such as ethane and propane, but also removing impurities such as water vapor and noncombustible gases that would interfere with pipeline operations or end-use applications.

Natural gas production from hydraulic fracturing has primarily come from shale and other tight rocks in the Marcellus and Utica formations of the Appalachian Basin, the Bakken formation in Montana and North Dakota, the Eagle Ford formation in Texas, and the stacked Permian Basin formations in Texas and New Mexico. Monthly natural gas production by geologic formation can be found at EIA's *Natural Gas Weekly Update*. Production and other drilling metrics by geographic area can be found in EIA's *Drilling Productivity Report*.

Marketed natural gas production from hydraulically fractured wells in the United States

billion cubic feet per day



Source: U.S. Energy Information Administration, based on IHS Global Insight and DrillingInfo Inc.

Hydraulic fracturing is not limited to natural gas-containing formations such as shales or other source rocks, nor is it limited to horizontal wells. Hydraulic fracturing has been successfully used in directional and vertical wells, natural gas and oil wells, and in non-tight formations and reservoirs. To date, most natural gas from hydraulically fractured wells has come from Lower 48, onshore tight rock formations.

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U.S. Energy Information Administration

Today in Energy

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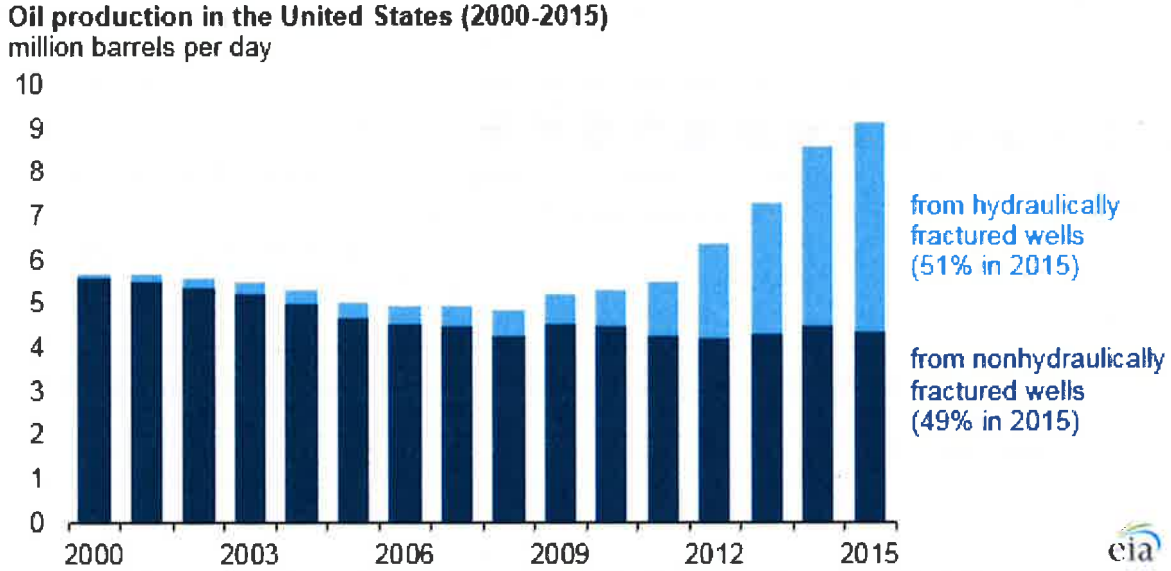
Hydraulic fracturing accounts for about half of current U.S. crude oil production



Source: U.S. Energy Information Administration, IHS Global Insight, and DrillingInfo

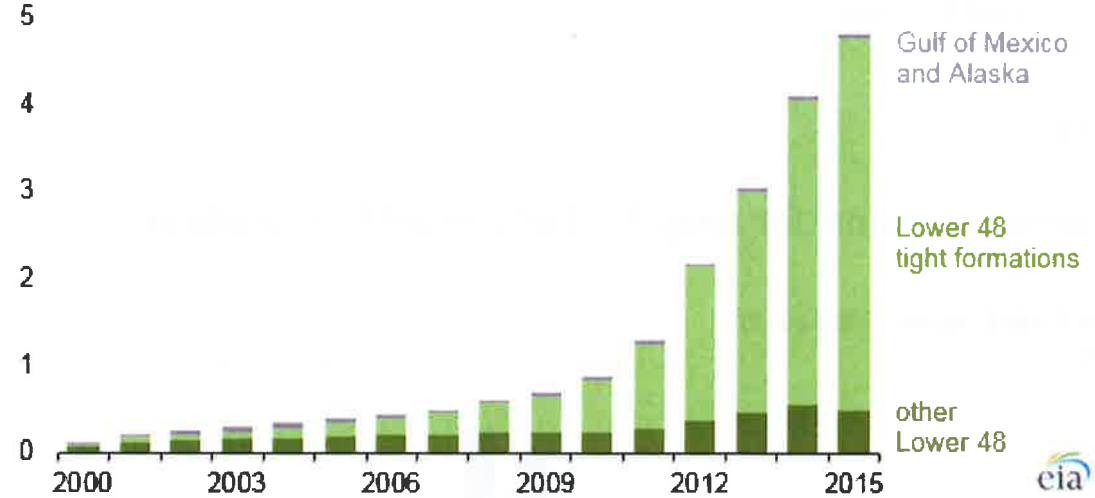
Even though hydraulic fracturing has been in use for more than six decades, it has only recently been used to produce a significant portion of crude oil in the United States. This technique, often used in combination with horizontal drilling, has allowed the United States to increase its oil production faster than at any time in its history. Based on the most recent available data from states, EIA estimates that oil production from hydraulically fractured wells now makes up about half of total U.S. crude oil production.

Hydraulic fracturing involves forcing a liquid (primarily water) under high pressure from a wellbore against a rock formation until it fractures. The fracture lengthens as the high-pressure liquid in the wellbore flows into the formation. This injected liquid contains a proppant, or small, solid particles (usually sand or a manmade granular solid of similar size) that fills the expanding fracture. When the injection is stopped and the high pressure is reduced, the formation attempts to settle back into its original configuration, but the proppant keeps the fracture open. This allows hydrocarbons such as crude oil and natural gas to flow from the rock formation back to the wellbore and then to the surface.

Using well completion and production data from DrillingInfo and IHS Global Insight, EIA created a profile of oil production in the United States. In 2000, approximately 23,000 hydraulically fractured wells produced 102,000 barrels per day (b/d) of oil in the United States, making up less than 2% of the national total. By 2015, the number of hydraulically fractured wells grew to an estimated 300,000, and production from those wells had grown to more than 4.3 million b/d, making up about 50% of the total oil output of the United States. These results may vary from other sources because of the types of wells included in the analysis and update schedules of source databases.

This new oil production has primarily come from shale and other tight rocks in the Eagle Ford formation and Permian Basin of Texas, and the Bakken and Three Forks formation of Montana and North Dakota.

Oil production from hydraulically fractured wells in the United States (2000-2015)
million barrels per day



Source: U.S. Energy Information Administration, IHS Global Insight, and DrillingInfo

The use of hydraulic fracturing is not limited to certain oil-containing formations such as shales or source rocks, nor is its use limited to only horizontal wells. Hydraulic fracturing has been successfully used in directional and vertical wells, both natural gas and oil wells, in tight formations and reservoirs, and in offshore crude oil production.

More information on U.S. crude oil production from tight formations is available in EIA's most recent *Drilling Productivity Report*.

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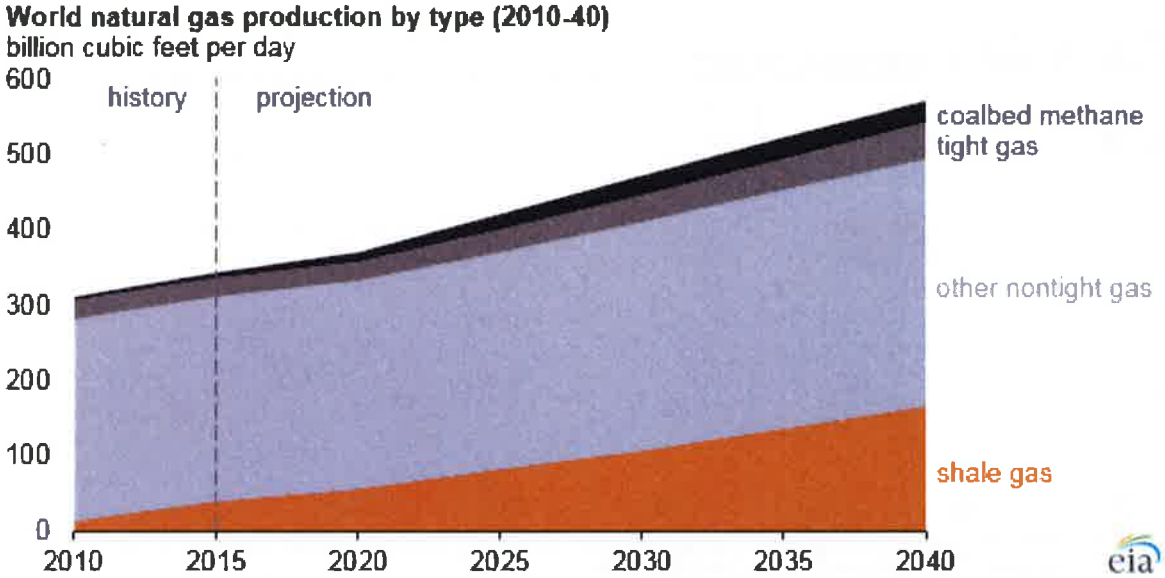
U.S. Energy Information Administration

Today in Energy

August 15, 2016

Shale gas production drives world natural gas production growth



Source: U.S. Energy Information Administration, *International Energy Outlook 2016* and *Annual Energy Outlook 2016*

In the U.S. Energy Information Administration's *International Energy Outlook 2016* (IEO2016) and *Annual Energy Outlook 2016* (AEO2016), natural gas production worldwide is projected to increase from 342 billion cubic feet per day (Bcf/d) in 2015 to 554 Bcf/d by 2040. The largest component of this growth is natural gas production from shale resources, which grows from 42 Bcf/d in 2015 to 168 Bcf/d by 2040. Shale gas is expected to account for 30% of world natural gas production by the end of the forecast period.

Although currently only four countries—the United States, Canada, China, and Argentina—have commercial shale gas production, technological improvements over the forecast period are expected to encourage development of shale resources in other countries, primarily in Mexico and Algeria. Together, these six countries are projected to account for 70% of global shale production by 2040.

In the **United States**, shale gas production accounted for more than half of U.S. natural gas production in 2015 and is projected to more than double from 37 Bcf/d in 2015 to 79 Bcf/d by 2040, which is 70% of total U.S. natural gas production in the AEO2016 Reference case by 2040.

Several AEO2016 side cases illustrate the effect of technological improvements on cost and productivity. Shale gas production in 2040 is projected to be 50% higher under the High Oil and Gas Resources and Technology case, reaching 112 Bcf/d, while in the Low Oil and Gas Resources and Technology case, production is projected to be 50% lower than the Reference case, reaching 41 Bcf/d.

Canada has been producing shale gas since 2008, reaching 4.1 Bcf/d in 2015. Shale gas production in Canada is projected to continue increasing and to account for almost 30% of Canada's total natural gas production by 2040.

China has been among the first countries outside of North America to develop shale resources. In the past five years, China has drilled more than 600 shale gas wells and produced 0.5 Bcf/d of shale gas as of 2015. Shale gas is projected to account for more than 40% of the country's total natural gas production by 2040, which would make China the second-largest shale gas producer in the world after the United States.

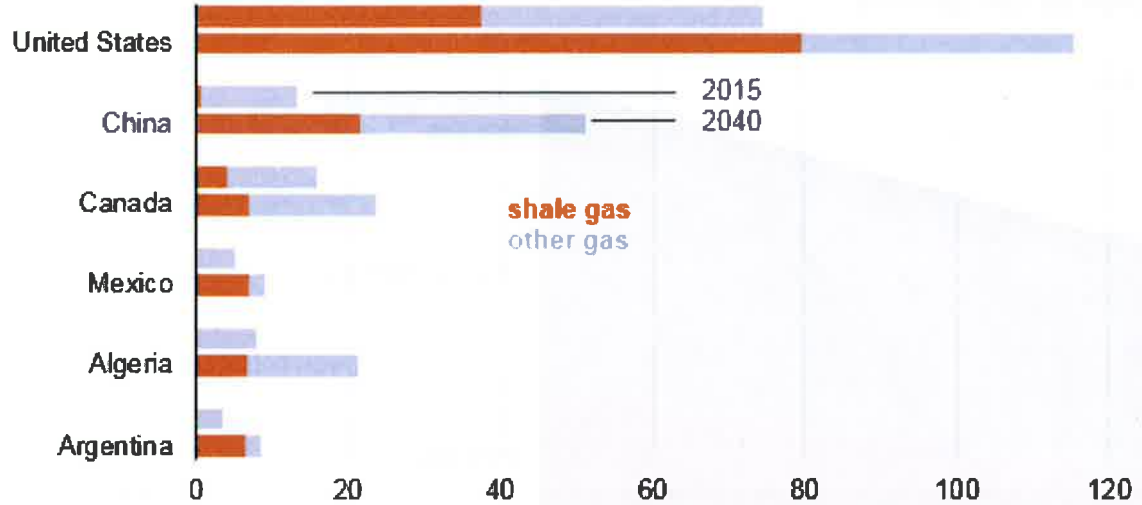
Argentina's commercial shale gas production was just 0.07 Bcf/d at the end of 2015, but foreign investment in shale gas production is increasing. Pipeline infrastructure in Argentina is adequate to support current levels of shale gas production, but it will need to be expanded as production grows. Current shortages of specialized rigs and fracturing equipment are expected to be resolved, and shale production is projected to account for almost 75% of Argentina's total natural gas production by 2040.

Algeria's production of both oil and natural gas has declined over the past decade, which prompted the government to begin revising investment laws that stipulate preferential treatment for national oil companies in favor of collaboration with international companies to develop shale resources. Algeria has begun a pilot shale gas well project and developed a 20-year investment plan to produce

shale gas commercially by 2020. Algerian shale production is projected to account for one-third of the country's total natural gas production by 2040.

Mexico is expected to gradually develop its shale resource basins after the recent opening of the upstream sector to foreign investors. At present, Mexico is expanding its pipeline capacity to import low-priced natural gas from the United States. Mexico is expected to begin producing shale gas commercially after 2030, with shale volumes contributing more than 75% of total natural gas production by 2040.

Shale gas and other natural gas production in selected countries, 2015 and 2040
billion cubic feet per day



Source: U.S. Energy Information Administration, *International Energy Outlook 2016* and *Annual Energy Outlook 2016*
Note: Other gas includes coalbed methane, tight gas and other (nontight) gas.

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