"GOVERNANCE OF SHALE GAS OUTSIDE UNITED STATES: LEGAL AND REGULATORY CHALLENGES"

MR. SAUMIK P. BATHAM

SUBMITTED UNDER THE GUIDANCE OF: MR. RAJKUMAR NARAYANAN

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CERTIFICATE

This is to certify that the research work titled ***" Governance of shale gas outside United States: Legal and Regulatory Challenges"*** is the work done **by Mr. Saumik P. Batham**, under my guidance and supervision for the partial fulfillment of the requirement of the degree of B.B.A. LL.B (Hons.) with Specialization in Corporate Laws at College of Legal Studies, University of Petroleum and Energy Studies, Dehradun.

Mr. Rajkumar Narayanan

Senior Lecturer,

College of Legal Studies,

University of Petroleum and Energy Studies, Dehradun.

Dated: - .04.2015

DECLARATION

I, declare that the dissertation **"GOVERNANCE OF SHALE GAS OUTSIDE UNITED STATES: LEGAL AND REGULATORY CHALLENGES"** is the outcome of my own work conducted under the supervision of Mr. Rajkumar Narayanan, at College of Legal Studies, University of Petroleum and Energy Studies, Dehradun.

I declare that the dissertation is an outcome of the information gained by me through articles and other information available on the Internet and the guidance provided by my Supervisor and in this respect due acknowledgment has been made in the text to all the material used.

Mr. Saumik P. Batham

SAP ID: 500011969

Enrollment No. R760210052

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CONTENTS

LIST OF ABBREVATIONS

ARI	:	Advanced Resources International Inc.
BLM	:	Bureau of Land Management
BTU	:	British thermal unit
CBM	:	Coal Bed Methane
DECC	:	Department of Energy and Climate Change, U.K.
DGH	:	Directorate General of Hydrocarbons
DOE	:	Department of Energy, U.S.
EIA	:	Energy Information Administration, U.S.
EPA	:	Environmental Protection Agency, U.S.
GAIL	:	Gas Authority of India Limited
GAO	:	Government Accountability Office, U.S.
GOI	:	Government of India
GSGI	:	Global Shale Gas Initiative
lEA	:	International Energy Agency
MLR	:	Ministry of Land and resources, China
MMSCMD	:	Million Standard Cubic Feet Per Day
MOEF	:	Ministry of Environment and Forest, India
MoPNG	:	Ministry of Petroleum & Natural Gas, India

NDRC	:	National Development & Reform Commission, China
NEA	:	National Energy Administration, China
NELP	:	New Exploration Licensing Policy
NORM	:	Naturally Occurring Radioactive Materials
NPDES	:	National Pollutant Discharge Elimination System
OIL	:	Oil India Limited
OISD	:	Oil Industry Safety Directorate
ONGC	:	Oil & Natural Gas Corporation
TCF	:	Thermal Cubic Feet
UGTEP	:	U.S. Gas Technical Engagement Program
USGS	:	U.S. Geological Survey

LIST OF FIGURES

ACKNOWLEDGMENT

It is with deep sense of gratitude and reverence that I express my sincere thanks to my supervisor. Shri Rajkumar Narayanan, Senior Lecturer, College of Legal Studies, University of Petroleum and Energy Studies, Dehradun, for his guidance, encouragement, help and useful suggestions throughout my research period. His untiring and painstaking efforts, methodical approach help made it possible for me to complete this work in time.

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-SAUMIK P. BATHAM

CHAPTER 1

INTRODUCTION: AN OVERVIEW

INTRODUCTION: AN OVERVIEW

Definition, History & Recent Scenario & Geology

DEFINITION

Shale gas is natural gas that is found trapped within shale formations[1] or in other words Natural gas production from tight formation is known as "shale gas". At present, it is one of the most rapidly expanding trends in onshore domestic oil and gas exploration and production. Emergence of shale gas as a new and potential source of energy in US and thereafter in other parts of the world mandates the need for studying and understanding the issues and challenges relating to its exploitation around the globe. Also it is important to devise measures, which can be adopted to begin a new era of cost effective and sustainable energy development, which holds high significance for world energy security especially when the conventional sources of energy pose a great threat of exhaustion in the coming future.

HISTORY

George P. Mitchell[2], is regarded as the father of natural shale gas drilling. Natural gas seeps in Ontario County, New York were first reported in 1669 by the French explorer, M. de La Salle, and a French missionary, M. de Galinee, who were shown the springs by local Native Americans. William Hart, a local gunsmith, drilled the first commercial natural gas well in the United States in 1821 in Fredonia, Chautauqua County. The Hart well was first dug to a depth of 27 feet in the shale that outcropped in the area. A 1.5 inch diameter borehole was then drilled to a depth of 70 feet. Hart built a simple gas meter and piped the natural gas to an innkeeper on the stagecoach route from Buffalo to Cleveland[3].

Shale gas was first extracted as a resource in Fredonia, New York, in 1821, in shallow, low-pressure fractures. The Big Sandy gas field, in naturally fractured Devonian shales, started development in 1915, in Floyd County, Kentucky. By 1976,

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[1] U.S. Energy Information Administration" www.eia.us.gov.com

[2] George Phydias Mitchell was an American businessman, real estate developer and philanthropist from Texas. He was the first to use hydraulic fracking to open the Barnett Shale field in Texas. He opened the door to development of shales worldwide. In 2002 Mitchell sold his company, Mitchell Energy & Development, for $3.5 billion to Devon energy, where he remains the biggest shareholder; See, http://www.forbes.com/profileigeorge-mitchell/, last visited on 12.03.2015

[3] http://www.dec.ny.govidocsimaterials_minerals_pdf/nyserda2.pdf.

the field sprawled over thousands of square miles of eastern Kentucky and into southern West Virginia, with five thousand wells in Kentucky alone, producing from the Ohio Shale and the Cleveland Shale, together known locally as the "Brown Shale." Since at least the 1940s, the shale wells had been stimulated by detonating explosives down the hole. In 1965 some operators started hydraulic fracturing the wells, using relatively small fracs: 50,000 pounds of sand and 42,000 gallons of water; the frac jobs generally increased production, especially from lower-yielding wells. The field had an expected ultimate recovery of two trillion cubic feet of gas, but the average per-well recovery was small, and largely depended on the presence of natural fractures[4].

Other commercial gas production from Devonian-age shales became widespread in the Appalachian, Michigan, and Illinois basins in the 1920s, but production was usually small.

GEOLOGY

Because shales ordinarily have insufficient permeability to allow significant fluid flow to a well bore, most shales are not commercial sources of natural gas. Shale gas is one of a number of unconventional sources of natural gas; others include coal bed methane, tight sandstones, and methane hydrates. Shale gas areas are often known as resource plays (as opposed to exploration plays). The geological risk of not finding gas is low in resource plays, but the potential profits per successful well are usually also lower.

[4]ibid

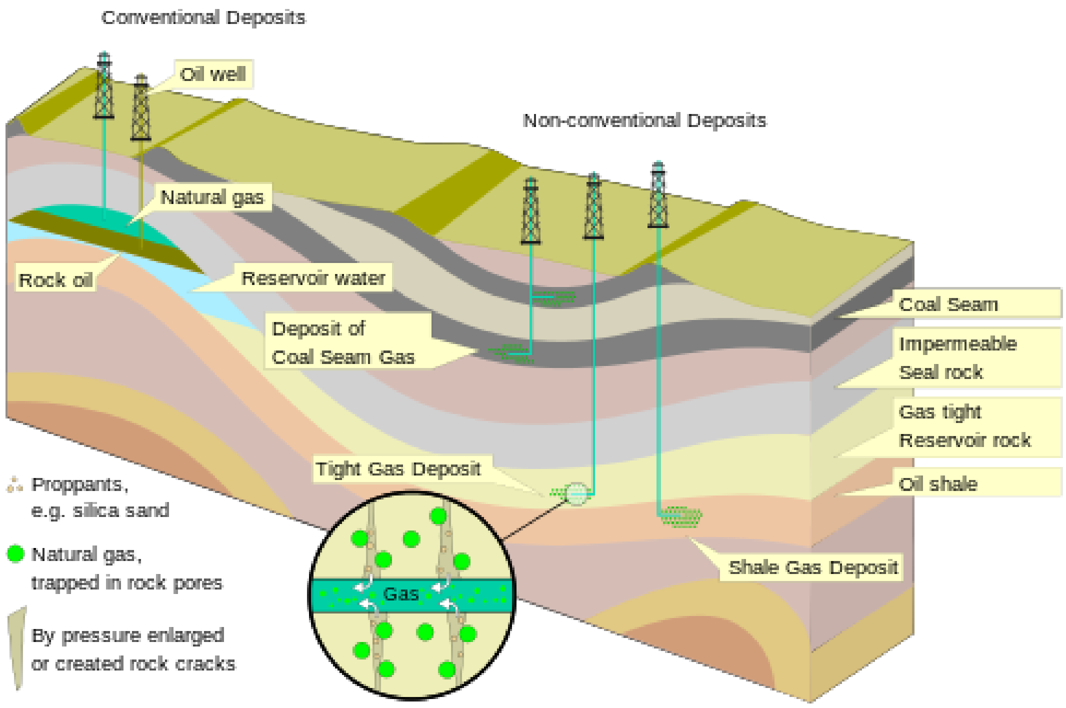

Figure I :An illustration of shale gas location in the Earth

Shale has low matrix permeability, so gas production in commercial quantities requires fractures to provide permeability. Shale gas has been produced for years from shales with natural fractures; the shale gas boom in recent years has been due to modern technology in hydraulic fracturing (frocking) to create extensive artificial fractures around well bores.

Shales that host economic quantities of gas have a number of common properties. They are rich in organic material to 25%) and are usually mature petroleum source rocks in the thermogenic gas window, where high heat and pressure have converted petroleum to natural gas. They are sufficiently brittle and rigid enough to maintain open fractures.

Some of the gas produced is held in natural fractures, some in pore spaces, and some is adsorbed onto the organic material. The gas in the fractures is produced immediately; the gas adsorbed onto organic material is released as the formation pressure is drawn down by the well.

RECENT SCENARIO

At present, Natural gas is one of the most rapidly expanding trends in onshore domestic oil and gas exploration and production. Emergence of shale gas as a new and potential source of energy in US and thereafter in other parts of the world mandates the need for studying and understanding the issues and challenges relating to its exploitation around the globe. Also it is important to devise measures, which can be adopted to begin a new era of cost effective and sustainable energy development, which holds high significance for world energy security especially when the conventional sources of energy pose a great threat of exhaustion in the coming future[5].

Recent improvements in technology have allowed companies that develop petroleum resources to extract oil and natural gas from shale formations, known as "shale or' and -shale gas", respectively, which were previously inaccessible because traditional techniques did not yield sufficient amounts economically viable production[6]. In particular, as we reported in January 2012, new applications of horizontal drilling techniques and hydraulic fracturing—a process that injects a combination of water sand, and chemical additives under high pressure to create and maintain fractures in underground rock formations that allow oil and gas to flow—have prompted a boom in shale oil and gas production[7].

The recent shale gas revolution' in the world has introduced huge uncertainties in the international gas markets that are likely to attract huge investments in gas—both conventional and unconventional—and in many renewable. If the revolution

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[5] http://en.wikipedia.org/wiki/Shale_gas#mediaviewer/file: GasDcpositDiagram.jpg Shale Oil differs from "oil shale". Shale is a sedimentary rock that is predominantly composed of consolidated clay-sized particles. Oil shale requires a different process to extract. Specifically, to extract the oil from oil shale, the rock needs to be heated to very high temperatures-ranging from about 650 to 1,000 degrees Fahrenheit-in a process known as retorting. Oil Shale is currently economically viable to produce. See, United States

[6] Government Accountability Office (GAO), Information on Shale Resources, Development and Environmental and Public Health Risks GA0-12-732 (2012). I United States Government Accountability Office (GAO), Information on Shale Resources, Development and Environmental and Public Health Risks GAO-12-732 (2012)

[7] GAO, Energy-Water Nexus: Information on the Quantity, Quality and Management of water Produced during Oil and Gas Production, GAO-12-156(2012).

continues, energy consumers can anticipate a future dominated by cheap gas[8]. However, if it falters and the current hype about shale gas ends up being an illusion, the world will face serious gas shortages in the coming years.

Till 1990s outside the former Soviet Union, gas failed to increase its share in global primary energy consumption. However, 1990s saw erosion of many of the earlier constraints on its use. Along with its natural advantages as an energy source, this opened up the prospects of much greater use of gas in the future. At the same time, economic and technical developments in liquefied natural gas (LNG) suggested that the international gas trade was likely to expand. Many observe began to speculate that these developments could encourage gas to become more of an international market. Questions began to be asked about whether the increasing globalization of gas might carry significant consequences, as had been the case with oil in the 1970s and after.

If we tend to analyze the reason behind boom of shale gas in United States we would find nothing but the cost effective combination of horizontal' drilling and hydraulic fracture or fracking. This process typically blast huge amount of water, mixed with sand and chemicals, underground to break apart rock and allow the natural gas to flow from the shale into the well. However, (largely) unexpected developments in unconventional gas in the US have confused the picture, in what has been dubbed the shale gas revolution[9].

In we talk about prospects of shale gas in Europe, it would be noteworthy that the geology there is less favorable, there are no tax breaks and the service industry for onshore drilling is far behind that in the United States. Also, there are concerns that disruption caused by shale gas developments will not find public acceptance, especially where the gas is the property of the State and thus the benefits accrue to governments and not to local landowners[10].

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[8] D. Silin & T. Kneafsey, Shale Gas: Nanometer-Scale Observations and Well Modeling, (2012) available at http://dx.doi.org/12118/149489-P.

[9] J. Deutch, The good news about gas: the natural gas revolution and its consequences, FOREIGN AFFAIRS (2011).

[10] Dhrum & Kevin, Is Fracking Good for Environment, (2012), available at http://www.motherjones.com/kevin-drunz/2012/09/fracking-goodenvironllient.

With these advancements, the questions regarding prospects of shale gas, environmental impacts of its use and the ability of current regulatory structure to deal with this development, has arisen. Both regulators and policy makers around the globe have mechanized a system to deal with the complex exploration and production activities pertaining to shale gas reserves which forms the part of the present study.

CHAPTER 2

SHALE GAS AS A POTENTIAL SOURCE OF ENERGY

SHALE GAS AS A POTENTIAL SOURCE OF ENERGY

Understanding shale gas and its significance as unconventional gas

Shale gas is one of the unconventional gases which have high yielding potential. Generally, unconventional gas consists of tight sands gas, shale gas, and coal bed methane gas[11]. Each of these gases is slightly different, but the same combination of technological advancements has been instrumental to their development today.

Tight Sand Gas: Tight sands gas is natural gas that does show natural flow and is formed in low permeability sandstone or carbonate[12].

Coal bed Methane (CBM): CBM is natural gas that exists in coal seams. To produce CBM, it is important to reduce the pressure in the coal seam by pumping huge amounts of water out of the seam. For quite a few years, the coal mining industry drilled through coal bed methane but did not understand how to effectively produce it until 19893[13].

Based on the experiences with coal seams in the United States, global coal seams found in over 100 geological basins hold the potential for coal bed methane production, even those that are too deep for traditional coal mining.

Shale: Shale gas is natural gas present with the fine-grained sedimentary rocks that make up shale formations. Shales are low permeability rocks, so it prevents hydrocarbons from flowing out of the shale into more permeable rock layers. Horizontal and hydraulic fractures are the latest techniques, which have made shale gas production commercially viable. In the United States, shale gas production is estimated to increase from 16 % of domestic natural gas production in 2009 to 47% by 2035[14].

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[11] 'Kent Perry & John Lee, Unconventional Gas Reservoirs Tight Gas, Coal Seams, and Shales 4 (Nat' I Petroleum Council, Working Document of the Global Oil and Gas Study, Topic Paper No. 29,2007) available at http://www.npc.orgiStudy_Topic _Papers/29-TTG-Unconventional-Gas.pdf.

[12] The Rise of unconventional Gas, THE ENERGY INSIDER (EnerDynamics, Laporte, Colo.), (2007), available at http://www.enerdynamics.com/documents/Insder91807 000.pdf

[13] Supra no. 1.

[14] Molly Wurzer, Taking Unconventional Gas to the International Arena, 7 TEX. J. OIL GAS & ENERGY L. 375-80 (2012)

The growth of unconventional gas exploration and development has economic, political, and environmental benefits, both to individual nations and to the world as a whole. As mentioned above, Hydraulic fracturing has helped create a shale gas boom in the United States[15]. It has high prospects of benefiting the public by generating needed energy, strengthening the economy, reducing green house gas emission and making the nation energy independent. Broadly, following benefits can be attribute to the shale gas use.

ENHANCEMENT IN ENERGY PRODUCTION

Oil and gas resources play a vital role in meeting the voracious energy needs of any economic. In US these reserves, currently account for almost two-thirds of the energy consumed. In 2011, oil accounted for about 36% and natural gas accounted for about 26% of the energy consumed in the United States[16]; the percentages for other energy sources were coal 21% nuclear 8% solar, wind, and other non-combustible forms of renewable energy 5% and wood and biomass 4%[17].

Increasingly, this oil and gas comes from unconventional sources of energy. For example, during November and December of 2012 oil production reached its highest volume in 20 years, with much of this increase in due to production from shale and other unconventional formations'. Similarly, the percentage of gas production attributable to shale formations has nearly quadrupled from 8% in 2007 to 30% in 2011, and total gas withdrawals have increased about 20% during this period to record highs'. Between 2009 and 2010 proved oil and gas reserves increased by more than 12% due to expanding exploration and development in unconventional formations, and this showed the largest increase recorded viable. In the United States, shale gas production is estimated to increase from 16% of domestic natural gas production in 2009 to 47% by 2035[18].

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[15] David Neslin, Hydraulic Fracturing: A Comparison of Regulatory Approaches And Trends For The Future, ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013).

[16] See EIA, Energy Perspective: Fossil Fuels Dominate U.S. Energy Consumption (Dec. 14, 2012), available at hitp://www.eia.gov/todayinenergv/detail.cfin?id-9210

[17] Ibid

[18] 'Molly Wuzer, Taking Unconventional Gas to the International Arena, TEX. J. OIL GAS & ENERGY L. 375-80 (2012)

The growth of unconventional gas exploration and development has economic, political, and environmental benefits, both to individual nations and to the world as a whole. As mentioned above, Hydraulic fracturing has helped create a shale gas boom in the United States[19]. It has high prospects of benefiting the public by generating needed energy, strengthening the economy, reducing green house gas emission and making the nation energy independent. Broadly, following benefits can be attribute to the shale gas use.

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[19] David Neslin, Hydraulic Fracturing: A Comparison of Regulatory Approaches And Trends For The Future, ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013).

[20] ibid

[21] See EIA, U.S. Crude Oil Production Tops 7 Million Barrels per Day, Highest Since December 1992 (Feb. 28, 2013), available at http://www.eia.gov./todayinenergy/detail.cfni?id-10171.

[22] See EIA, Natural Gus Summary (Feb. 28, 2013), available at http://www.eia.gov/dnaving_sum_isum_dcu_nus_a.htm.

[23] See EIA, U.S. Crude Oil. Natural Gas, And Natural Gas Liquids proved reserves (Aug.

These trends are projected to continue, with oil production increasing by any one more than 30% by 20l9 and the United States becoming a core natural gas exporter by 2020. Natural gas including shale gas is becoming a prominent energy sources in many ways. First, it is the cleanest burning fossil fuel, with half of the carbon dioxide emissions as coal and 30% less than oils. With the encouragement of climate regulations, natural gas is emerging as a leader in the electric power industry‘. Also natural gas is safe and publicly acceptables[25]. This fact has become increasingly significant after the earthquake and tsunamis that caused a nuclear havoc at Fukushima-Daiichi nuclear plant in Japan in March 2011[26].

Beyond meeting more of the nation’s increasing energy needs, unconventional oil and gas development also enhances the countries geopolitically[27]. It helps in reducing the nation’s dependence on foreign energy and consequently improves its energy security and ultimately its national security. Reducing energy imports also lessen the outflow of currency of foreign interests, making these funds available for domestic investment[28].

12,2012), available at http://www.eia.gov/naturalgas/crudeoilreserves.

[24] 1DBP’T OF ENERGY, Modern Shale Gas Development in the United States (2009), available at http://www.netl.doe.gov/technologies/oil- p@figafi0Meprepom/smle_gas_primer_2009.pdf. _
lneson, Op-Ed., America's natural Gas Revolution, WALL St. J.

[25] J. OIL GAS & ENERGY L. 375-80 (2012)

[26] Perspectives of Unconventional Gas: A , 1 " ,§the.EU's Energy Security, EUCERS STRATEGY
* ' A . <- ‘K available at http://www.eucers.eu/wp- Perspect1ves_of_Unconventional_
regulatory Approaches And Tends
r " (2013)

[27] See EIA, Annual Energy Outlook 2013 Early Release Overview (Dec. 5, 2002, available at hlgp:/Mww.eia.govlforecasts/aeo/er/early_pr0duction.cfm.

[28] See EIA, U.S. Crude Oil. Natural Gas, And Natural Gas Liquids proved reserves (Aug 12,2012), available at http://www.eia.gov/naturalgas/crudeoilreserves.

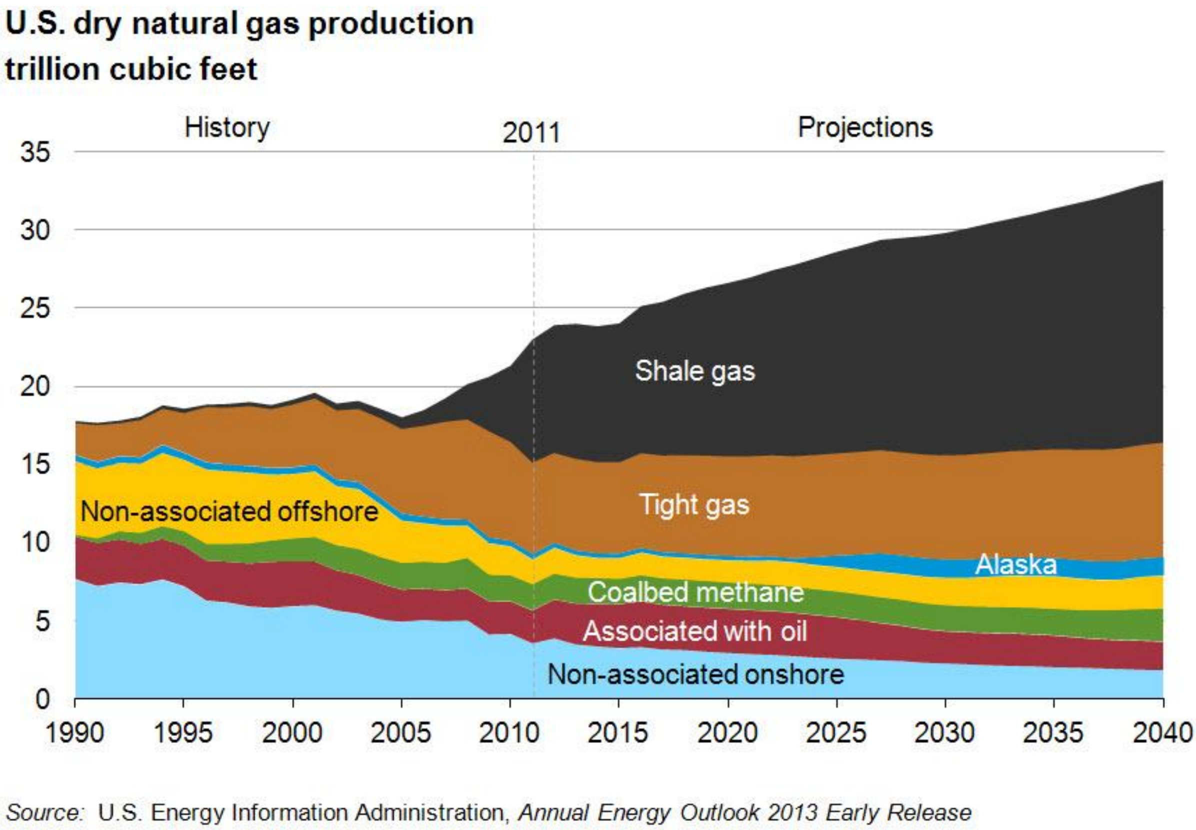

Figure 2: US Dry Natural Gas Production in TCF

CHAPTER 3

TECHNIQUES USED FOR EXPLORATION OF SHALE GAS

TECHNIQUES USED FOR EXPLOITATION OF SHALE GAS

The process of bringing a well to completion is generally short-spanned, taking a few months for a single well, after which the well can be in production for 20 to 40 years[29]. The process of drilling a single horizontal well typically includes four to eight weeks to prepare the site for drilling, four or five weeks of rig work, including casing and cementing and removing all associated auxiliary equipment i.e. fixtures off the well site before fracking operation commence, and thereafter it takes two to five days for the entire multi-stage fracturing operation. The modern technologies developed for extracting shale gas are discussed herein[30].

HORIZONTAL DRILLING AND HYDRAULIC FRACTURING

Exploration and production of shale gas reservoirs have been possible as a result of the increased use of two specific technologies: horizontal drilling and hydraulic fracturing. Horizontal drilling is a form of directional drilling, in which the wellbore departs from a traditional vertically drilled wellbore by more than 80 degrees'. The wellbore typically penetrates a greater length of a reservoir than a traditional vertical well, so production from horizontal wells is generally improved from production in vertical wells[31].

Hydraulic fracturing refers propagation of fractures in a rock layer, using a pressurized fluid. Some hydraulic fractures form naturally—certain veins or dikes are examples—and can create conduits along which gas and oil from source rocks may displace to reservoir rocks.

Induced hydraulic fracturing or hydro-fracturing, commonly known as fracking, is a technique used to release petroleum, natural gas (including shale gas, tight gas, and coal seam gas), or other substances for extraction. This type of fracturing causes fractures from a wellbore drilled into reservoir rock formation.

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[29] SCHLUMBERGER OILFIELD GLOSSARY, Horizontal Drilling, available http://www.glossary.oilfield,slb.coni/Display.cfin?Term=horizontal%20drilling, SCHLUMBERGER OILFIELD GLOSSARY, Directional Drilling, available a, http://www.glossary.oilfield,s1b.com/Display.cfm?Term=directional%20ch-illing

[30] Ibid

[31] P.R. Reddy, Shale gas as an energy resource-Pros and cons, 17 J. IND. GEOPHYS UNION 195-99(2013

The first of hydraulic fracturing was done in 1947 but the modern fracturing technique, called horizontal slick water fracturing, that made the extraction of shale gas economical was the results of continued technological development and additional experimentation by Mitchell Energy, and Development Corporation in the 1980s and 1990s in the Barnett fields in Texas, USA[32]. This process involves harnessing the energy from the injection of a highly pressurized hydraulic fracturing fluid creating new channels in the rock, which can increase the extraction rates and ultimately recover the hydrocarbons[33].

The advancement in technology that made horizontal drilling viable include improved down hole drilling motors and down hole telemetry equipment'. Other advances include "enhancements for prospect evaluation and core testing; shale litho typing which determines key characteristics of technically recoverable shale; and optimizing and tailoring water-fracturing fluid chemistry for the shale and remedial treatment processes for obtaining long-term production. In addition to these existing technologies, modern technologies are constantly being developed that will further assist in the development of unconventional gas.

[32] David Spence, Federalism Regulatory Lags, and the Political Economy of Energy Production, U.PA. L. REV.(2012).

[33] U.S. Energy Info. Admin., U.S. Dept't Of Energy, World Shale Gas Resources: An Initial Assessment Of 14 regions Outside The United States 2 (2011), available at http://www.ela.gov/analysis/studies/worldshalegas/pf/fullreportpdf.

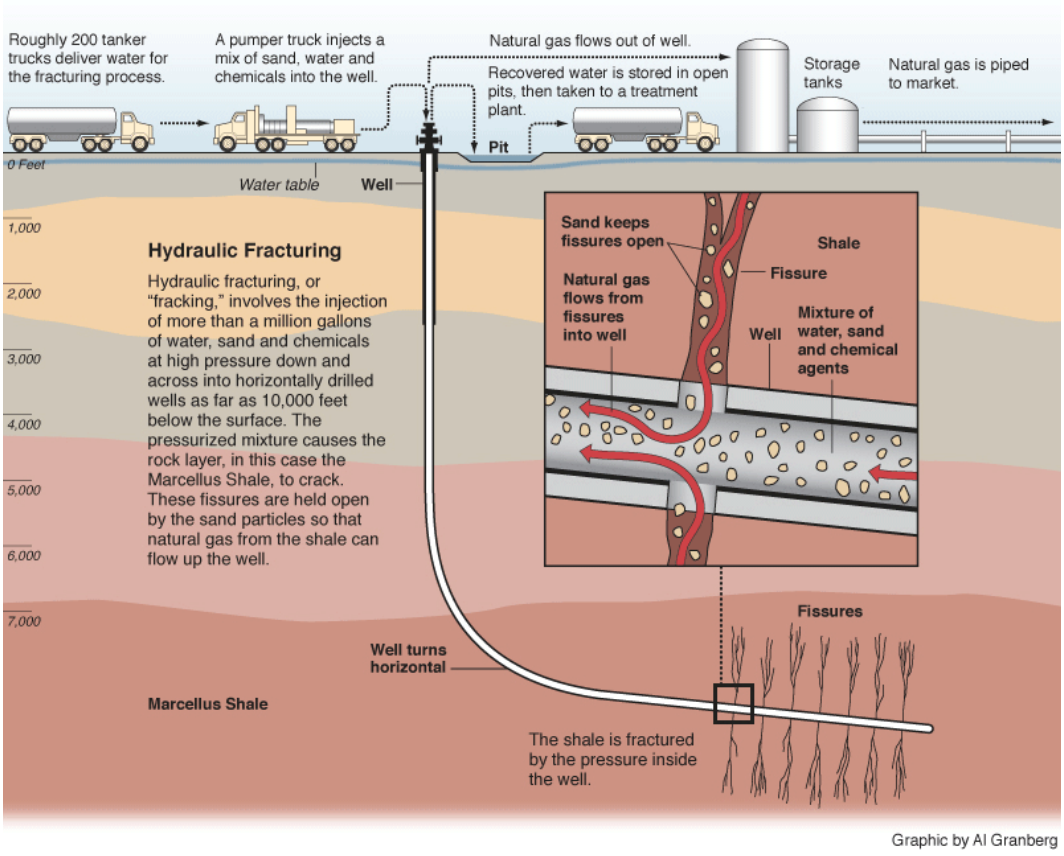

Figure 3: Hydraulic Fracturing Process

FRACTURING FLUIDS

High pressure fracture fluids are injected into the wellbore, with the pressure above the fracture gradient of the rock. The two main purpose of fracturing fluid are, firstly to cause the fractures and secondly, to carry proppant into the formation, the purpose of which is to stay there without harming the formation or production of the well. The most commonly used proppant, is silica sand, though proppants of uniform size and shape, such as ceramic proppant, is believed to be more effective.

Two modes of transporting the proppant into the fluid are used—high-rate and high-viscosity. High viscosity fracturing tends to create large dominant fractures, while with high rate (slick water) fracturing causes small spread out micro fractures. This fracture fluid contains water soluble gelling agents (such as guar gum) which increase viscosity and efficiently deliver the proppant into the formation. The fluid injected into the rock is generally a mix of water, proppants, and chemical additives.

Additionally, gels, foams, and compressed gases, including nitrogen, carbon dioxide and air can be injected. Typically, of the fracturing fluid 90% is water and 9.5% is sand with the chemicals amounting to about 0.5%. Due to a higher porosity within the fracture, a larger amount of oil and natural gas is liberated. The fracturing fluid varies in composition depending on the type of fracturing used, the conditions of the specific well being fractured, and the water characteristics. A typical fracture treatment uses between 3 and 12 additive chemicals. The most regular chemical used for hydraulic fracturing in the United States in 2005-2009 was methanol; while some other most widely used chemicals were isopropyl alcohol, 2-butoxyethanol, and ethylene, glycol.

FRACTURING MONITORING

Measurements of the pressure and rate during the growth of a hydraulic fracture, as well as understanding the properties of the fluid and proppant being injected into the well provides the most common and simplest way of monitoring a hydraulic fracture treatment. This data, plus the knowledge of the underground geology can be used to model information such as length, width and conductivity of a propped fracture.

For more advanced applications, micro seismic monitoring is often used to estimate the size and orientation of hydraulically induced fractures. Micro seismic activity is measured by placing an array of geophones in a nearby wellbore. By mapping the location of any small seismic events attached to the growing hydraulic fracture, the approximate geometry of the fracture is inferred. Tilt meter arrays, employed on the surface or down a well, provide different technology for monitoring the strains produced by hydraulic fracturing.

CHAPTER 4

SHALE GAS AND ENVIRONMENT

SHALE GAS AND ENVIRONMENT

Unconventional gas exploitation involves the significant use of advanced technologies, specifically, the use of hydraulic fracturing. Consequently, it has spurred concerns about immediate and long-term environmental effects[34]. Past a few years, both the United States and the global community have been subjected to sharp public criticism of this technique and calls for continuing research and studies. Hydraulic fracturing has been stopped (either in outright bans or temporary moratoriums while additional research is done) in a variety of places, including Quebec, France and South Africa[35]. In other countries, in China, where the media is state-owned, and environmental activists particularly those opposing government decisions do not receive much media attention.[36]

WATER USE AND TREATMENT OF WASTE WATER

Shale gas exploitation through the technique of hydraulic fracturing uses enormous quantities of fresh water. This issue is more serious in water-stressed areas. Water is thus a major -concern in the development of unconventional gas. Around two to four million gallons of water are needed to drill a horizontal well and hydraulically fracture it[37].

However, hydraulic only occurs at the beginning of well's life. In the United States, service companies have been trying to increase the amount of times water can be reused for hydraulic fracturing[38]. Reverse osmosis systems and evaporation systems

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[34] Kevin Dougherty, Minister Con firms Ban on Frocking in Quebec, CALGARY HERALD (2011), available at ht-tp://www.canada.comicalgarybusinessistory.html?id-6c0f3da,lf$d1- 4b86-99c3-4d0b9lcbe46b

[35] Tara Patel, France Vole Outlaws 'Fracking' Shale for Natural Gas, Oil Extraction, BLOOMBERG (July 1, 2011), available at http://www.bloomberg.com/news/2011-07- 0 1 /france -vote-outlwas-fi acking-shale-for-natural-gas-oil-extraction.html

[36] John Shimkus, South Africa's Mining Minister Extends Shale Frac Ban, ENERGY DIGITAL (Aug. 18, 2011), available at http://www.energydigital.com/oil_gas/south¬africa's-mining-minister-extends-shale-frac-ban

[37] John Daly, China to Embrace Fracking in an Effort to Ramp up Energy Production, OIL PRICE.COM (Nov. 28, 2011), available at http://oilprice.com/energy/natural-gas/china -to-embrace-fracking-in-an-effort-to-ramp-up-Energy-production.html

[38] Jennifer L., Miskimins & Jeff Johson, The Technical aspects of hydraulic fracturing, presentation at Rocky Mountain Mineral Law Foundation Workshop: Hydraulic Fracturing: Core Issues & Trends (Nov. 17, 2011)

can treat water so that it can be recycled. Modern technology enables water to be recycled in the large volumes needed for hydraulic fracturing[39].

Available solutions include:

(i) reuse or recycle of flowback water (although this does not account for 100% of the water needed for each tracking operation), and

(ii) use of water from saline aquifers which are not used for human consumption or agriculture[40].

Regulators must consider introducing these requirements for shale gas operations. The water consumption issue has another edge. Oil and gas contracts often do not have water rights attached, so producers generally have to buy access to water from the Government or the landowners (depending on the legal regime). Regulators must also consider how to regulate water use incentives, the life of such incentive and the fees to be charged[41].

CONTAMINATIONS OF AQUIFERS

Contamination of water and the aquifers is another serious issue. After drilling of the well and completion of process of hydraulic fracturing, there is a lot of water left over, filled with contaminants from the fracturing fluids or naturally occurring radioactive materials. These left over water are not fit for human use and needs to be treated accordingly[42].

These are three potential leak paths for this water to get into the aquifers[43]:

(i) Migration of contaminated water through naturally occurring or induced fractures;

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[39] Jennifer L., Miskimins & Jeff Johson, The Technical aspects of hydraulic fracturing, presentation at Rocky Mountain Mineral Law Foundation Workshop: Hydraulic Fracturing: Core Issues & Trends (Nov. 17, 2011).

[40] ibid

[41] Jose Martinez de Hoz & Thomas Lanardonne et. al., Shall We Dance An Unconventional Tango? ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013)

[42] Supra no. 38

[43] Molly Wurzer, Taking Unconventional Gas to the International Arena, 7 TEX.J.OIL GAS & ENERGY L.375-80 (2012)

(ii) Groundwater contamination through poorly lined pits of drilling fluids, fracturing fluids, and flow back water; and

(iii) Poor cementation of well casing that causes water to leak out the wellbore and contaminate the aquifer through which it passes.

The first and foremost potential leak path is migration through natural or induced fissures. In the United States, fracturing fluid disclosure conditions have become a hot topic. Currently, the **Fracturing Responsibility and Awareness of Chemicals Act (FRAC Act**) is in force, which requires disclosure of fracturing fluids'. Although hydraulic fracturing fluid is comprised of over 98% of water and sand', there has been much public concern that dangerous substances are being pumped into the ground that will gradually make their way to contaminate aquifers[44].

Second, hydraulic fracturing fluid can contaminate aquifers if ground water is contaminated. Water used for drilling, temporary oil storage, and burn-off of waste oil is often kept on the well site in storage pits'. Contamination takes places when there is a failure of a storage tank, a storage pit liner, or the line carrying fluid in the pit. To avoid contamination, it is important to ensure that these fluids stay in the pits'. Another measures measures is a closed loop fluid handling system, which does not use a pit, and that keeps the fluid away from touching the ground'. Some states also have additional regulation to make sure contamination does not occur, such as restrictions on how close a pit can be to a water sources[45].

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[44] Fracturing Fluid Management, FRAC FOCUS (2012), available at http://fracfocus.org/hydraulic-fracturing-how-it-works/dri I ling-risks-safeguards.

[45] See, Ian Urbina, A Tainted Water Well, andConern There May Be More, N Y TIMES, Aug. 3 2011, available at http://www.nytimes.com/2011/08/04/us/04natgas.html?_r= I

Finally, leak paths can also occur within aquifers through poor casing. Although there has been much public concern about water contamination because of hydraulic fracturing, it is really an issue of wellbore integrity rather than the fracturing process itself[46].

LAND USE

Like any type of drilling operation, unconventional gas exploitation involves a great deal of land. Since these unconventional gas reservoirs are found in places not traditionally associated with drilling, well pads will increasingly need to be constructed in new areas, with some of these areas around population centers[47].

Several researchers cite population density as a major factor that will delay shale gas production outside the United States3. While population density is 34 people/km in the United States, it is 259 people/km2 in the U K and 139 people/km in China[48]. Among the concerns of high density populations include problems related to noise pollution and landscape disruptions. Another potential problem is the inadequate time it takes to get a. license for drilling when there is significant community opposition to a well site. Variety of technologies and practices exist to make well pads less burdensome on the public[49]. These include:

The use of sound walls and blankets to reduce noise, the use of directional or shielding lighting to reduce nighttime disturbance to nearby residence and businesses, the use of pipelines to transport water resulting in reduced truck traffic, and the use of solar-powered telemetry devices to monitor gas production resulting in reduced personnel visits to well sites[50].

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[46] Fracturing Fluid Management, FRAC FOCUS (2012), available at http://fraelocus.org/hydraulic-fracturing-how-it-works/drilling-risks-safeguards.

[47] DEUTSCHE BANK, EUROPEAN GAS: A First Look At Eu Shale-Gas Prospects 4 (2011), available at http://www.longfinance.netlimages/reports/pdf/db_shale_2011.pdf

[48] Written Ministerial Statement by UK's Secretary of State for Energy and Climate Change on Exploration for Shale Gas (2012), available at www.decc.gov.uklenicontent/cms/news/wms_shale/wms_shale.aspx.

[49] ibid

[50] ibid

EARTHQUAKES

Since hydraulic fracturing involves use of high pressures to crack rock deep below the earth's surface, there has been concern over the possibility of earthquakes. For most of the parts, scientists have been unable to confirm a link between hydraulic fracturing and large seismic events[51].

An earthquake of magnitude 2.5 on the Richter scale was recorded on April 1, 2011 in U K and thereafter the Government imposed an almost 2-year moratorium on hydraulic fracturing operations as the disaster was found linked to the injection of flow back water. So, the potential correlation of increased shale gas production and increased earthquake risks is another major concern[52].

Experts opine that moderate earthquakes can be generated when the well or the fractures intersect and reactivate an existing "fault". So, it is recommended to the operators to survey carefully the geology of the area to assess whether faults present an increased risk of earthquake and to avoid such areas for drilling and fracturing[53]. "Conventionally techniques can identify such faults and interaction with them can be avoided°. Moreover, while drilling or fracturing, operators must monitor any possible seismic activity and should immediately suspend operations if there are signs of increased seismic activity.

AIR EMISSIONS

During well completion, collecting and processing flow back water is standard practice. Capturing the gas requires investments in gas separation and processing facilities, which does not always take place[54]. Venting and/or flaring5 of the gas

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[51] Henry Fountain, Add Quakes to Rumblings over Gas Rush, N.Y. TIMES (Dec. 12, 2011), available at http://www.nytimes.com/2011/12/13/science/some-blame-hydraul ic-fracturing-for -earthquake-epidemic.html?pagewanted=1&_r=1&ref=science

[52] Jose Martinez de Hoz & Tomas Lanardonne et.al., Shall We Dance An Unconventional Tango?, ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013)

[53] Flaring & Venting in the oil & gas exploration & production industry" (2000) of the International Association of Oil and Gas Producers, available at www.ogp.org.uk./pubs/288.pdf)

[54] Unwanted gas (in shale oil operations) has been increasing significantly in the U.S.A. over the last years causing growing conscience about the waste of recourses and damage tc the environment. The years volume of gas flared off in North Dakota raised 50% in 2012 and the Texas state regulator issued in 2012 six times more permits to flare than in 2011 Flaring is the result in part of the tow price of natural gas in the U.S.A. which can mak(uneconomic to build pipelines to handle gas. See "Shale Gas

(mostly methane) at this stage is one of the environmental concerns related to greenhouse emissions by shale gas operations.

Regulators should consider to target zero venting and minimal flaring of natural gas by way of:

(i) establishing restrictions to such practices and mandating the installment of equipment to minimize emissions, and/or

(ii) taxing the greenhouse gases released during shale gas operations such as the "carbon tax" created y the Province of Alberta (Canada) in respect of oil tar sands exploitation'.

As with water, these air emissions are the subject of proliferating and sometimes conflicting studies and commentary. For example, a study by researchers at the University of Colorado, School of Public Health found that residents living within one-half mile of wells in Western Colorado are at greater risk for health effects from natural gas development than residents living further away and that the risks were greatest during the hydraulic fracturing process[55].

However, an extensive study prepared for the city of Fort Worth "did not reveal any significant health treats" extending beyond the City's 600-foot setback requirement[56].

Emissions data collected by the State of Pennsylvania indicates that shale gas development generally accounted for less than 10% of the air pollutants generated by stationary sources during 2011[57].

Boom Now Visible Fron Space", Financial times, January 28, 2013, available at www.cnbc.com/id/100412356.

[55] Lisa M. Mckenzie, Roxana 2. Witter, Lee S. Newman, John L. Adgate, Human heal!, risk assessment of air emissions from development of unconventional natural ga resources, SCIENCE OF THE TOTAL ENV'T 424:79-87 (May 2012), abstract availabl at http://www.ncbi.nlm.nih.gov/pubmed/22444058.

[56] Eastern Research Group, Inc. & Sage Environmental Consulting, Lp, City Of Fort Wort Natural Gas Air Quality Study xiv (July 13, 2011), available ; http://fortworthtexas.gov/gaswells/defaultaspx?id=87074.

CHAPTER 5

SHALE GAS IN INDIA

[57] Eastern Research Group, Inc. & Sage Environmental Consulting, Lp, City Of Fort Wort Natural Gas Air Quality Study xiv (July 13, 2011), available ; http://fortworthtexas.gov/gaswells/defaultaspx?id=87074

NATURAL GAS SCENARIO IN INDIA

Compared to coal, the importance of gas m India will grow manifolds. However there is an uncertainty in the expectations of an Indian shale-gas boom: the US government's Energy Information Administration found that India had just 96tcf of technically recoverable shale-gas resources1&2[58]. However, large offshore finds have helped to boost India's reserves significantly assuming more discoveries are made. Present demand for Natural gas stands at 300 mmscmd while production is only 180 mmscmd. Gas based power plants are operating at Plant Load Factor of 29% while many are lying idle for want of gas and can't operate because expensive LNG imports make electricity generation at current prices unviable. India's 26 sedimentary basins are relatively unexplored with potential reserves at 8935 million barrels of oils. Even today, 15% of sedimentary areas remain unexplored, which was 50% in 1996'. The fledgling KG-D6 block of Reliance is producing just 14 mmscmd against the envisaged 80 mmscmd[59]. Rigid regulations and APM have kept foreign investors with expertise away from NELP with major blocks going to ONGC and OIL. These state-run companies don't have incentive or the finances to innovate and expedite production with the result that their production levels have been stagnant in last 10 years and many new discoveries lagging years behind schedule making gas shortage chronic[60].

In the current scenario, India needs to tap foreign expertise to exploit hard-to-reach hydrocarbons. A generally problematic environment for foreign investors in India, however, means that joint ventures are likely to be helpless to bureaucratic delays[61]. A cap on retail prices for fuel will continue to discourage investment and hamper production growth. Gas demand will outstrip domestic supply. As industry's needs

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[58] Report by US Energy Information Administration titled 'Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale formations in 41 countries.' Chapter 24. Published on 10 June 2013

[59] ibid

[60] 'Detailed report on Natural Gas Scenario MoPNG - 12th:13th Five Year Plan' Infraline Energy Database http://www.infraline.com/ongsector/#Natural-Gas-Scenario-XlIth-XIIIth-
five- year-plan-161586.htm

[61] Central Electricity Authority Website,littp://www.cea.nic.in/reportsimonthly/ elecreview/ jun 1 3.pdfJune 2013

http://world.bymap.org/OilReserves.html Established January 2012 grow and gas displaces coal in the power sector, consumption of natural gas will grow by 9% annually to 109.7 mtoe in 2020. The shortage of gas supplies is likely to continue during FY13— FY22. It is estimated to average around 72 mmscmd per annum[62]. While the deficit as a percentage of demand is likely to decrease from 38.2% in FY12 to 12.4% in FY22, the country's dependence on imported gas is likely to increase considerably'. The share of imported gas in India's total gas supplies is likely to increase from 22.5% in FY12 to 54.2% in FY 2022. More gas imports will be needed, heightening energy-security worries. Out of this, LNG is likely to account for a major share, with LNG imports increasing from 38.5 mmscmd in FY12 to 258 mmscmd in FY22. This high dependence on imported gas could have significant implications on India's energy security and the overall trade deficit of the country. Although the global LNG liquefaction capacity is projected to increase significantly over the next few years, gas prices under new LNG supply contracts are likely to remain high given the forecast of high crude oil prices. The sourcing of fresh LNG supplies at competitive rates has been a challenge on account of the intensifying competition among Asian companies. Competition is likely to further intensify due to an increased Japanese appetite for LNG for power generation after the shutdown of most of the country's nuclear power plants along with China's plans to augment its LNG imports. LNG supply projections for India depend upon the timely commissioning of the proposed LNG terminals (Ennore, Mundra, Paradip, Vizag, Mangalore and Dhamra).

On the bright side, India benefits from relative proximity to Australia, a burgeoning LNG provider. India is also exploring its pipeline gas options, although the outlook is challenging. Construction of the Turkmenistan-Afghanistan-Pakistan- India (TAPI) gas link could be undermined by instability along the route. India cannot count on TAPI to shore up its gas security. More gas imports and expanded domestic production will NNexpand the proportion that natural gas claims in India's energy

[62] `Directorate General of 1 lydrocarbons ht-tp://www.dghindia.org /SedimentaryBasins.aspx# Report by Ernst and Young 'Shale Gas - global experience and key learning', released at the International Congress on Shale Exploration India 30th August 2013.

consumption to 9.4% at decade's end from around 6.7% in 2011. That is still a long way behind coal and oil[63].

BENEFITS OF SHALE GAS IN INDIA

India being the state of unstable supply and heavy dependence on imports, it has becomes essential to harness all its energy resources, including shale gas and Coal Bed Methane, appropriately. The unlocking of domestic shale gas can help India meet its growing energy demand, besides reducing its dependence on expensive energy imports and the energy import bill. Taking a note from the impact of shale gas development in the US, the development of the sector can help increase economic activity in the country, thereby boosting government revenues and creating new jobs.

A case in point is Gujarat where the development of gas infrastructure led to the application of gas in new sectors such as industrial and commercial establishments in the ceramics, glass, chemicals, textiles, pharmaceuticals and diamond industries, among others. With just 5% of population, the state of Gujarat accounts for a mammoth 32% of India's gas consumption[64]. With some degree of intervention from the judiciary and local state governments, the household and automobile segments have the potential to further boost city gas demand as well. This will result in saving of cost involved in packaging of LPG cylinders and reduction in the subsidy bill. Initially, the prices of shale gas may not be economically viable for industries, such as power and fertilizers, where the prices of end products are regulated or price hikes are difficult to pass on to customers. However, it could be a viable alternative for meeting the needs of peak and captive power units and other sectors such as transportation, refineries and steel where it can substitute expensive liquid fuels.

[63] Report by Ernst and Young 'Shale Gas - global experience and key learning', released at the International Congress on Shale Exploration India 30th August 2013

[64]

KEY POLICY REQUIREMENTS FOR DEVELOPING SHALE GAS

Oil and Gas sector is single largest contributor to the national exchequer. Therefore, government must make reforms in Oil and Gas sector a priority including incentives, abolishing duties and tax holidays. For real boom in the development of Shale gas to occur in India, private sector needs to play the key role. Following the path of success stories ofCairn and Reliance, private oil companies must try play a vitalrole so that India can truly reform/improve its gas story.

Certain things which can be followed in this regard can be as follows[65]:-

- Firstly establishing a research center for development of shale gas technologies for the Indian geology should be the first step.

- Secondly, for existing companies to make investment in Shale gas, government could move to Revenue sharing contracts rather than Production Sharing contract (PSC) with 60- 40% or 75-25% revenue sharing.

- Thirdly, since this is a capital intensive sector, liberal FD1 regimes and increased participation from large global oil companies such as BP, ConocoPhillips, BHP Billiton etc. should be encouraged since they will also bring with them modern technology and technical know- how to ramp up the gas production with ease.

- Fourthly, Indian government must try and engage USA for sharing of technical data on shale gas and its prospects in India.

- Fifth, joint ventures between National Oil companies and foreign private sector operators such as Bakers field, Halliburton with EPC contracts can help firms such as ONGC and OIL to complete their work on time. e.g. contracts given by OIL to Schlumberger for development of shale in Assam-Arakan region'.

- And sixth, there is a need for favorable pricing mechanism for shale gas operations due to the initial high costs of production.

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[65] Gujarat Infrastructure Development Board, Report No. 345/2013 available at http://www.gidb.org/cms.aspx?content id=145

The lEA estimates shale gas production costs between US$3/mmbtu and US$7/mmbtu in North America. Production costs in India are likely to be higher, given the relatively unknown geological terrain, water disposal costs, inadequate domestic service industry and other expenses[66]. Gas gathering and processing costs are also likely to be on the higher side. However, operational costs have substantially reduced in the US with the application of new and advanced technology. For instance, breakeven costs have reduced by around 40% during the past few years and a similar trend could be expected in India, with the implementation of advanced technology[67].

INDIAN BASINS

India has several Shale formations indicating the presence of Shale Oil/Gas. Preliminary estimates suggest that fairly thick sequences with high shale gas potential are extensively present in the oil, gas and coal sedimentary basins such as Cambay, Gondwana, Krisha¬Godawari on land and Cauvery on- land2.Directorate General of Hydrocarbons (DGH) has initiated steps to identify prospective area for Shale Gas exploration and acquisition of additional geo- scientific data[68].

Like many other places in the world with shale gas potential, India recognizes the strategic importance of developing its shale gas resources[69]. Shale gas could help meet the rapidly growing needs of a large and developing population while mitigating the need to increase imported natural gas via liquefied natural gas (LNG) or pipeline. India has significant governance, market, and industry hurdles to overcome before shale gas production can make a significant contribution to India's energy mix. Most analysts believe India is farther behind than other nations in almost all aspects of creating the right commercial frameworks for developing its shale gas potential.

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[66] Chairman's address, OIL website http://oil-india.com/CAddress.aspx, 24th September 2011 ; "OIL hires Schlumberger for Shale gas foray",

[67] Ministry Of Petroleum And Natural Gas, "Draft Policy For Exploration And Exploitation Of Shale Gas In India", 2012

[68] 'Gireesh Chandra Prasad, "Shale Gas In India Is 300 Times Kg D-6", Financial Express, 06-Jan-2011

[69] April 2011 report by Energy Information Administration (Eia), USA.

A recent study[70] by USA indicates that there is a significant potential for Shale Gas that could play an increasingly important role in global natural gas markets. The Report assessed 48 Shale Gas basins in 32 countries. India is one of the countries covered in this Report along with Canada, Mexico, China, Australia Libya, Brazil, etc.

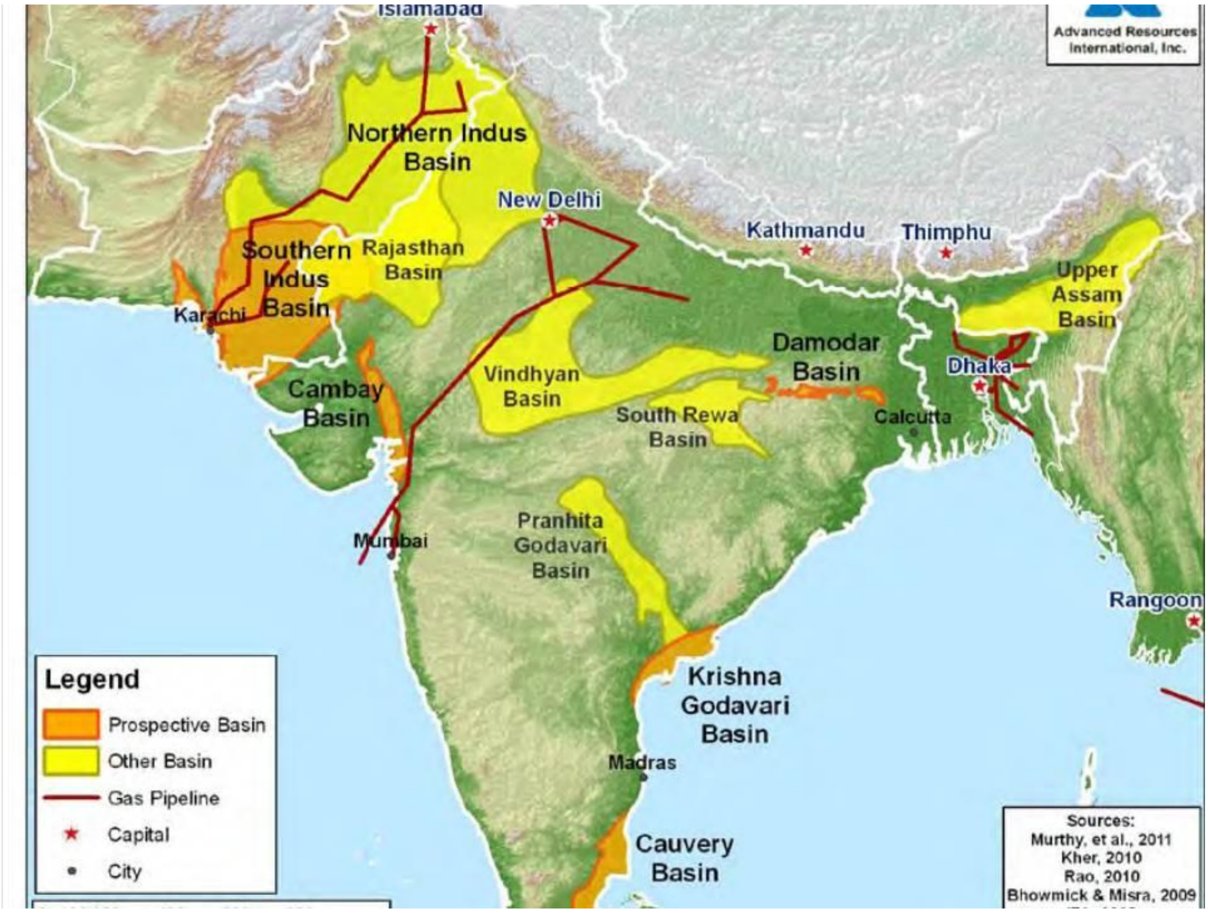

FIGURE 4: Shale gas sedimentary basin in the Indian Sub- continent

SHALE GAS PROSPECTS IN INDIA

70 ibid

According to estimates by EIA, India has 96 tcf of recoverable shale gas reserves; however limited exploration has been carried out so far. It is quite possible that similar to the US, India's shale gas reserve potential could be upgraded with further exploratory drilling. The Cambay, Krishna Godavari, Cauvery and the Damodar Valley are the most prospective sedimentary basins for carrying out shale gas activities in the country. The Cambay basin in Gujarat is the largest basin in the country, spread across 20,000 gross square miles, with a prospective area of 1,940 square miles[71]. Around 20 tcf of gas has been classified as technically recoverable reserves in the basin[72]. It is estimated that the Krishna Godavari basin, located in eastern India, holds the largest shale gas reserves in the country. It extends over 7,800 square miles in gross area, with a prospective area of around 4,340 square miles[73]. The basin encloses a series of organically rich Shale's, containing around 27 tcf of technically recoverable gas.

LATEST DEVELOPMENTS

The Government of India, along with Indian companies, is undertaking various initiatives to accelerate the development of shale gas reserves in the country. India is likely to launch the bidding for shale gas exploration toward the end of 2013[74]. As a part of this initiative, the government has set up a multi- organizational team (MOT) comprising the Directorate General of Hydrocarbons (DGH), Oil and Natural Gas Corporation (ONGC), Oil India Limited (OIL), and GAIL (India) Limited for analyzing the existing data set and suggesting a methodology for shale gas development in the country[75]. Further, in April 2012, the DGH submitted its draft

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[71] World Shale Gas Resources: An Initial Assessment of 14 regions outside United States EIA website, http://www.eia.gov/analysis/studies/worldshalegas/, April 2011.

[72] ibid

[73] ibid

[74] India's first ever shale gas exploration bidding by 2013-end:PM" The Press Trust of India Ltd, 23 March 2012, The Economic Times http://articles. economictimes.indiatimes.com/2012- 03-23/news/31230446_1_shale-gas- conventional¬oil-and-gas-coal-bed- methane

[75] "Energy, Infrastructure and Communications," Chapter 11, India Budget 2011-12 http://indiabudgetnic.inies2011- 12/echap-11.pdf, March 2012

policy[76] on exploitation of shale gas to the Ministry of Petroleum and Natural Gas (MoPNG). ONGC and OIL are aggressively implementing pilot projects to assess the shale gas potential in the country. In addition, Reliance Industries Limited (RIL) and GAIL have entered the US shale industry to gain technical expertise and may apply that expertise in developing shale gas reserves in India.

- In January 2011, ONGC discovered shale gas in its first pilot shale gas-drilling venture in the Damodar basin. Further, the company plans to explore shale gas potential in other promising basins in the country. To gain expertise in this emerging industry, the company signed an agreement with ConocoPhillips in March 2012, for cooperation in the exploration and development of shale gas resources in India and other regions[77]. The company will drill 4 gas wells in Cambay basin at estimated cost of 150-200 Crores in 2013 with ConocoPhillips.

- OIL has hired Schlumberger to conduct a feasibility study of shale gas potential in the Assam-Arakan and Rajasthan basins[78].

- RIL has signed three upstream joint ventures (Chevron, Pioneer Natural Resource and Carrizo Oil & Gas) and a midstream JV (Pioneer) for carrying out operations in the US. R1L has invested a total of US$5.7 billion. More than a third of gas production of Reliance is expected to come from Shale in 2013[79].
- GAIL signed an agreement with Carrizo Oil & Gas to acquire a 20% stake[80] in the latter's Eagle Ford acreage for US$95 millions. GAIL has also signed a 20-

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[76] DGH drafts new policy on exploitation of shale gas," The Indian Express 4 May 2012 http://www.indianexpress.com/news/dg h-drafts-new-policy-on-exploitation-of- shale¬gas/945129/

[77] "ONGC MoU with ConocoPhillips," ONGC press release, http://www.ongcvidesh.com/NewsCont ent.aspx?ID=901, 30 March 2012

[78] Chairman's address, OIL website http://oil-india.com/CAddress.aspx, 24th September 2011 ; "OIL hires Schlumberger for Shale gas foray", Accord Fintech 17 June 2011 via Factiva

[79] "Oil India and Indian Oil acquire Houston-based Carizzo oil and gas' shale asset for $82.5 million", 4th October 2012 The Economic Times http://articles. economictimes.indiatimes.com/2012- 10-04/news/34260444_1_oil-india-chairman-shale-asset-carrizo-oi I-ga

[80] Reliance Industries sees shale gas production to be a third of total", Reuters India edition June 6,2013 http://inseuters.com/article/2013/06/06 /reliance-shareholders-shale gas-id INDEE95506Z20130606

year agreement with Cheniere Energy for the supply of 3.5 million ton per year of LNG[81].

INDIA: A HIGH GROWTH MARKET

The recent power failure in India underscored India's acute energy challenge; miners were trapped underground, trains stopped running, and 620 million people experienced the world's largest blackout. India, a country of 1.21 billion people, strives to keep up with China and other developing countries, with hopes someday of being a superpower. The blackout highlights an infrastructure adjustment that must.be addressed for those plans to progress.

The Indian government did anticipate such a power failure and in March of 2012 unveiled a shale gas-bidding plan allowing 100% foreign participation[82] in the development of Indian shale gas resources — a departure from India's terms for conventional oil and gas exploration. Licensing could occur in December 2013[83]

In a notice published by the Government of India on the website for the Directorate General of Hydrocarbons, India has solicited suggestions from the public, stake holders, oil and gas sector experts, environmental experts, NGOs, and other concerned entities on the draft policy for exploration and exploitation of shale oil and gas. Suggestions must be submitted before September 2013.

As the fourth largest energy consumer in the world after the United States, China, and Japan, India has a projected demand of natural gas of 473 MMSCND by 2016, up from its current demand of 173 MMSCMD (1 MMSCMD = 35.32 MCF). Natural gas output must increase tremendously. To meet the demands, unconventional or alternate hydrocarbon resources such as CBM, shale oil and gas hydrates must be explored.

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[81] Carrizo strikes deal with India's Gail to monetize producing Eagle Ford Shale assets", September 29, 2011 http://www.ogfj.com/articles/2011/09/c arrizo-strikes-deal.html

[82] ibid

[83] GAIL signs deal to source 3.5 mt of LNG annually from Chenier arm", December 11, 201IThe Business Line http://www.thehindubusinessline.com/companies/gail-signs-deal¬to-source-35- mt-of-lng-annually-from-Chenier- arm/article2706684.ece

Acreage in six identified shale gas/oil basins will be offered through an international competitive bidding process; successful bidders will enter a contract with the government. If unconventional areas overlap into an area of conventional exploration, the existing contractor will be given the first right of refusal to match the selected bidder. If they refuse, then they will enter into a model company development /operating agreement for simultaneous exploration.

Proposed incentives include tax breaks and fixed percentages of revenue on gas sales to the government. The operator pays a royalty, land acquisition costs, fees and sliding scale ad valorem production level payments. Contract duration will comprise two phases totaling 32 years. Phase I, lasting seven years, is the exploration, appraisal and project feasibility study phase. Phase II will be the 25-year development and production phase.

Under conventional oil and gas production sharing contracts, the government uses a cost-recovery sharing method; profits are shared once the contractor has recovered costs. Production sharing agreements (PSAs) are not yet common in India, however.

Long term, India's potential is enormous. Internal market efficiencies are needed, however, to attract greater inward investment.

POLICY FOR EXPLORATION AND EXPLOITATION OF SHALE OIL AND GAS

In line with the policy of the Government of India attracting private investment to move towards self reliance in the indigenous production of oil and gas sector, it is important to have a framework to facilitate and regulate Shale Oil and Gas Exploration and Exploitation. This initial technical study undertaken in the country has indicated presence of Shale Gas as a hydrocarbons resource that can be commercially explored and exploited.

The offer of acreages under this policy would be made through an open International Competitive Bidding (ICB) process. The successful bidders would be required to enter into a contract with the Government, which will be negotiated based on the Model Contract (MC).

Simultaneous Exploration and Exploitation of Hydrocarbons i.e. conventional Oil and Natural Gas, Coal Bed Methane (CBM), tight gas and Shale Oil and Gas from the same contract area by same/ different operators will be governed by the relevant policy of the Government of India.

As such, in case of acreage an offer for shale oil / gas overlaps or falls within an existing Oil and Gas /CBM Block, right of first refusal will be offered to the existing contractor to match the offer of the selected bidder, provided he agrees to al the terms and conditions of the bid. In case they refuse, they will have to enter into a model co development /operating agreement for simultaneous exploration.

All areas which are already allotted under nomination /pre NELP/NELP/CBM rounds and where operations have entered the development/production phase shall be excluded from area to be offered for shale oil/ gas exploration.

As financial and contractual regime for conventional oil and gas and shale oil and gas are different, in case of the same contractor operating both the blocks, the policy will be to adequately ring fence the two so that two distinct accounts are maintained, without affecting each other.

Assignment of Interest would be permitted, as in NELP.

All data gathered during the course of operation shall be the property of the GOI.

Safety aspects will be regulated as per existing regulations / OISD guidelines and practices, as in the case of Oil and Gas and CBM operations. New rules / guidelines, whenever notified by competent authority, in this regard, will also become applicable.

Ministry of Environment and Forest (MOEF) will prescribe a panel of agencies, competent to carry out the Environment Impact Assessment for the blocks allotted to successful bidder.

Government of India will seek in-principle approval of the State Governments concerned, for the areas of shale oil / gas blocks, prior to bidding, including facilitation in the matters of land acquisition and water management issues.

Government of India will ensure all statutory, regulatory and security clearances are obtained before bidding.

Exploration of Shale oil / gas will be accordance with the law of the land, including the Water (prevention and control of pollution) Act, 1974, Air (prevention and control o pollution) Act, 1981 and the overall ambit of environment protection measures.

DRAFT POLICY - FISCAL AND CONTRACT TERMS

The fiscal terms to be offered to the investors need to be adequately balanced in terms of risks and rewards associated with the exploration of shale oil/ gas, being unconventional and cost intensive in nature. It should be globally completive and comparable to terms offered for similar operations elsewhere.

Fiscal regime proposed for exploration of shale oil / gas is proposed to be based on royalty and production linked payments, similar to the regime adopted for CBM operations. Ad-valorem Royally at the prevailing rate for crude oil and natural gas would be applicable to shale oil and gas respectively, and accrue to the State Governments, whereas the production liken payment on ad-valorem basis, will be made of the central government. This is proposed to be linked to different production slabs which will be biddable item. This will minimize Government intervention and remove complications ill accounting, and incentive for gold plating, which may occur while allowing profit sharing, based on cost recovery. Government share of production will be net of all statutory dues.

- A Steering Committee will be constituted under the Contract represented by the Government and the contractor which will decide upon the issue on projects / major work programs, audits and accounts with a view of exploit resources optimally. The 1st Government Nominee will chair the Steering Committee. Contractor with the approvals of Operating Committee to Steering Committee shall submit the relevant matters. The District Collector (DC) of the District where the block is situated will be member of the Steering committee, to facilitate the required assistance and coordination from the State Government side. Further, a member of Ministry of Environment and Forest (MOEF) and NEERI may also be included in the committee.

- As shale gas / oil production is likely to be made in small quantity but over a longer period, it is proposed that the mining lease (ML) may be given for 30 years. Further, extension of ML may be made automatic to all the contractors who do not have any dispute with the State /Central Government, and who do not have any arbitration pending.

BIDDING AND APPROVAL SYSTEM

- Blocks for shale oil /gas would be identified by the MoPNG and the relevant data package and information docket for each block so identified will be made available for interested companies for inspection and purchase.
- The size of the blocks and sub-surface operational window of depth will be determined by MoPNG keeping in view the resources —in-place, the prospectively of shale, location of the resource in relation to human habitations and economics of scale in Shale Gas operation along with other relevant factors.
- The identified blocks will be advertised for international competitive bidding. Participation of the State will not be mandatory. Requisite promotional exercise would be undertaken to apprise the prospective bidders with the proposed fiscal and contractual arrangement.

In addition to the round system of bidding. The Government may adopt Open Acreage Bidding system at any given point of time.

Offer of blocks would be open to different categories of investors, i.e. public / private sector and domestic / foreigners. Up to 100% participation by foreign companies and participation through unincorporated Joint Ventures would be permitted;

To provide for a transparent bid evaluation system, detail-bidding formats would be provided to the interested companies to maintain uniformity in submission of bid documents.

A team constituted by the MoPNG, which may include officers having knowledge and experience in technical and financial aspects and fiscal and contractual framework would do evaluation of bids received by the bid closing date. The report of the bid evaluation committee would be submitted to the MoPNG.

EMPOWERED COMMITTEE OF SECRETARIES:

It is proposed to constitute an Empowered Committee of Secretaries (ECS), which will be a standing committee, competent to take various decisions relating to allocation and monitoring of shale gas / oil exploration and production.

The committee will be responsible for the following:

FINALIZATION OF SHALE OIL / GAS BLOCK FOR OFFER

Considering the report of the bid evaluation committee and to make recommendations on award of contract for shale gas / oil blocks to the Cabinet Committee on Economic Affairs (CCEA).

`Taking decisions on issues arising during the course of monitoring of exploration and production activities.

The committee will ensure that the block offered is having necessary statutory and • regulatory clearances before the bidding. The committee will also monitor the progress of clearance during various steps of contract.

The MoPNG as may be necessary for the deliberations of the ECS will arrange technical support and inputs.

DRAFT POLICY

FOR THE EXPLORATION AND EXPLOITATION OF

SHALE OIL AND SHALE GAS

IN INDIA

"DRAFT POLICY FOR THE EXPLORATION AND EXPLOITATION OF SHALE OIL & GAS IN INDIA"

INTRODUCTION

India is the largest oil and gas consumer in the world after USA, China and Japan. Share of crude Oil and Gas in primary energy consumption is about 40.3%, which is second to coal which is meeting 53% of the total requirements. Though the contribution of hydro, nuclear, and other renewable energy is slated to rise in the coming years, dependence on coal, oil and gas is likely to continue. In recent years, natural gas has increasingly become the preferred option globally, as it offers clean and low price energy equivalence to expensive liquid fuel. Demand of natural gas in India was 179 MMSCMD during the year 2010-11 and it is projected to be 473 MMSCMD in 2016-17. As against this, the total production of natural gas from indigenous sources was 146 MMSCMD during the year 2010-11. Further, about 75% of domestic oil consumption is met through imports, as the crude oil production in 2010- 11 was 38.19 MMT and projections at 41.15 MMT in 2016-17 are nowhere near the requirement. Thus, there is an express need for availability of natural gas to be enhanced. This has necessitated the need to explore vigorously for unconventional or alternate hydrocarbon resources like Coal Bed Methane (CBM), Shale Gas / Oil, and Gas Hydrates etc.

BACKGROUND:

Unconventional gas resources are also natural gas deposits but in a different and difficult environment from the exploitation point of view. Technically, these are the gas deposits where permeability of the surrounding rock is too low to permit standard drilling techniques. Technological advance have allowed companies to exploit some of these natural gas deposits in recent times. There are four main types of unconventional gas resources: Coal Bed Methane (CBM), Shale Gas, Hydrates and Tight Gas. Steps were taken by the Government to develop CBM resource in the country by formulating CBM Policy in 1997. Success of the of the recent specialized techniques such as horizontal drilling combined with fracturing of the rock has led to path breaking development of Shale Gas as an unconventional or alternate gas resource.

POLICY REGIME

1. SHALE OIL & GAS

Definition and explanations:

Shale Gas means natural gas generated in-situ and retained in Shale matrix storage, adsorbed onto organic particles, or within fractures in shales of source rock origin and obtained there form through boreholes.

Shale Oil means crude oil that is generated in-situ and retained in shale matrix storage in shales of sources rock origin and obtained there from through boreholes.

Shale Gas and Shale Oil reservoirs are continuous gas or oil accumulations in shale that persist over a large geographical area and are generally characterized by lack of oil-water contacts. These are unconventional in their mode of occurrence and exploitation technology. They are producible only through special stimulation techniques.

Shale Gas and Shale Oil blocks will have specific operational window for shale oil/ gas, in terms of sub-surface vertical depth. Any sub-surface formation producing hydrocarbons, other than that which can be g3oloically classified as shale, under standard and universally accepted norms, are excluded from this policy.

India has several Shale formations indicating the presence of Shale Oil/Gas. Preliminary estimates suggest that fairly thick sequences with high shale gas potential are extensively present in the oil, gas and coal sedimentary basins such as Cambay, Gondwana, Krisha-Godawari on land and Cauvery on- land. Directorate General of Hydrocarbons (DGH) has initiated steps to identify prospective area for Shale Gas exploration and acquisition of additional geo- scientific data. With new exploration technologies, such as multistage hydraulic fracturing or "fracking" combines with horizontal drilling, Production of shale gas has become easier and economic, contrary to the different countries has the potential to bring about drastic changes in composition of their energy basket.

A recent study (April 2011) by Energy Information Administration (EIA), USA indicates that there is a significant potential for Shale Gas that could play an increasingly important role in global natural gas markets. The Report assessed 48

Shale Gas basins in 32 countries. India is one of the countries covered in this Report along with Canada, Mexico, China, Australia Libya, Brazil etc. The initial estimate of technically recoverable shale gas resource in these countries (5,760 TCF), and USA (862 TCF) put together works out to 672 TCF. This study has assessed risked gas-in-place of 290 TCF with technicall recoverable resource of 63 Tc•F for 4 out of 26 sedimentary basin:; in India. In view y of the advances made by the USA in exploration and recovery of shale oil and gas resources, McPNG has entered ;lac., ano MOU with the United States Geologi(q-d survey (USGS). Iii a conaucted by the USGS in.2011-12, technically recoverable resource cf 6.1 -1C12 ha, study been estimated in 3 out of 26 sedimental)' basins in India. The studies also indicates potential for shale oil in Indian basins. Furthe;-, proccas of identification of potentia: shale resources in 11 other basins has also been initiated.

2. ISSUES IN EXPLOITATION OF SHALE GAS/OIL:

Optimal Exploitation of Shale Gas/ Oil requires Horizontal and Multilateral walls and Multistage Hydraulic fracturing treatments of stimulate oil and gas production from shale. This may require large volume of water, i.e. 3 to 4 million gallons per well (11000 to 15000 cubic metres of water required for drilling/ hydro fracturing depending upon the well type and Shale characteristics.

The wale..after Hydraulic fracturing is flowed back to the surface and may have high content of Total Dissolved Solids (TDS) and other contaminants (typically contains proppant (sand), chemical residue occur in many geologic formation, mainly in shale). Therefore, the treatment of this water before discharge to surface / subsurface water needs to be in line with the Central / State Ground Water Authority regulations.

Possibility of contamination of Aquifer (both surface and subsurface) from hydro-fracturing and fracturing fluid disposal and the need for safeguarding the Aquifer. Multiple casing programme (at least 2 casings) will be mandatory requirement across all sub- surface fresh water aquifers.

Details of measures proposed relating to water management issues in commercial exploitation of Shale Oil/ Gas are placed at Annexure-I

Although there are no specific provisions as on date relating to regulation of the process of hydraulic fracturing, and water injection process as has been provided in the Safe Dr;nking Water Act (SDWA) brought out by the Environment Protection Agency (EPA) in the USA, the water (prevention and control of pollution) Act 1974, has stringent provision to regulate / prohibit disposal of polluting matters into water stream / wells (Section 24-25).

As per section 3(J) (iv) of the Act, streams include subterranean waters, which would include Aquifers. Extracts of the Act are placed at Annexure-II. Further, the National environment policy 2006 para 5.2.5 (ii) Point (i) action plan states as under:

"Suitable sites for dumping the toxic waste material may be identified and remedial measures may be taken to prevent the movement of the toxic waste in the ground water."

3. PROPOSED POLICY FOR EXPLORATION AND EXPLOITATION OF SHALE OIL AND GAS

In line with the policy of the Government of India attracting private investment to move towards self reliance in the indigenous production of oil and gas sector, it is important to have a framework to facilitate and regulate Shale Oil and Gas Exploration and Exploitation. This initial technical study undertaken in the country has indicated presence of Shale Gas as a hydrocarbons resource that can be commercially explored and exploited.

The offer of acreages under this policy would be made through an open International Competitive Bidding (ICB) process. The successful bidders would be required to enter into a contract with the Government, which will be negotiated based on the Model Contract (MC).

Simultaneous Exploration and Exploitation of Hydrocarbons i.e. conventional Oil and Natural Gas, Coal Bed Methane (CBM), tight gas and Shale Oil and Gas from the same contract area by same/ different operators will be governed by the relevant policy of the Government of India. As such, in case of acreage an offer for shale oil / gas overlaps or falls within an existing Oil and Gas /CBM Block, right of first refusal will be offered to the existing contractor to match the offer of the selected bidder, provided he agrees to al the terms and conditions of the bid. In case they refuse, they will have to enter into a model co development /operating agreement for simultaneous exploration.

All areas which are already allotted under nomination /pre NELP/NELP/CBM rounds and where operations have entered the development/production phase shall be excluded from area to be offered for shale oil/ gas exploration.

As financial and contractual regime for conventional oil and gas and shale oil and gas are different, in case of the same contractor operating both the blocks, the policy will be to adequately ring fence the two so that two distinct accounts are maintained, without affecting each other.

Assignment of Interest would be permitted, as in NELP.

All data gathered during the course of operation shall be the property of the GOI. Safety aspects will be regulated as per existing regulations / OISD guidelines and practices, as in the case of Oil and Gas and CBM operations. New rules / guidelines, whenever notified by competent authority, in this regard, will also become applicable.

Ministry of Environment and Forest (MOEF) will prescribed a panel of agencies, competent to carry out the Environment Impact Assessment for the blocks allotted to successful bidder.

Government of India will seek in-principle approval of the State Governments concerned, for the areas of shale oil / gas blocks, prior to bidding, including facilitation in the matters of land acquisition and water management issues.

3.1 Government of India will ensure all statutory, regulatory and security clearances are obtained before bidding.

3.2 Exploration of Shale oil / gas will be accordance with the law of the land, including the Water (prevention and control of pollution) act, 1974, Air (prevention and control of pollution) act, 1981 and the overall ambit of environment protection measures.

4. FISCAL AND CONTRACT TERMS.

4.1 The fiscal terms to be offered to the investors need to be adequately balanced in terms of risks and rewards associated with the exploration of shale oil/ gas, being unconventional and cost intensive in nature. It should be globally completive and comparable to terms offered for similar operations elsewhere.

4.2 Fiscal regime proposed for exploration of shale oil / gas is proposed to be based 01 royalty and production linked payments, similar to the regime adopted for CBM operations Ad-valorem Royally at the prevailing rate for crude oil and natural gas would be applicable to shale oil and gas respectively, and accrue to the State Governments, whereas the production liked payment on ad-valorem basis, will be made of the central government. This is proposed to be linked to different production slabs which will be biddable item. This will minimize Government intervention and remove complications in accounting, and incentive for gold plating, which may occur while allowing profit sharing, based on cost recovery. Government share of production will be net of all statutory dues.

4.3 A Steering Committee will be constituted under the Contract represented by the Government and the contractor which will decide upon the issue on projects / major work programs, audits and accounts with a view of exploit resources optimally. The Steering Committee will be chaired by the I 'Government Nominee. The relevant matters shall be submitted by contractor with the approvals of Operating Committee to Steering Committee. The District Collector (DC) of the District where the block is situated will be member of the Steering committee, to facilitate the required assistance and coordination from the State Government side. Further, a member of Ministry of Environment and Forest (MOEF) and NEERI may also be included in the committee.

4.4 As shale gas / oil production is likely to be made in small quantity but over a longer period, it is proposed that the mining lease (ML) may be given for 30 years. Further, extension of ML may be made automatic to all the contractors who do not have any dispute with the State /Central Government, and who do not have any arbitration pending.

Broad of fiscal and contract terms are placed at Annexure-III

5. BIDDING AND APPROVAL SYSTEM

5.1 Blocks for shale oil /gas would be identified by the MoPNG and the relevant data package and information docket for each block so identified will be made available for interested companies for inspection and purchase.

5.2 The size of the blocks and sub-surface operational window of depth will be determined by MoPNG keeping in view the resources —in-place, the prospectively of shale, location of the resource in relation to human habitations and economics of scale in Shale Gas operation along with other relevant factors.

5.3 The identified blocks will be advertised for international competitive bidding. Participation of the State will not be mandatory. Requisite promotional exercise would be undertaken to apprise the prospective bidders with the proposed fiscal and contractual arrangement.

5.4 In addition to the round system of bidding. The Government may adopt Open Acreage Bidding system at any given point of time.

5.5 Offer of blocks would be open to different categories of investors, i.e. public / private sector and domestic / foreigners. Up to 100%) participation by foreign companies and participation through unincorporated Joint Ventures would be permitted;

5.6 To provide for a transparent bid evaluation system, detail bidding formats would be provided to the interested companies to maintain uniformity in submission of bid documents.

5.7 Evaluation of bids received by the bid closing date would be done by a team constituted by the MoPNG, which may include officers having knowledge and experience in technical and financial aspects and fiscal and contractual framework. The report of the bid evaluation committee would be submitted to the MoPNG.

Broad bidding and evaluation terms and placed in Annexure-IV.

6. CONSTITUTION OF AN EMPOWERED COMMITTEE OF SECRETARIES:

6.1 It is proposed to constitute an Empowered Committee of Secretaries (ECS), which will be a standing committee, competent to take various decisions relating to allocation and monitoring of shale gas / oil exploration and production. The committee will comprise of the following Secretaries:

(i) Cabinet Secretary Chairman (ii) Secretary, MoPNG Member (iii) Secretary, M/o Finance Member (iv) Secretary, M/o L&J Member (v) Secretary, M/o E&F Member (vi) Secretary, M/o Defense Member (vii) Director, NEERI Member.

6.2 The committee will be responsible for the following:

(i) Finalization of Shale oil / gas block for offer

(ii) Considering the report of the bid evaluation committee and to make recommendations on award of contract for shale gas / oil blocks to the Cabinet Committee on Economic Affairs (CCEA).

(iii) Taking decisions on issues arising during the course of monitoring of exploration a production activities. and

(iv) The committee will ensure that the block offered are having necessary statutory and regulatory clearances before the bidding. The committee will also monitor the progress of clearance during various steps of contract.

6.3. Technical support and inputs as may be necessary for the deliberations of the ECS will be arranged by the MoPNG

7. APPROVAL OF THE CCEA FOR AWARD OF BLOCKS.

The proposals along with the recommendations of the ECS will be submitted for the final approval of the CCEA.

8. NEGOTIATIONS AND FINALIZATION CONTRACTS:

8.1 A model contract shall be prepared by MoPNG in consultation with the Law Ministry and other relevant Ministries, which will form the basis for negotiations of individua contracts with successful bidders. The terms and conditions of the A model contract will b(based on Fiscal and contract terms outlined in Annexure-II.

8.2 Individual contract will be finalized through negotiations with successful bidders o such points as indicated as negotiable in the model contract, after consulting the fins outcome of such negotiation with the Ministry of Law. The contract shall be executed wit the approval of the Minster, Petroleum and Natural Gas.

9. COMMENTS FROM OTHER MINISTRIES/DEPARTMENTS:

The draft policy would be circulated to Ministries of Finance, Environment, and Law and to the Planning commission for comments.

10. APPROVAL OF CCEA:

10.1 Approval of the CCEA would be solicited as under:

(i) To offer the blocks for exploitation of Shale Oil / Gas through Open Global competitive bidding.

(ii) In case of acreage on offer for shale oil /gas overlaps of falls within an existing Oil and Gas /CBM Blocks, right of first refusal will be offered to the existing contractor to match the offer of the selected bidder.

(iii) Fiscal and contract terms as given at Annexure- 11-10

(iv) Constitution of an Empowered standing committee of Secretaries (ECS for making recommendation to the CCEA for award Shale Oil/ Gas Blocks, comprising of:

(1) Cabinet Secretary ……………………..Chairman
(2) Secretary, M/o P&NG………………… Member
(3) Secretary, M/o Finance……………….. Member
(4) Secretary, M/o L&J ……………………Member
(5) Secretary, M/o E&F……………………. Member
(6) Secretary, M/o Defense ………………..Member
(7) Director, NEERI ………………………..Member

This committee will ensure that the block offered is having necessary statutory and regulatory clearances before bidding. The committee will also monitor the progress of clearance during various steps of contract.

(v) A model contract will be prepared by this Ministry in consultation with Ministries of Law, Finance, Environment and other relevant Ministries. The model contract will be the basis for negotiations of contracts for individual block and the M/o Law will consulted on the final contract to be signed. The contract shall be executed with the awardees with the approval of Minister, Petroleum & Natural Gas.

(vi) Government of India will seek in-principle approval of the State Governments concerned, for the areas of shale oil / gas blocks, prior to bidding, including facilitation in the matter of land acquisition and water management issues. •

(vii) There will be freedom to market Shale Gas within India on arm's length basis within the framework of the Government Policies on Marketing and Pricing of the gas. Marketing of shale oil will be as per prevailing NELP guidelines for crude oil.

(viii) The contractor will have to abide by water management provisions and other environmental issues related to exploration and exploitation of Shale Oil /Gas within the framework of existing Central & State Environment Acts and statures. New rules / guidelines, whenever notified by competent authority, in this regard, will also become applicable.

ANNEXURE - I PROVISIONS PROPOSED FOR ADDRESSING WATER MANAGEMENT ISSUES.

There will be mandatory full base line testing of water and air quality before undertaking drilling of wells.

Rain water harvesting provision in a suitable area in the block shall be a mandatory requirement under this Policy and will be guided by the relevant guidelines of the ..c,, Government As far as possible, river rain or non-potable groundwater should only be utilized for hydro-fracturing jobs. Re-use/recycling of water should be the preferred method of water management.

Multi-well pad based drilling would be mandatory in phase II, to have lesser footprint in view of limited land availability, local concerns and large number of wells.

The other environmental issues related to exploration and exploitation of Shale Oil I Gas will be addressed by the Contractor within framework of existing Central & State Environment Acts and statues. New rules/guidelines, whenever notified by competent authority, in this regard, will also become applicable.

Ample provisions should b mad by the Contractor for the Site Restoration per provisions under NELP/Government guidelines which will be part of the Model Contract.

ANNEXURE- II

EXTRACT FROM THE WATER (PREVENTION AND CONTROL OF POLLUTION) ACT, 1974 NO. 6 OF 1974

Section 3:

e) "Pollution means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisers;

(j)"Streams" includes.- (i) river;

(ii) Water course (whether flowing or for the time] being dry); (iii) Inland water (whether natural or artificial);] (iv) Subterranean waters;

(v) Sea or tidal waters to such extent or, as the case may be, to such point as the State Government may, by notification in the Official Gazette, specify in this behalf;

(k)discharged from any premise used for carrying on any [Industry, operation or process, or treatment and disposal system" other than domestic sewage.

"Trade effluent" includes any liquid, gaseous or solid substance.

Section 24. Prohibition on use or stream or well for disposal of polluting matter, etc.

(1) Subject to the provisions of this section --

(a) No person shall knowingly cause or permit any poisonous. noxious or polluting water determined in accordance i with such standards as may be laid down by the State Board to enter i (whether directly or indirectly) into any [stream or well or sewer or on land]; or

(b) No person shall knowingly cause or permit to enter into any stream any other matter which may tent, either directly or in combination with similar matters, to impede the propel flow of the water of the stream in a manlier leading or likely to lead to a substantial aggravation of pollution due to other causes or its consequences.

(2) A person shall not be guilty of an offence under sub-section (1), by reason only of having done any of the following acts, namely:-

(a) constructing, improving a maintaining in or across or on the bank or bed of any stream any building, bridge, weir, darn, sluice, dock, pier, drain or sewer or other permanent works which he has a right to construct, improve or maintain;

(b) Depositing any materials on the bank or in the bed of any stream for the purpose of reclaiming or for supporting, repairing or protecting the bank or bed of such stream provided such materials are not capable of p011uting such streams;

(c) putting into an stream any sand or gravel or other natural deposit which has flowed from or been deposited by the current of such stream:

(d) causing or permitting, with the consent of the State Board, the deposit accumulated in a well, pond or reservoir to enter into any stream.

(3) The State Government may, after consultation with, or on the recommendation of, the State Board, exempt, by notification in the Official Gazette, any person from the operation of sub-section (1) subject to such conditions, if any, as may be specified in the notification

and any conditions so specified may by a like notification and be altered, varied or amended.

Section 25. Restrictions on new outlets and new discharges

[(I) Subject to the provisions of this section, no person shall, without the previous consent of the State Board,--

(a) establish or take any steps to establish any industry, operation or process, or any treatment and disposal system or an extension or addition thereto, which is likely to discharge sewage or trade effluent into a stream or well or sewer or on land (such discharge being hereafter in this section referred to as discharge of sewage); or

(b) bring into use any new or altered outlets for the discharge of sewage; or

(c) being to make any new discharge of sewage

Provided that a person in the process of taking any steps to establish any industry, operation or process immediately before the commencement of the water (Prevention and Control of Pollution) Amendment Act, 1988, for which no consent was necessary prior to such commencement or, if he has made an application for such consent within the said period of three months, till the disposal of such application.

(2) An application for consent of the State Board under sub-section (1) shall be made in such from, contain such particulars as shall be accompanied by such fees as may be prescribed.

(3) The State Board may make such inquiry as it may deem fit in respect of the application for consent referred to in sub-section (1) and in making any such inquiry shall follow such procedure as may be prescribed.

[(4) The State Board may - (a) grant its consent referred to in sub-section (1), subject to such conditions as it may impose, being-

(i) In cases referred to in clauses (a) and (b) of sub-section 25, conditions as to the point of discharge of sewage or as tot the use of that outlet or any other outlet for discharge or sewage;

(ii) In the case of a new discharge, conditions as to the nature and composition, temperature, volume or rate of discharge of the effluent from the land or premises from which the discharge is to be made; and

(iii) That the consent will be valid only for such period as may be specified in the order and any such condition imposed shall be binding on any person established or taking any steps to establish any industry, operation or process, or treatment and disposal system or extension or addition thereto, or using the new or altered outlet, or discharging the effluent from the land or premises aforesaid; or

(b) refuse such consent for reason to be recorded in writing.

(5) Where, without the consent of the State Board, any industry operation or process, or any treatment and disposal system or any extension or addition thereto, is established, or any steps for such establishment have been taken or a new or altered outlet is brought into use for the discharge of sewage or a new discharge of sewage is made, the State Board may serve on the person who has established or taken steps to establish any industry, operation or process, or any treatment and disposal system or any extension or addition thereto, or using the outlet, or making the discharge, as the case may be, a notice imposing any such conditions as it might have imposed on an application for its consent in respect of such establishment, such outlet or discharge.

(6) Every State Board shall maintain register containing particular or conditions imposed under this section and so much of the register as relates to any outlet, or to any effluent, from any land or premises shall be open to inspection at all reasonable hour by any person interested in, or affected by such outlet, land or premises, as the case may be, or by any person authorized by him in this behalf and the conditions so contained in such register shall be conclusive proof that the consent was granted subject such conditions]

(7) The consent referred to in-sub-section (I) shall, unless given or refused earlier be deemed to have been given unconditionally on the expiry of a period of four months of the making of an application in this behalf complete in all respects to the State Board.

(8) For the purpose of this section and sections 27 and 30.

(a) The expression "new or altered outlet" means any outlet which is wholly or partly constructed on or after the commencement of this Act or which (whether so constructed or not) is substantially altered after such commencement.

(b) The expression "new discharger" means a discharge which is not, as respect the nature and composition, temperature, volume, and rate of discharge of the effluent substantially a continuation of a discharge made within the preceding twelve months (whether by the same or different outlet), so however that a discharge which is in other respects a continuation of previous discharge made aforesaid shall not be deemed be a new discharge by reason of any reduction of the temperature or volume or rage of discharge of the effluent as compared with the previous discharge.

ANNEXURE-III

FISCAL REGIME AND BRAOD CONTRACT TERMS.

The fiscal and contractual regime proposed for shale oil / gas policy has been formulated keeping in view the CBM policy which is meant for exploration and exploitation of another form of unconventional hydrocarbons resource.

FISCAL REGIME:

The proposed fiscal terms under this policy are given below:

(i) Contractors shall pay Royalty either to the Central or the respective State Government to for shale oil/gas, at the prevailing ad-valorem rate at the well head, as determined by Government under the P&NG Rules 1959 / ORDA act 1948 for crude oil / natural gas.

(ii) In addition, the Contractors would he required to pay to State / Central Government, license / lease fee and charge including surface rentals, land acquisition charges, water charges etc. as per the Petroleum & Natural Gas Rules or as required under any other provision.

(iii) Contractors will be required to bid for ad valorem Production Level Payments (PLP) on a sliding scale based on incremental production wherein incremental PLP will be applicable only to the incremental production. Slabs of production rate for bidding PLP will be decide by this Ministry. This arrangement would afford the flexibility to the contractor to offer higher PLP for prospective areas and vice-versa while at the same time capturing the highest market determined value for the block on offer to the Government Production Linked Payments (PLP) would be made to the Government of India. Further, Government share of production will be net of all statutory dues.

(iv) Cost Recovery will not be admissible.

(v) The contractor will be required to pay a commercial discovery bonus of US$ 0.3 million or its equivalent amount in Indian Rupees from Indian Companies on the declaration of commercial discovery.

(vi) No cess would be levied on shale oil.

(vii) The contractor would be required to pay applicable income tax as per Income Tax Act, 1961 / DTC.

(viii) Exemption from the payment of customs duty on import of goods and materials required for exploration and exploitation of Shale Gas / Oil, as defined in NELP and other Government Guidelines.

(ix) Contractor would be responsible for site restoration as practiced under NELP / CBM contracts.

Contract Terms.

An individual contract, based on the Model Contract will be executed between the Government and the successful bidders. Following are the proposed terms for the Model Contract (MC).

(i) The contract duration will be of 32 (thirty two) years and will be divided into two phases- Phase I and Phase—

(ii) Phase I will be for a period of 7 (seven) years and will be for exploration, appraisal, evaluation of the prospect and feasibility. This would include following:-

(a) Detailed Geological, Geophysical and Geochemical studies

(b) Drilling of test wells, hydraulic fracturing and flow rate studies.

(c) Scheme for availability of water and treatment / recycling / disposal/ disposal of flow back water.

(d) Any other study which the contractor considers relevant to assess the prospectively of the block ana feasibility to exploit the resource in a commercial manner.

(e) Third party certification of Shale gas / oil resources for techno — economic feasibility report and full scale commercial development plan.

(f) Environmental and Social impact and related studies.

(iii) Extension of Phase-I would be permissible similar to NELP/ CBM or any other Government Guidelines and will be a part of the Model contract.

(iv) The block shall be deemed to be relinquished at the end of Phase-I if the operator does not enter into Phase. if Prior written communication is to be given by the contractor to this effect.

(v) The contractor will have the opinion to relinquish part / whole of the contract area during Phase-I subject to completion of Minimum Work Programme and / or other applicable provision of the contract. The contractor will be allowed to retain only the development area (s) s approved by the Steering Committee, at the end of Phase-I.

(vi) Phase — H will be the Development and Production Phase for duration of 25 years. Plus the time saved in Phase-II if any. This would include the following :-

(a) Development wells drilling

(b) Establishment of field facilities

(c) Commercial production and marketing

(vii) A Steering Committee will be constituted under the Contract represented by the

Government and the contractor which will decide upon the issued on project / major work programme. Audits and accounts with a view to exploit resources optimally. The Steering Committee will be chaired by the lst Government Nominee. The relevant matter shall be submitted by contractor with the approval of Operating Committee to Steering Committee. The District Collector (DC) of the District where the block is situated will be a member of the Steering Committee, to facilitate the required assistance and coordination from the State Government side. Further, a member of Ministry of Environment and Forest (MOEF) and NEERI may also be included in the committee.

(viii) All the transactions under the contract shall be at Arm's Length basis. (ix) Bank Guarantee will be submitted towards committed work programme bid by the Contractor during phase-1.

(x) Dispute Resolution would be done through arbitration in accordance with the Indian Laws, in India.

(xi) Up-front / Pre-determined Liquidated Damages (LD) will be payable by the contractor, in case of non completion of committed work programme as bid by the Contactor.

(xii) The Contractor will have option to enter the phase-II at any given time within duration the phase-I, with the approval of Steering Committee. However, the contractor will be required to complete the Minimum Work Programme (MWP) of Phase-I.

ANNEXURE — IV

BIDDING PARAMETERS.

Interested entities, which are otherwise eligible for bidding under NELP/CBM rounds, shall be required to bid for:

(i) A Minimum Work Programme (MWP) for phase-I in terms of the test wells to be drilled which should penetrate the target shale interval as defined in the Notice Inviting Offer (NI0). The Contractor will also indicate the total investment that will be mad for competing the MWP of Phase-I. The weight age of this parameter in the Bid Evaluation Criterion (BEC) would be as determined by the Government from time. In the first round of bidding, this parameter is assigned 40% weight age.

(ii) Shale Gas / Oil — Production Linked Payments (PLP) which would be a fixed percentage of revenue receipt from the Shale gas and / or shale oil and any other mineral resource sold from the contract area, net of royalty, tax/ cess on a monthly basis. The weight age of this parameter in the Bid Evaluation Criterion (BEC) would be as determined by the Government from time to time. In the first round of bidding, this parameter is assigned 60% weight age.

(iii) The contractor's technical capability will be evaluated mainly based on the requirement that any consortium partner should have at lest 3 years of operational experience in upstream conventional oil and gas / CBM/ shale gas or oil, anywhere in the world, and will be considered as one of the basis for award of contract. The operator, in case of a consortium, should have a minimum of 25% participating interest (PI).

(iv) The Net Worth of the bidders shall be the qualifying criterion for the bidANNEXURE — IV

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A Brief

For the financial year 2012, crude oil with $140 billion was the single largest item on the import basket affecting the CAD (current account deficit) badly[84]. Since 2000, India's crude oil imports in the oil mix have risen considerably from 60% to 80% with increased demand and insufficient domestic supplies'`. Buying oil assets abroad has not yielded good results yet. Meanwhile, Gas supplies are dwindling as well. If gas along with coal and oil are imported at the current rate, India will head into a major energy crisis along with a economic crisis. India's sedimentary basins do not have sufficient crude oil to support 3.6 mb/d (million barrels per day) of oil demand[85]. But there is the possibility of prolific unconventional gas deposits in the country. We need to grab this opportunity of higher domestic gas production by its horns. India being new to the shale gas game enjoys the advantage that state-of-the-art shale gas technologies are already present in the United States and its global oil companies. The existing technologies can jump start our shale gas development. However, a great deal of innovations will be needed to adapt to new terrain and modify technologies to profitably exploit shale gas resources where geology and water availability is significantly different. Indian companies are already involved in shale gas business in the United States and will readily invest in Indian shale gas auctions if a liberal and conductive policy is adopted. Global oil majors with India operations could participate as well bringing in the technologies and capital required. Moreover, with increased gas operations, government too would extra revenue for its social programs. Indian industry will mature and bring more business into India in the form of foreign contracts and turn- key projects. All these activities will result in significant savings of foreign exchange and lift GDP growth and engineering exports. Development of cutting edge technologies and the talent pool created in association with this industry will create world class opportunities for R&D work and technical institutes[86]. In the process, we will be creating a truly global gas

[84] India's high trade deficit due to oil, not gold import: HSBC", The Economic Times February, 2013 http://articles.economictimes.indiatime s.com/2013 -02- 05/news/36764873_1gold-import- fiscal-deficit-current-account-deficit

[85] ibid

[86] Nearly 80% of India's crude oil needs imported", M VeerappaMoily in Written reply to Parliament, dnaindia 27 August 2013 http://www. dnaindia.com/money/1880629/report¬nearly-80pct-of-india-s-crude-oil- needs-imported

industry and with increased ability to buy assets and businesses has acquired 20% stake in Carrizo Oil and Gas Inc's liquid rich state assets in the Denver- Julesburg Basin in Colarado, USA in abroad in relatively unexplored areas such as Africa. Increased gasification of the economy will reduce our emissions from coal-fired plants and petroleum driven vehicles till renewables such as solar and wind become economical. Meanwhile, sound environmental regulations (double steel casing, cementing etc.) are required to make shale boom sustainable and acceptable to people.

CHAPTER 6

LEGAL AND REGULATORY CHALLENGES

INTRODUCTION

India is a prominent consumer of natural gas. While natural gas is a minor part of the overall energy mix, accounting for only 7 percent in India as of 2007; between 2007 and 2035, the consumption is set to rise to 12 percent[87]. In 2007, India imported about 0.4 trillion cubic feet of natural gas through its LNG re-gasification terminals, accounting for about 24 percent of the natural gas consumed in India[88].Rising demand of gas in India spells good news for the oil and gas producers in India as this will encourage them to commercially develop shale gas, when the current license policy is changed to allow exploration and exploitation of unconventional energy[89].

Much as there as several benefits for chasing the shale gas dream, lack of adequate project financing could pose a potential and prominent roadblock to shale gas development. As a financier, there are several risks associated with the project such as regulatory risks and other legal risks, market risks, environmental risks, land acquisition risk and the capital availability risk stemming from the current global credit crisis that would hinder the investor's attempts to acquire project financing. To mitigate these risks, there are a number of strategies available for 'risk allocation and management' that could be adopted which could breach these barriers. The object of this chapter in the present dissertation is to highlight the barriers in the shale gas industry in India arid how these barriers could be overcome.

PROJECT FINANCING

India is not resistant to the shale gas developments as compared to that of U.S., however is interested in having the pie and eating it too. Reportedly, Reliance Industries paid USS1.7 billion for acquiring 40% in Atlas Energy's leasehold in the Marcellus shale gas in the US'. . Several basins in India have been identified as holding shale gas resources, such as Cambay (in Gujarat), Assam-Arakan (in the Northeast) and Gondwana (in central India)`. In January 2011, Oil and Natural Gas Corporation (ONGC) discovered the country's and Asia's first shale gas reserve[90],

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[87] EIA, International Energy Outlook 2010, available at http://www.eia.doe.gov/oiaf/ieo/nat_gas.html, last visited on 07/1/15

[88] ibid

[89] Durham, Louise S., Marcellus Poised for Even More Attention, available at http://www.aapg.orglexploter/2010/07jul/marcel1us0710.cfm, last visited on 07/1/15

[90] ONGC finds shale gas reserve in Durgapur, available at

considered the world's third shale gas find, at Durgapur, India'. However, any further commercial exploration of shale gas reserves will only be possible after India changes its regulatory policy: government-issued leases cover only conventional petroleum exploration and not unconventional sources such as shale gas[91]. However, before we go into detail on the barriers of project financing shale gas and overcoming those barriers, the need for considering project financing has to be explored.

"Containing half the world's population, Asia-Pacific has huge requirements for the financial engineering called project finance. [92] Project Finance involves alternative financing tools "enabling project sponsors to shed risks to the banks or capital debt markets."' Consequently, the financiers can only rely on the cash flow from the project for repayment. This is attractive to the developer since the non-recourse or limited recourse financing ring-fencing of the assets of the developer and allows the developer to develop other projects. In contrast, corporate financing or on-balance sheet financing makes the developer vulnerable to claims against its own assets in the event the project fails. Shale gas exploration is risky business and "the ability to transfer risks to the financier is at the heart of the project-finance process."' Very often such risks are transferred around through the single purpose vehicle. Which would also explain why the developers would want project financing as an option: investing in the shale gas pie would stretch any company's budget. Consequently, the company would also want to limit its exposure in the event the project goes bust by quarantining the project. “The discipline to sequester a deal in this way provides a useful negotiating framework with suppliers, offtakers, and governments.[93]”One One of the biggest risks in shale gas industry is revenue certainty. This risk can be alleviated by off-take contracts. This is an example of the highly structured nature of

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http://www.hindustantimes.com/business-news/corporatenews/ONGC-finds- shale-gas-reserve-in-Durgapur/Article1-654699.aspx

[91] Aiyar, SA., Shale Gas: Could it be a new energy source?, available at http://blogs.timesofindia.indiatimes.com/Swaminomics/entry/shale- gas-could-it-be, last visited on 07/1/15

[92] Tinsley, Richard, Project Finance in Asia Pacific: Practice Case Studies, London, UK: Euromoney, 2002) at Project Financing: Structuring Risk, (London, UK)

[93] Shale Gas Mission to US, available at http://www.telegraphindia.com/1100706/jsp/business/story_12650352.jsp

project financing: every party in the horizontal and vertical matrix are connected to each with back to back contracts which transfers around all the risks affecting the project (in the best case scenario). Another advantage of opting for project financing is the long term exposure which the banks are willing to take.

BARRIERS TO SHALE GAS FINANCING

A key issue in project financing is analyzing the risks involved in the project and a thorough understanding of how these fundamental risks will affect the cash-flow in the future to get the best deal for all the stakeholders in the project matrix. If these risks are not identified, understood and managed adequately, financiers might not commit their money into the project or if they do, the interest rate will be high. "Bank credit committees hate surprises and crave predictability. As a general rule, they will not accept risks which are incapable of proper assessment or analysis or which are potentially open-minded in their effect.[94]

REGULATORY AND LEGAL RISK

"The legal system of a country may not be adequate to cope with the complexity of project finance. Some countries have constitutional and legal regimes which are highly protective of domestic entities and not at all suited for any foreign investment, not least project finance." While India has explored the project finance option for several infrastructure and energy projects, project financing shale gas development could end up being trickier. There are several uncertainties surrounding extraction of shale gas and one of them involves lack of a robust regulatory framework. While there are talks of India formulating a policy for the shale gas industry to attract investment, the presence of other risks in the project will likely play a spoilsport in getting approvals and licenses from the Government. Political uncertainty (e.g. change in the government) in the country could also lead to a change in law and therefore increase legal risk. Financiers are unprepared to take any regulatory risk where the cost consequences cannot be passed on to the consumer or an off taker.[95] The change of law risk is a 'wild card'; there is no way of knowing whether the risk

[94] Vinter, G., Project Finance, (Singapore and Kuala Lumpur, Singapore and Malaysia: Sweet & Maxwell Asia, 3rded.) at 139

[95] ExxonMobil inserted a similar clause in its acquisition of XTO Energy. From Kefferputz, R., Shale Fever: Replicating the US Gas Revolution in the EU?, available at http://www.ceps.eu/book/shale-fever-replicating-us-gas-revolution-eu, last visited on 08/1/15

will actually materialize or, if it does, what the extent of the changes will be. "The financiers could then stipulate an exit clause in the contract whereby they could pull out of the project if the Government decided to make hydraulic fracking illegal or commercially impractical2.Such risks cannot be valued and will therefore be difficult to manage, though sponsors are, in principle, able to take greater risk than the financiers.

Legal risk also translates to several obstacles for financing in India. Like most developing countries, India is riddled with corruption, slow and mostly inefficient judicial systems and red-tapism. Also the shale gas projects would require sound technical knowledge from the Ministry to the Court while drafting policies and dealing with any disputes. When foreign parties are brought to the mix, the contracts would have to clearly specify the law applicable to the contract and the place and forum of dispute, amongst other issues.

ENVIRONMENTAL RISKS

If a project has unacceptable environmental risk, project financing should not be used. The implication of this statement is that the possibility of liability for environmental damage can cause severe impairment with the project's viability. As stated previously, financiers involved in project finance do not necessarily object to risk; they object to uncertain and unquantifiable risk against which they may not be able to protect themselves. In 2010, the French Government[96] granted three drilling permits to explore for shale gas and then did a turnaround this year by introducing a legislation that would cancel those very permits and ban exploration'. The official reason (and in almost every country around the world gearing for shale gas extraction) is the adverse impact on the environment. The issue is the risk of contamination of water supply aquifers by the chemicals used in hydraulic fracturing'. Large quantities of water mixed with chemicals will be needed for fracturing purposes. Not only will the diversion of such large quantities of water for fracturing create controversy, there are chances that the chemical water might migrate into water supplies and pollute them. The State of New York has already imposed a moratorium on shale gas drilling near a watershed that supplies drinking

[96] French government backs of shale gas rethink, available at http://www.re uters.com/artic I e/2011/04/13/us-france-gas-shale-id USTRE73C59920110413, last visited on 07/1/2015

water to New York City[97]. The BP-Macondo disaster in the Gulf of Mexico has set off the general public to be wary and opposed to any projects that will affect the environment. The financiers would in such cases be extremely anxious as the project could end up being abandoned or result in unlimited liability (strict or absolute liability, depending on the extent of the damage) or significant unforeseen liability.

MARKET RISK

The forecasted cash flow changes in projects are often brought about by change in demand of project output. It could also be a result of change in competition, off-taker reducing purchases, quality and quantity of product drops or the off-taker going broke. But apart from the obvious risks that could affect extraction of shale gas, there are additional issues: one of them being economics. Shale gas wells have lower productivity than conventional wells with production level dropping rapidly in the first couple of years itself. This implies drilling more wells: driving up costs of extraction (factoring in the techniques used in such extraction is more expensive than the normal extraction of conventional gas). The cost of shale gas extraction will depend on the site and the shale characteristics.

Additional costs will be added to shale gas depending on the infrastructure in place and the transportation costs to local and world markets. While from the buyer's point of view, gas from shale may be cheaper than energy from renewable, an overload of gas on the market might push down prices forcing it to compete with other sources of gas, namely imported LNG. India is already in the process of developing new LNG terminals (at Okhamadhi, Gujarat and near Encore Port, Chennai, Tamil Nadu) and importing gas from the Middle East, African countries and Malaysia[98]. If shale gas becomes more expensive than LNG then procuring long-term off-take contracts becomes difficult. Financiers would be wary of funding projects where there is a high probability of revenue coming from sales in the spot market. There would be no predictability of cash-flow, notwithstanding the economical viability of such project.

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97 Shale Gas in Europe: A revolution in the making?, available at http://www.gasstrategies.com/files/files/euro%20shale%20gas_tinal.pdf, last visited OF 07/10/2014

98 Dawson, Jane., New LNG Terminal for India, available at ht-tp://www.gasworld.corn/news.php?a=4956, last visited on 05/1/2015

LAND ACQUISITION RISK

Land acquisition is said to be the biggest challenge for the shale gas industry. Depending on the size of the project and the amount of political (government) support garnered by the project, land acquisition risk could be minimal or phenomenal. In a country like India where agriculture is major source of income, the Government has to ensure not to ruffle any farmer's feathers. Any issue involving farmers and their land could end up being a political battle changing the dynamics of the project. Many projects in the past have suffered and needed to be shifted out to more investor- friendly states and clear land laws. Land acquisition process could be delayed due to various reasons such as breach of agreement between the relevant stakeholders (private sector, government and land owners), legal suits for compensation, land owners' rehabilitation and resettlement issues, environmental issues, public interest litigation, etc. According to Sashi Mukundan, country head, BP India, 275 sq km of land will be required for 3TCF of gas[99]. Therefore any ambitions of extraction have to be done on large scale and not in small blocks'. Prem Sawhney, CEO of Essar Oil, adds that "local planning is very important. He is not off the mark there - if any antagonism is to be prevented from taking root. Aligning surface rights with mineral rights is another challenge for the policy makers. Any delay in acquiring land automatically leads to delay in completion of the project and project cash-flows.

CAPITAL AVAILABILITY RISK

"Banks will always be the first in line to finance your second project.[100] The current global crisis has affected the availability of funds for project finance. If the developer is a large company and has a good track record of completing projects, banks will loosen their purse-strings faster. The story would be slightly different for any developer not falling in that category. Further, the capital reserves of most financiers were almost wiped out with the recession, reducing the capital available for

[99] Public-Private Partnership in Infrastructure Development: Case Studies from Asia and Europe, available at http://www.bcapitalpartners.com/english/images/PPP_in_ln frastruct ure — Development_Case_Studies_EU_Asia.pdf, last visited on 8/1/2015

[100] Bloomberg New Energy Finance, Crossing the Valley of Death: Solutions to the next generation clean energy project financing gap, available at http://bnef.com/free¬publications/white-papers/, last visited on 06/1/2015

projects.[101] If gas prices remain low and there is a dearth of off-take or gas sales and purchase contracts, the financiers might either refuse loans or give it at a high interest rate. If the project does manage to secure project financing at high interest rate, the cost of the project will also go up thereby negatively affecting the economics of the project[102].

STRATEGIES TO OVERCOME THE BARRIERS

In project finance, some would argue that risks are allocated to the parties who are best equipped to tackle them).After the risks have been identified and assessed, steps should be taken to transfer the said risks to the parties best able to manage and control them at lower premium. However, in practice, the legal teams of all the parties involved in the project would negotiate hard to keep the risks as far away from them as possible. In such cases what can be done to ensure that the expected or projected project cash flow does not change?

A common risk allocation method is a syndication arrangement. The financier usually uses this tool to minimize his exposure to project risks by inviting other lenders to join in. A `lead syndicate manager' who ensures that the terms and conditions of the credit agreement are followed generally oversees the coordination and operation within this syndication. All the other partners will be subordinate to this lead bank and will have similar terms and conditions that the lead bank has with the developer.

There are several other tools available to reduce the impact of the risks on the concerned parties. The following sub-sections analyze how these tools can be used advantageously.

REGULATORY RISKS

Mitigating regulatory risks are tricky. One of the options available for the developer is including a stabilization clause in the contract with the Government of India. However, in spite of the presence of such clauses, there is nothing preventing the

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[101] Shale Gas: India Inc wary on regulatory hurdles, available at http://www.moneycontrol.com/news/news/shale-gas-india-inc-waryregulatorylitirdles 51 2379.html, last visited on 06/1/2015

[102] Ruster, J., The World Bank: Mitigating Commercial Risks in Project Finance, available at http://rru.worldbank.org/documents/publicpolicyjourna1/069ruster.pdf, last visited on 05/1/2015

Government from changing laws. Any contract that attempts to freeze the application of new legislation or regulations will be held unenforceable under the sovereign laws or even international laws. A contract could attempt to have a narrow stabilization clause to stabilize royalties or any tax laws applicable to the project2.The developers could also seek economic stabilization or equilibrium stabilization clauses in the contracts with the Government. What these clauses imply is either an automatic readjustment of the affected party's (in this case, the developer) position or a good-faith renegotiation. Either ways the developer can only hope to have some protection against such risk.[103] If the Government grants the developer license to explore and develop shale gas and then the next day decides to cancel the license granted, the developer would have very little option but to take the Government to court. Even then, such a move would be considered an exit strategy as the Government would very likely threaten to cancel any licenses granted to such developer in any other project or refuse to do business with him. The developer can try to reduce the risk by bringing in several partners in the project, preferably from different countries. Not only is the risk of the project going under shared, the Government would be risking a lot of international hue and cry and a bad reputation.

To avoid going to Courts in the event of a dispute, the contract between the developer(s) and any of the parties involved in the project could include an alternative dispute resolution clause, especially arbitration. Not only will that avoid the lengthy court battles, the arbitrators will have the technical expertise required in the oil and gas industry. This is, of course, very specific to India as resolution through arbitration is not always a speedy process or a desirable option - between the arbitrators and the innumerable parties involved in a dispute, getting a date fixed on the dispute resolution diary is often a herculean task.

ENVIRONMENTAL RISK

Most of the international banks, active in project financing, abide by the Equator Principles, a voluntary code of conduct for the financiers. "The Equator Principles are a set of principles which seek to regulate the approach of financial institutions to environmental issues when those institutions are involved in financing projects." The

[103] Smith, E.E., et al, Materials on International Petroleum Transactions, (Colorado, U.S.A: Rocky Mountain Mineral Law Foundation, 2010, -,rd ed.), at pg. 509

financiers that abide by these Equator Principles will not provide loans to projects where the developer will not be complying with the environmental and social policies. The Equator Principles apply to any project with a total capital cost of USD 50 million or moreand have a categorization of projects based on their impacts on the environment. Category A project is a project which "is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented". Category B is a project whose potential adverse environmental impacts on human populations or environmentally important areas (e.g., wetlands and forests) are less adverse than Category A projects.

The Equator Principles place several obligations on the financiers such as requirements of an environmental assessment for Category A and B projects, independent environmental expert to provide additional monitoring and reporting services, etc. All these obligations protect the financiers from funding projects which have a high risk of environmental liability. Insurance is another handy tool that can be used to overcome the environmental risk barrier. In fact, insurance comes to the fore when anyone thinks of risk. The conventional insurance cover includes Contractor's All Risks to cover loss or damage to physical property; a liabilities policy to cover physical loss or damage to another person or property; and even consequential losses from physical damage. Coverage could also include employer's liability and force majeure insurance (covering losses due to strikes, contractor insolvency, acts of God, etc). For purposes of this sub-section, pollution insurance would be a must for the developers.[104] If the banks are asked to accept that the project companies take the environmental risk, they will as a minimum require a detailed environmental consultant's report on the state of the site. Banks may be more willing to accept that the project company should bear the risk of environmental liability caused by the operation of the project in question but they will need to be satisfied that adequate measures will be taken during the operating phase to prevent, limit or contain anyenvironmental pollution."The developer could also seek an indemnity against damages from the Government or the previous land owner in case the land has traces of contamination prior to transfer of the land.

[104] Nevitt, P.K., Fabozzi F.J., Project Financing, (London, UK: Euromoney, 2000, 7thed.) at pg. 229

There should also be more than one developer or more than one party owning an interest in the Special Purpose Vehicle. The risk is spread out amongst the partners creating a deeper pocket.

MARKET RISK

One of the methods used for reducing market risk is gas sales and purchase agreement or a supply agreement. In the absence of this agreement, the gas will have to be sold on the spot markets. Financing such projects however becomes difficult. An off take agreement constitutes of two categories:

(a) a true sale arrangement; or

(b) a pass-through sale arrangement. A gas sales and purchase agreement guarantees a steady revenue stream by including a 'take or pay clause'.. Take or pay clause means "the purchaser will agree to purchase over a specified period a minimum quantity of the project company's product at an agreed price."If there is no demand for the product, the purchaser would still have to pay for the product, provided the product was available for delivery. With the electricity industry being revamped in India and the generation capacity being increased, the future looks bright for shale gas for availability of long term gas sales and purchase contracts. This contract can also be used to allocate price and volume risk amongst the parties.

Another tool available to the developer of the shale gas project is derivatives. Derivatives can be a useful hedging tool against price fluctuations reducing the risk exposure associated with a project. The developer can either get an obligation or the choice to buy or sell a financial asset, currency, or commodity without hedging, low cash flow forces a company either to bypass profitable investment opportunities because they could not be funded internally or to increase the cost of the investment because it must use more expensive external funds. The latter would decrease the overall economics of the project; however, hedging will reduce the probability of facing shortages in cash flows caused by decreases in output prices or increases in costs. Thus, hedging would decrease the probability that a firm would bypass economic investments.[105]

Some of the derivate instruments used are:

(a) Futures contracts: Future contracts are products created by exchanges."lt is a legal agreement between a buyer (seller) and an established exchange or it's clearing house in which the buyer (seller) agrees to take (make) delivery of something at a specified price (called the futures price) at the end of a designated period of time (called the settlement or delivery date)."

(b) Forward contracts: A forward contract is an over-the- counter instrument for the future delivery of something at a specified price at the end of a designated period of time with the slight exception that it is usually a non-standardized contract as it is negotiated individually between the buyer and the seller; there is no clearing house and negligible secondary ' markets. Forward contract, however, is exposed to credit risk or counterparty risk as chances of default are high.

(c) Options: An option gives the buyer the right to sell (`put option') or buy (`call option') a commodity for a given price (`the exercise or strike price') agreed today but to be paid in the future (in the date of exercise of the option).

(d) Swaps: A swap is an agreement whereby two parties (called counterparties) agree to exchange periodic payments. The swaps that are commonly used in project financing are currency swaps, interest-rate swaps and commodity swaps.

LAND ACQUISITION RISK

Land acquisition might lead hardship and impoverishment to the landowners resulting from loss of shelter and income. To ensure that the land acquisition process is smooth, the people affected by the project should be consulted and compensated. The Government should have measures in place for rehabilitation of these people and restoring their livelihoods and standards of living prevailing prior to the beginning of project implementation'. All the affected people should be involved in the consultation process which should be transparent and open to negotiations.

[105] Derivatives and and Risk Management in the Petroleum, Natural and Electricity Industries , available at http://www.eia.doe.gov/oiaf/servicerpt/derivative/chapter8.htm1 , last visited on 07/03/2015

Compensation should be provided to the displaced people, and if possible, employment opportunities in the project should be offered to them to boost local affability.

CAPITAL RISK

If the developer faces difficulty in obtaining project financing, the option of corporate financing is always available, if the company is large with significant asset base and corporate debt facility. Risk to the financiers is reduced since all the assets in the balance sheet, including other projects are vulnerable to claim by such financiers. However, the risk to the developer would proportionately increase. If he is averse to such a rick, he could go for a finance cocktail as was the case in the Noida Bridge project in indict. Noida Bridge was India's first BOT toil bridge with a debt: equity rate of 70:30:The project structure involved project finaneing, rated deep-disecunt bonds (with an underwritten takeout by two Indian financial institutions: IDFC and IL&FS) and listed FCDs. (nun est on the FCC.; was fully guaranteed by IL & FS. The innovative IL&FS/IDFC credit enhancements sprang the

.funds on a back-ended principal tepayment basis that v,orked well for the inEastru•-lure project. The combination of retail investor, mezzanine debt, convertible debt, institutional investors and project financing worked so successfully ibr the project that the bridge was commissioned in January 2001, four months ahead of schedule and with a 27-lane toll plaza (more AVI lanes).

CHAPTER 7

IMPERATIVES IN SHALE GAS DEVELOPMENT

IMPERATIVES IN SHALE GAS DEVELOPMENT

There are certain imperatives in shale gas development which cannot e overlooked it shale gas potential has to be harnessed. Those imperatives broadly relate to overcoming the challenges that are presently facing shale gas development, developing strict policies and regulations for exploitation of shale gas, addressing the issue of technology advancement and transfer and strengthening market structure and infrastructure. These issues have been dealt with in this chapter.

OVERCOMING CHALLENGES

The anti-fracking movement can sustain on strict regulation only by building a highly effective advocacy campaign based on four points: grassroots mobilization, online and social media, direct action, and networking. The present shale revolution can ear sweet fruits only if the challenges are effectively addressed.

GRASSROOTS MOBILIZATION

Mobilization of grassroots opposition has been fundamental to the global anti-fracking movement. Much of this opposition on hydraulic fracturing emerged and spread organically, stimulated by messaging such as Gasland, rising media coverage of the industry and the physical advent or expansion of drilling activity. This is reflected in the hundreds of community-based anti-fracking groups that have emerged in the US, France, Australia, the UK, Ireland, South Africa, Canada, Bulgaria, Germany and elsewhere in the last few years, many of which initially had few if any ties to environmental groups.

France's collect if movement, for example, spread largely organically through areas earmarked for unconventional gas development, and included more than 260 groups nationwide by May 2012[106].

Similarly, scores of rural community groups--some tied to established farm bureau organizations, others consisting of just a handful of resident activists—comprised upstate New York's anti-fracking movement. For policymakers and the media, grassroots activists lend legitimacy, credibility and authenticity to the anti-fracking movement.

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[106] Control Risks Group Limited, The Global Anti-Frocking Movement: What it wants, How it Operates And What 'S next (2012), available at http://www.controlrisks.com/—/media/Public%20sites/Files/Oversized°/020Assets/shale_gas _whitpaper.pdf

ONLINE AND SOCIAL MEDIA

A notable feature of the anti-fracking movement-shared with other social movements such as Occupy—is the extensive use of online social media to disseminate information, organize and mobilize. Many of the co-coordinating groups at the centre of various national anti-fracking movements originated as forum groups, petitions or blogs, professionalizing over time as attention and resources flowed into the anti-fracking movement. The extensive use of free or low-cost online platforms—including Google Calendars, Google Maps, YouTube, Twitter and Facebook—has both facilitated grassroots participation and helped level the information playing field vis-à-vis the gas industry. In line with the generic evolution of social movements, online and social media are also instrumental in organizing and mobilizing the anti-fracking movements[107].

Local and national anti-fracking demonstrations, for example, are promoted heavily via Facebook pages and Twitter feeds, with websites providing ready-made templates for posters, T-shirts and banners. At the more sophisticated end of the spectrum for example, the anti-shale Quebecois (Canada) campaign Moratoiredune generation maintains a dedicated initiative—Schist 911—to alert activists by email to drilling activity in the province. In addition, major actions—such as the Stop the Frack Attack demonstration in Washington, DC, in July 2012 (endorsed by more than 130 organizations) or the worldwide Global Frack-down in September 2012—often have sophisticated dedicated websites that bundle fundraising, outreach, organization and networking tools[108].

GLOBAL NETWORKING

Rapid global networking helps to explain the speed and scale of the anti-fracking movement's development. Although organized and focused primarily at the local and national levels, the anti-fracking movement extends globally through peer-to-peer activist networks, international environmental NGO campaigns and shared ideological and political frameworks.

[107] The Global Anti-Frocking Movement: What it wants, How it Operates And What 'S next (2012), available at http://www.controlrisks.comf-Imedia/Public%20sites/Files/Oversized%20Assets/shale_gas/whitepaper.pdf

[108] ibid

Networking is both passive, as when one group publicizes the actions of another (as South Africa's TKAG did for Australia's Lock the Gate movement), and active, involving direct pooling of organizational resources and co-ordination of fundraising, messaging, direct action and policy advocacy. The 'international coalition' established in February 2012 between TKAG and the US's Water Defense—a spin—off of New York's Frack Action--highlights the active process of global networking Describing hydraulic fracturing as a 'global threat', the groups swapped board members and agreed to co-operate on fundraising.

The intervention of international NGOs has inevitably pulled the anti-(racking movement at the global level-towards the climate change agenda, meaning that purely climate change-focused groups, such as 350.org, have obtained a prominent position This has occasionally resulted in friction within the anti-fracking movement, to the extent that some climate change-focused NGOs-though not the three listed above-view unconventional gas as a low carbon alternative to coal. Not only do such groups ignore pressing local impact concerns, they may also be more amenable to tighter regulation as opposed to an outright ban. In New York, for example, activists pushing for a ban on hydraulic fracturing in 2011 decried the more accommodations stance of mainstream environmental NGOs. despite the organizational muscle those groups brought to the anti-fracking movement[109].

DIRECT ACTION

Although anti-(racking direct action primarily project site denial of access (blockades) equipment occupations and demonstration currently poses limited operational and security risks to unconventional gas development, it is becoming a more prominent feature of the anti-fracking movement. Direct action serves both strategic and tactical purposes. Strategically, it attracts media attention, raising public awareness of hydraulic fracturing, and thereby increasing receptiveness to anti-fracking messaging and aiding activist recruitment. Demonstrations, day of action and non-violent civil disobedience provide impetus and focus to the anti-fracking movement, helping to mobilize grassroots support, and generating solidarity both locally and globally.

[109] ibid

Direct action can also confer political influence on the anti-fracking movements at the imposition of moratoriums in France, Bulgaria, South Africa, Czech Republic and elsewhere has demonstrated. Blockades are a favored non-violent direct action tactic across the environmental activist movement, particularly for rural gas drilling projects, which often depend on single, purpose-built access roads. Blockades generally do not require site security to be breached and can occur at a distance from the project.

Furthermore, while the costs to activists of blockades are extremely low—both in terms of organization and penalties—the potential for disruption to the target can be significant in terms of lost productivity and extra operating costs. The Lock the Gate movement is virtually predicated on blockades, and has targeted a range of operators and services companies in both Queensland and New South Wales. Blockades to prevent shale gas development have also occurred in Canada, the US, the UK and Poland, and are increasingly prominent across environmental direct action campaigns generally. Activists are increasingly actively courting arrest in the course of blockades, drawing increased media attention to their actions[110].

FORMULATION OF EFFECTIVE POLICIES TO ATTRACT INVESTMENT

Although moratoriums and bans capture most public attention, the majority of the anti fracking movement simply wants tighter environmental regulation of unconventional gas development. With tighter regulation, enforcement and accountability, a sizeable swathe of the anti-fracking movement—from grassroots activists with single—issue grievances to influence environmental NGOs such as the US's Natural Resources Defense Council (NRDC)—is prepared to drop its objection to hydraulic fracturing. In its report on 'golden rules', the lEA provides a useful summary of the key issues[111]. These include mandatory disclosure of fracturing chemicals and volumes; restrictions on well placement; compliance with well and pipeline construction criteria; responsible water use, and wastewater storage, transport and disposal; and reduction of methane and CO, emissions.

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[110] Control Risks Group Limited, The Global Anti-Fracking Movement: What it wants, How it Operates And What 'S next (2012), available at http://www.controlrisks.com/—/media/Public%20sites/Files/Oversized%20Assets/shale_gas _whitpaper.pd

[111] ibid

The anti-fracking movement is active on each of these fronts, but has made the most progress on requiring disclosure of fracturing chemicals, a key focus of Gasland and the first issue around which the movement coalesced. For example, in the US since 2010 legislation has been introduced at both state and federal levels to compel disclosure, the administration of Barack Obama has mandated disclosure for drilling on federal lands, and—citing a need to better engage stakeholders-the industry has embraced voluntary disclosure (including through the online, searchable registry FracFocus). Even with these victories, the US anti-fracking movement continues to push for an end trade secrets exemptions embedded in many state laws, as well as a comprehensive federal disclosure requirement, such as that contained in the FRAC Act, a disclosure bill introduced in each of the last two Congresses. However, with analogous action in the UK, parts of Australia and by companies in Poland and South Africa-let alone the lEA's endorsement of mandatory disclosure-its war on disclosure is largely won.

Consequently, the focus of the movement has shifted to other areas of environmental regulation. Water usage and wastewater (or 'produced water') management is one of the more potent environmental concerns of the anti-fracking movement worldwide. In the run¬up to France's national ban, for example, collectives in Rhone-Alps department argued that the millions of gallons of water required for hydraulic fracturing would place stress on scares local water supplies, while the national ranch of European anti-austerity campaign ATTAC highlighted the risk of surface contamination from toxic wastewater. Water usage is also a critical issue in South Africa's arid Karoo region, where activists are particularly sensitive to the wake of water pollution from mining elsewhere in the country.

Even in the western US, the birthplace of intensive hydraulic fracturing, a record drought is raising tension between gas companies and farmers over water pricing and access. Meanwhile, calls to regulate well placement and construction reflect an array of environmental health and safety, and cultural concerns. However small the actual drilling footprint becomes- an area where the industry has made considerable progress in recent years through directional drilling and multi-well pads- the anti-fracking movement will continue to insist on exclusion from sensitive ecologies, critical waterheds, historic loctions and densely populated areas.

In the US, for example simmering controversy over drilling beneath cemeteries in Texas, protests against wells in state parks in Pennsylvania and the use of historic preservation designations to restrict gas development in New York highlight the push to precisely regulate both well pad and well ore placement. Every blowout, gas leak or other containment failure strengthens for increasing regulation- if not completely excluding drilling- near schools, hospitals and the other sensitive structures.

In General, establishing increased local control of the unconventional gas industry through the use of local regulation or property rights is a growing trend. This is party a reaction against the remoteness of provincial or national policymakers from ground-level impacts, and party a reflection of the parochial interests of anti-fracking activitists.

For seasoned campaigners, local regulatory apparatuses are often more malleable and expedient than ponderous and highly competitive provincial or national bureaucracies. In • the US, France, Bulgaria, Czech, Republic, South Africa, and elsewhere, municipal authority is at the heart of anti-fracking movements. Communities throughout the US's Marcellus shale region, for example, have implemented local ordinances regulating aspects of drilling activity from truck traffic to noise levels, invoking authorities only recently granted by court decisions. In two bellwether cases in New York, for example, state courts upheld local bans against industry lawsuits, setting a precedent that may be enshrined in the state's energy policy in late 2012.

Meanwhile, in Pennsylvania, a 2009 state Supreme Court decision gave primacy to local ordinances in terms of energy regulation, which has manifested as complex local (sometimes per well) variations in regulations and fees. In Australia, green Party politicians have sought to replicate this result, introducing legislation in mid-2011 that would override arbitrated consent and permit farmers to block CSG exploration outright. Meanwhile, in Poland, communities, have banned together to use private property rights, consent requirements and formal petitions to deflect exploratory drilling, in one case suing a geophysical services company for allegedly forgoing consent documentation.

DEVELOPMENT OF MARKET AND INFRASTRUCTURE

A well developed physical infrastructure and market system is very important for a successful gas development. It is vital to have both a developed physical infrastructure and a favorable market system for gas development and transport; moreover, the two must interact and coordinate with each other[112]. Unconventional gas projects are expensive and a county's infrastructure must be favorable to the development of Shale plays. In the United States, an average shale gas project in the Marcellus Shale in Pennsylvania costs $4million[113].

Where there is a lack of infrastructure, some of the primary considerations when entering into a gathering agreement for both the producer and gatherer are[114]:

(0 Gathering capacity and related access to a marketing hub;

(ii) Necessary treating, terminalling or processing facilities for oil and liquids;

(iii) Producer dedication;

(iv) Volume commitments by both parties; and

(v) Contract term

With the rapid increase in drilling activities and completion in the shale areas, multiple well connections and related gathering facilities are required. Gatherers need capita protection in case production is not sufficient to cover the costs of new construction. This protection is usually in the form of the producers dedication and/or minimum volume commitments to the system. In turn, the producer will want to ensure that any system will have sufficient capacity before dedicating its production, especially in the early stages of a play when there are other competitive options for the producer to pursue[115].

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112 Paul Stevens, The Shale Gas Revolution: Developments and Changes, (August 2012), available at www. Chathamhouse.org

113 Molly Wurzer, Taking Unconventional Gas to the International Arena, 7 TEX. J. OIL GAS & ENERGY L. 375-80 (2012)

114 Arthur J. Wright, Anna R. Trion, Thompson & Knight, You Found It, Now What Do You Do With It? Gas and Oil Gathering In New Shale Plays, ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013).

115 ibid

Unless a producer has amassed a large acreage position in an emerging play or will be the anchor tenant on a new Greenfield- system[116], a gatherer with capacity to offer or a project in the construction stage in an infrastructure-poor area will have an advantage in negotiating the terms of their gathering agreements. When negotiating, the parties must always consider what their negotiating position will be at the end of the term in "x" years if a contract must be renegotiated or a project marketed.

TECHNOLOGICAL ADVANCEMENTS AND FINANCIAL ASSISTANCE

Because many of the technological enhancements are new and because the technology has such valuable market applications, hydraulic fracturing technology is highly patented. The ability to develop unconventional gas reservoirs that were previously inaccessible is a competitive advantage and a valuable intellectual property asset, so companies tend to want to protect this technology. Since the beginning of 2011, the United States Patent and Trademark Office has issued over 100 patents related to hydraulic fracturing.

Location is also an important part of technology. In 2010, the United States had a total of 1,546 drilling rigs that could be used for shale gas exploration, while there are only seven in Poland suitable for drilling and eighty eight rigs total in Europe, many of which cannot be used[117]. Furthermore, technology costs are expensive because there is little competition as a results of Europe's state control on importing rigs from overseas'.

What is the solution, Equipment can be imported from the United States. However, even If a country has enough money to import equipment and technology, additional problems will be encountered[118]. European countries use the metric system, so there would be a delay and conflicts as drilling rigs were switched over from U.S. imperial

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[116] The term "Greenfield" refers to a project in a newly discovered play or field with no existing infrastructure

[117] 'John Schneider et al., Intellectual Properly Issues in Shale" Protecting Your Intellectual Property and Avoiding Infringement, FULBRIGHT & JAWORSKI (July 13, 2011), available at http://www.fulbright.com/index.cfm?fuseaction=publications.detail&pub_id=5012&site_id=494&detail=yes.

[118] John D. Furlow & John R. hays, Jr., Disclosure with protection of trade secrets comes to the hydraulic fracturing Revolution 7 TEX. OIL GAS ENERGY L. 289-355 (2011)

measurements. Secondly, Europe has strict import regulations and requirements, which would cause additional delay.

Another solution is to build the rigs in-country. The EUCERS Paper suggests this approach would work in Europe, which has engineers and skilled workers and rigs can be built in nine to twelve months. On the other hand a report by Ernst and Young disagrees, arguing that Europe lacks not only suitable equipment, but also skilled workers and an oilfield service sector capacity. Whether or not European Countries have the ability to build rigs in-country is up for debate; however, most countries around the World do have this ability.

CHAPTER 8

US BOOM IN SHALE GAS PRODUCTION

past a decade, the US Energy Information Administration (EIA) and others forecast a gloomy picture of future domestic energy production'. The US was facing scarcity of domestically produced natural gas[119]. With Production falling in many conventional fields, the EIA forecast that the US would need to reply more and more on foreign sources of energy and that the manufacturers, businesses, and consumers could expect to bear significantly more for energy'. Today, conservative estimates put US natural gas supply at ninety years. Some suggest that the US could have more than double that supply enough to last 200 years, or more[120].

The seeds of the shale gas boom were sown in the late 1970s, when the US government aimed to encourage the development of unconventional natural gas in response to the severe natural gas shortage at the time[121]. Private entities lacked the incentives to make large, risky R & D investments, partly because it is difficult to keep modern technologies proprietary in the oil and gas industry, where certain technologies are patentable or licensable. Also, in the initial years, unconventional gas sources could not compete with conventional oil or gas sources for investment dollars, and most US gas producers were not big and did not have the incentive or capacity to do much R & D[122]. In response, the US government funded R & D programs and established tax credits (and incentive pricing) that stimulated the development of shale gas in the Appalachian and Michigan Basins and helped develop some key technologies, such as microseismic fracture (frac) mapping[123]. It was however, the private, entrepreneurship of Mitchell Energy & Development (Mitchell Energy, hereafter) that played the primary role in developing the Barnett

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[119] U.S. Energy info. Admin., Review Of Emerging Resources: U.S. Shale Gas And Shale Oil Plays 6 (2011), available at
www.eia.gov/analysis/stitdies/usshalegas/pdf/usshaleplays.pdf

[120] U.S. Energy Info. Admin., Annual Energy Outlook 1998, at 61-66 (1997), available at http://www.eia.gov/FTPROOT/forecasting/038398.pdf

[121] 'David Spence, Federalism Regulatory Lags, and the Political Economy of Energy Production, U.PA. L. REV.(2012)

[122] .S. Energy Info. Admin, What Is Shale Gas and Why is it Important? Available at http://www.eia.gov/energy_in_brief/about_shale_gas.cfm

[123] Zain Shauk, Natural Gas Revolution to Fuel CERABu:z, Fuel FIX (2012), available at http://fuelfix.corniblog/2012/-3/08/natural-gas-revolution-continues-to-fuel-cera

play in Texas, and it was the successful development of the Barnett play that jump-started the shale gas boom. Government-sponsored Research & Development program did not target the Barnett play, and the credits had a rather limited impact on Mitchell Energy[124]. What Mitchell Energy had was the necessity and the financial capacity to develop the Barnett play. Later the firm was also motivated the potential to obtain huge financial rewards from its innovations. The firm did this by leasing large tracts of land the associated mineral rights at low prices and later selling the company-including not only its leases but also its innovations and expertise- at a higher price. This strategy, which is made possible by the private land and mineral rights ownership system in the United States, overcomes the difficulty of monetizing technology innovations in the industry'.

Around 1960s and 1970s in the U.S. price limits on interstate natural gas were set at levels below the equilibrium prices that would arise in a competitive market. By stimulating demand and discouraging supply, these price ceiling resulted in storages, first in natural gas reserves and later in production. The shortage led to the passage of the Natural Gas Policy Act of 1978 (NGPA), which demanded phased removal of wellhead price controls and provided incentive pricing to encourage the development of new natural gas, including from unconventional sources.

In response to the 1973 oil embargo and the subsequent "energy crisis" the US government adopted a series of policies, including the consolidation and expansion of energy-related R&D programs, that ultimately led to the enactment of the Department of Energy (DOE) to consolidate responsibilities for all federal energy policy and R&D programs.

The oil crisis of 1979 led to the enactment of the Crude Oil Windfall Profit Tax Act in 1980, part of which provided tax for producing unconventional fuels. This credits, enforced under Section 29 of the Internal Revenue Code, applied to unconventional gas from Devonian shale, coal seams, and tight gas as well as some other fuels. The amount of the tax credit for Devonian shale (and coal bed methane) was gradually phase out the effect of the tax credit when the price of oil was high such that the

[124] ZhongminWang and Alan Krupnick, US Shale Gas Development: What led to the Boom? RESOURCES FOR THE FUTURE (2013)

credits would take effect when oil were low enough to limits the competitiveness of unconventional fuels.

The implications for energy independence and energy security are also tangible'. Instead of of relying more on foreign imports, increases in domestic energy production from shale gas and shale oil production have helped decrease the net import share of total U.S. energy consumption from 29% in 2007 to 22% in 2010. As shale production continues to grow, the EIA predicts the net import share will drop to 13% by 2035'. As per AE0120132, shale gas provides the largest source of growth in U.S.'s natural gas supply, thus making U.S. stand in an extremely advantageous position.

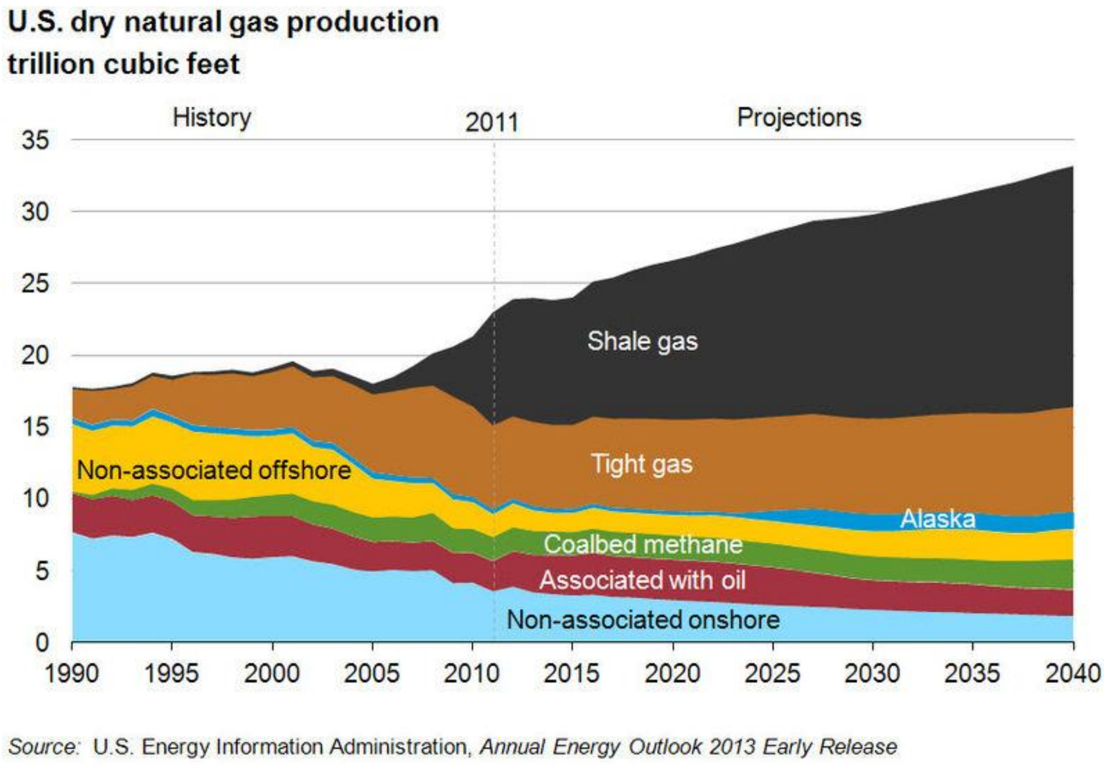

FIGURE 5: US Dry Natural Gas Production in TCF

OTHER PROSPECTIVE LOCATIONS OF SHALE GAS IN THE WORLD[125]

[125] U.S. Energy Information Administration, Annual Energy Outlook (2013)

3 http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282012%29.pdf

A recent study by Energy Information Administration (EIA) USA shows that there is a significant potential for Shale Gas globally that could play and increasingly important role in global natural gas markets. EIA reports shale formations in 41 countries outside the United States4. EIA gives a detailed report of prospective locations of shale gas around the globe. Earlier in the year 2011, EIA assessed 48 Shale Gas basins in 32 countries which 2013 reached to 137 shale gas including U.S. has increased from 6,622 tcf in 2011 or 7,299 tcf in 2013. India is one of the countries covered in the studies of EIA along with Canada, Mexico, China, Australia, Libya, Brazil etc. This shows that shale gas reserves are widespread throughout the globe and thus it is of wide importance among various nations.

Technically recoverable resources only from the subject matter of study of EIA.

Technically recoverable resources represent the quantity of oil and natural gas that could be produced with present technology, regardless of oil and natural gas prices and production costs.

Another categorization of resources is due as economically recoverable resources. These are those resources that can be profitably marketed under current market conditions. The economic recoverability of oil and gas resources depends mainly on three factors: the costs of drilling and completing wells the amount of oil natural gas produce from an average well over its lifetime, and the prices received for oil and gas production.

Recent experience with shale gas in the United States and other counties suggests that economic recoverability can be significantly influenced by above-the-ground factors as well as by geology. The positive above-the-ground advantages on the United States and\Canada that may not apply in other locations include private ownership of subsurface rights that provide a strong incentive for development: availability of many independent operators and supporting contractors with critical expertise and suitable drilling rigs and, preexisting gathering and pipeline infrastructure; and the availability of water resources for use in hydraulic fracturing.

See, EIA, Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States (2013).

If looked at the major countries possessing shale gas reserves, then following picture would emerge:

If global picture of shale gas reserves are to be considered then following figure need to be referred to.

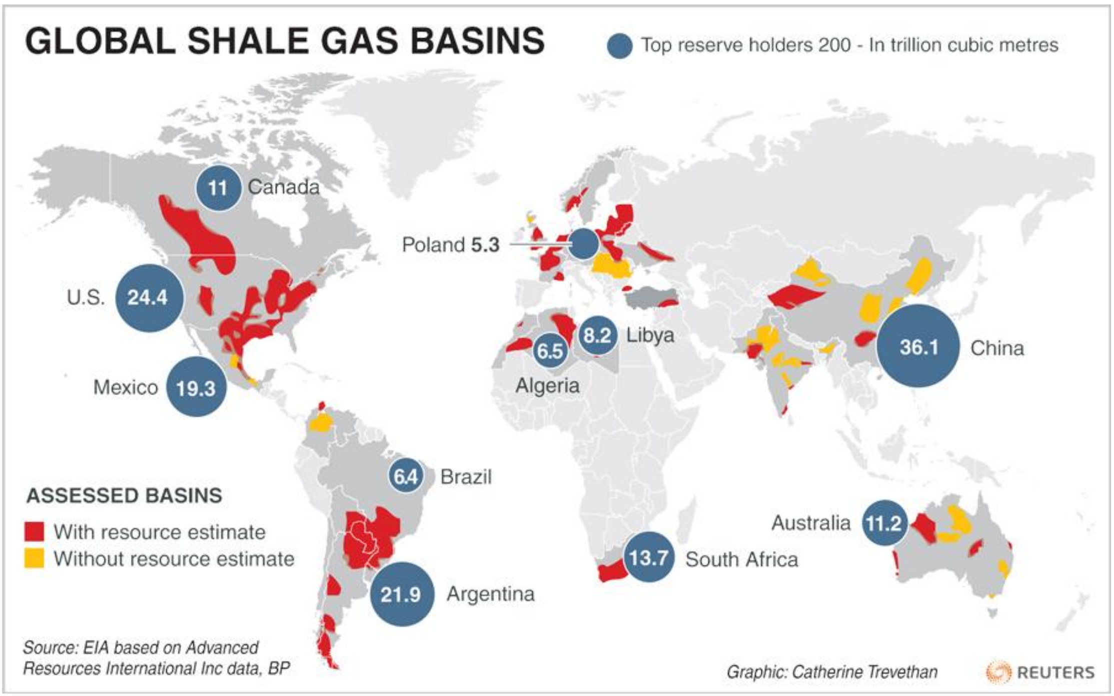

FIGURE 6: Global Shale Gas Basins

Map of basins with assessed Shale Oil and Shale gas formations, as of May 2013'. As per records, U.S., China, Argentina, Canada and Mexico account for nearly two-thirds of the assessed, technically recoverable shale gas resource. Out of which U.S. Canada and Argentina fall under active shale development category and rest in active shale exploration category.

CHAPTER 9

REGULATORY COMPLIANCES AND POLICY MAKING ALL AROUND THE GLOBE

REGULATORY COMPLIANCES AND POLICY MAKING ALL AROUND THE GLOBE

USA

Shale gas has gained predominance in USA and contributes approx. 20 % of total gas production. The experience accumulated so far in USA with the exploration and exploitation of these plays has encouraged other countries to venture into shale gas exploitation. As discussed earlier, slick water fracking is the predominant method used in "shale plays" in the U S "Shale play" is an industry term used to describe an area located in a shale formation in which hydrocarbon accumulations or prospects exist.

Shale Reserves

EIA's current estimate of technically recoverable dry shale gas resources is 637 trillion cubic feet, including proved reserves of 94 trillion cubic feet. Given a total estimated U S dry natural gas resource of 2,335 trillion cubic feet, shale gas resources constitute 27 percent of the domestic natural gas resource represented in the AE02013 projections and 36 percent of Lower 48 onshore resources[126].

The growth in tight oil production shows how important shale oil production has become in the United States. US tight oil production shows how important shale oil production has become in the United States. U S tight oil production increased from an average 0.2 million barrels per day in 2000 to an average of 1.9 million barrels per day in 2012 for 10 select formations[127]. The growth in tight oil production has been so rapid that U S tight oil production was estimated to have reached 2.2 million barrels per day in December 2012. Although EIA has not published tight oil proved reserves, EIA's current estimate of unproved U S tight oil resources is 58 billion barrels[128].

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[126] John D. Furlow & John R. hays, Jr., Disclosure with protection of trade secrets comes to the hydraulic fracturing Revolution 7 TEX. OIL GAS ENERGY L. 289-355 (2011)

[127] ibid

[128] ibid

Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.
Updated: May 9, 2011

FIGURE 7: Shale gas locations in US

As per EIA reports, the proliferation of drilling activity in the Lower 48 shale formations has increased dry shale gas production in the United States from 0.3 trillion cubic feet in 2000 to 9.6 trillion cubic feet in 2012, or to 40 percent of US dry natural gas production. Dry shale gas reserves increased to 94.4 trillion cubic feet by year-end 2010, when they equaled 31 percent of total natural gas reserves2.

Given the unique characteristics of the shale industry, regulators have to consider if existing upstream oil and gas regulations are adequate, or if a new specifically-designed regulatory framework is of the essence.

Whatever the decision, if success is the aim, such business legal regime should be formulated which provide prospective investors a set of clear guarantee and assurances in relation to the activities and should contemplate the following issues:

Having Access To Shale Resources[129]

Property rights in the United States make the shale hydrocarbons the property of the landowner. This has been one of the important reasons of the rapid development of the shale industry in the United States, as the barriers for entry are lower than in countries where ownership of mineral substances invested in the sovereign, thus subject to the licensing timing-agenda of the Government.

In such countries, regulators should consider which type of contract to award (e.g. license, concession, production sharing agreement, risk service contract), if the State will participate in petroleum operations (directly or through a National Oil Company), and if the award of contracts will be made by bidding or direct negotiation.'

Severance of Mineral Rights[130]

Both conventional and shale reservoirs may be found underlying the same text of land surface. The former may be under present exploitation, while the latter not. The coexistence of conventional and unconventional oil and gas resources under the same tract of land builds the opportunity, for debating unique policy and legal issues.

Owners of the resources may consider severing mineral rights over different strata (e.g. deep rights and shallow rights). Severance of mineral rights originally was meant to encourage exploration and production from non-producing areas, and to enhance the amount of mineral rights available for resale. With the shale gas, revolution, severance can be used to efficiently exploit both types of resources, conventional and unconventional.

Of courses, this regulatory action poses the question of parenting, existing exploitation contracts, and if not, be exposed to legal claims brought by such investors', or introduce negative signs to investors as a result of violating the terms of existing contract arrangements to the extent they do not impose limitations on exploitation rights based on the depth of reserves .

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[129] Jose Martinez de Hoz & Tomas Lanardonne We Dance An Unconventional Tango? ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013)

[130] Paul Stevens, The Shale Gas Revolution: Developments and Changes, (August 2012), available at www. Chathamhouse.org

Taxation

The success of the US shale gas industry owes its roots to small independent oil and gas companies, who took on the risk to pioneer early entry to the technically challenging shale industry. One reason for that was the presence of "US 1980 Energy Act" that granted gas producers:

(i) tax credits amounting to 50 cents per million BTUs[131], and

(ii) introduced the "Intangible Dulling Cost Expenses Rule" which covered typically more than 70% of the well development costs[132]

Pricing Regime

The shale gas industry in the United States really emerged during a decade of high prices of the US natural gas price is broadly based on supply and demand, as well as some influence of hedgers and speculators[133].

But many countries with important prospects for shale oil and gas development have "price-control" schemes (such as China and Argentina) that may hamper any real Possibility of shale development. These countries have different' courses of action to address this issue. A few may prefer to remove price controls and to adopt a market taxed pricing regime, such as China has already decided in its l2th Five-Year Plan'.

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[131] 'The Provinces of Alberta and British Columbia in Canada have established different legal regimes which create two types of mineral rights (deep rights and shallow rights) to foster the reversion to the State of any portion of the strata which is not being explored or produced by producers (See Allan Ingelson & Will Randall, Shallow Rights Reversion: Uncertainty and Disputes, 48 ALTA. L. REV. 397 (2010-2011)

[132] The "shallow rights reversion" (SRR) regime adopted by the Province of Alberta establishes that the petroleum and natural gas rights above the top of the shallowest production zone in an agreement will be served from existing exploitation contacts and therefore, some investors have alleged expropriation of their mineral rights and sued Canada. See Jose Martinez de Hoz & Tomas Lanardonne et.al., Shall We dance An Unconventional Tango?, ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013)

[133] Mamdouh G. Salameh, Impact of U.S. Shale Oil Revolution on the Global Oil Market, the Price of Oil & Peak Oil, INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS (2013)

Other might resort to a price-control; scheme, but allow higher prices for shale gas as compared to Conventional gas. Or they may even control the price of conventional hydrocarbons and leave to the market the price of shale hydrocarbons. This "dual regime" approach was first crafted by the United States in the "Natural Gas Policy Act of 1978" in respect of inter state and intra-state gas production, is currently being used in Argentina for the development of the "Vasa Muerta"(Dead Cow) shale play[134].

Marketing

The characteristics of natural gas and the uses-that most countries make of such resource (e.g. electricity generation, commercial and residential heating, feedstock for industry), constitute for regulators a different "ball game" for considering "gas use priorities" including:[135]

- Use of gas for reinjection for maintaining or enhancing oil production
- Use of gas for in-field electricity generation by producers.
- Domestic supply obligation to the domestic market in general, or to specific

segments (e.g. residential and commercial heating demand, electricity generation)

- Export sales by pipeline or LNG.

Regulators should define with clarity the order of priority, as well as the ability of producers to perform neither long term nor spot sales of shale gas (including exports) with no contract interference nor re-routing of contracted volumes to other consumers.

Duration and Phase of Contracts

The blurred cuff-off lines between the exploration and the exploitation stages of a shale oil/gas development project are another key issue regulators have to bear in mind when designing the legal regime-. In the shale industry, exploration of shale

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[134] In the late 1980s and early 1 990s, NYMEX included natural gas on its exchange. Henry Hub, Louisiana, is a major natural gas transmission and transaction point and it is the location that NYMEX relies upon fur the selling of futures contracts on its exchange

[135] CLAUDE DUVAL ET AL, International Petroleum Exploration and Exploitation Agreements: Legal, Economic & Policy Aspects, 184 (Second edn. 2009)

reservoir is not usually the hurdle given that the existence of the source rock is almost already known3.

What constitutes a hurdle is the "appraisal period" Extensive drilling is usually required to verify the size, shape and nature of the shale resources and to carry out an economic analysis. Whereas each appraisal well of a conventional reservoir tends to increase knowledge about the overall reservoir structure and its limits, it is much more difficult with a shale play to extrapolate the results of individual appraisal wells to the acreage as a whole.

Many legal regimes have no provisions dealing with the situation in which the exploration period was too short to permit the appraisal of a discovery that might take several years[136].

Shale hydrocarbons require regulators to consider incorporating larger exploration periods or introducing an "in-between" stage between exploration and exploitation during which producers evaluate the commercial feasibility of the shale gas development'.

Transportation Capacity

Experts opine that third-party access to pipelines in the US has been one of the main factors of shale gas success, since it provided small gas producers' confidence that their new gas output would able to reach the market, thus incentivizing investment'.

In the United States, ownership of transportation capacity rights in unbundles from ownership of the pipeline itself. Unbundling of capacity rights from facility ownership makes it possible for a producer to access markets through a competitive bid for pipeline throughput capacity.

Regulators have to keep in mind that shale gas developments will delay if there are no transparent rules on how to allocate the available capacity. types of services (e.g. firm,

[136] Kenneth B. Medlock Iii etal, "Shale Gas and US National Security (July 2011), available at www.bakerinstitute.org

interruptible, firm with "interruptible windows"), applicable tariffs, and expansion of pipeline capacity[137].

Flexibility of Operations

The shale oil and gas service industry "is an American dominated oligopoly"[138]. The US shale revolution was possible thanks to a large fleet of land drilling rigs operating in the country. Currently, there is no comparable onshore service industry in any part of the world. These circumstances will delay the pace of development in countries willing to replicate the United States Shale gas revolution, such as Poland, China and Argentina.

On such ground, there is a set of standard obligations in international petroleum agreements that regulators may have to change to facilitate shale gas operations.

Performance of mandatory working commitments (e.g. drilling of wells) within specific and rigid deadlines. “Purchase local" or "local content" rules pursuant to which producers must retain local labor and service companies for the development of their fields, and Restrictions of imports of goods in the form of import tariffs or time consuming administrative procedures[139].

if shale development is to be successful, regulations should develop rules whereby procedure should have the right:

(i) To suspend the term of the exploration and/or exploitation period if such activities become impossible due to lack of equipment,

(ii) To be released from the "purchase local" and "local content" requirement if the -

contracting of local labor and service companies is not feasible due to availability of local know-how, personnel or service companies with the qualifications or expertise necessary to carry out the operations, and

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[137] Robert Means and Deborah Cohn, Common Carriage of Natural Gas, TUL. L. REV. 529-53(1984)

[138] David Neslin, Hydraulic Fracturing: A Comparision of regulatoy Approaches and Trends For the Future, ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013)

[139] Vikrarn Rao, Shale Gas: The Promise and the Peril, RTI PRESS (2012)

(iii) To freely and automatically import capital goods necessary for the shale gas operations.

Safe Drinking Water Act

The SDWA is the core federal law that ensures the quality of drinking water. it is applicable to oil and gas development through the Underground Injection Control (-U1C") program under which the Environment Protection Agency ("EPA") or a state with an approved program monitors the injection of fluids underground, including the injection of produced water from oil and gas operations. An operator seeking to inject produced water underground (including frack flowback water) is duty bound to obtain a UIC permit from the EPA or state.

Clean Water Act

The Clean Act is the country's principal federal charter the protection of surface water quality'. Section 402 of the Act requires a permit for discharging the pollutant from a point source into waters of the United States. The Section 402 permitting program-known as the National Pollutant Discharge Elimination System program ("NPDES") is administered y the EPA and by states with approved programs3. The Clean Water Act prohibits the discharges from a point source of oil and gas produced water into the surface unless the discharger obtains and complies with a properly issued NPDES permit[140].

Section 404 of the Act requires a permit for the discharges of dredge or fills material from a point source into waters of the United States. The Army Corps of Engineers administers the Section 404 program, although a few states are authorized to administer Section 404 within their orders. For oil and gas developers, the Section 404 program regulates the development of facilities, structures, and roads that might impact waters of the United States, which may include wetlands[141].

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[140] 'Ezekiel J. Williams, Ducker, Montgomery, Lewis & Bess, Environmental and Liability Issues Associated with Horizontal Development, ROCKY MOUNTAIN MINERAL LAW FOUNDATION (2013

[141] ibid

Clean Air Act

The Clean Air Act regulates air pollution from mobile and stationary sources'. The EPA, or states with approved programs, administers the Clean Air Act, which is one of the most complex federal regulatory programs of any stripe. Depending on the facts and the jurisdiction at issue, the Clean Air Act also applies to air emissions from oil and gas drilling rigs, generators, compressors, and other field equipment'.

Oil and Gas Development on Federal Lands

Oil and gas development of federal minerals on lands managed by the United States Department of the interior and by the United States Forest Service is subject to additional federal laws and regulations. Onshore Order No. 1 provides a handy summary of the practical permitting requirements to develop and operate oil and gas wells on federal lands and minerals'.

State Regulation of Oil and Gas Development on Fee Lands

Oil and gas development on private fee lands is subject to the regulatory jurisdiction of state oil and gas regulating agencies. An operators should consult the rules and regulations of the states at issue to identify environmental standards that may apply to the development of horizontal wells[142].

Comprehensive Emergency Response, Compensation, and Liability Act

The Comprehensive Emergency Response, Compensation and Liability Act ("CERCLA") addresses the cleanup of hazardous substances, pollutants and contaminates[143]. CERCLA defines "hazardous substance" to exempt petroleum, crude oil natural gas liquids, and associates substances . But it does apply to release of other

[142] See, JohR. Jacus & Sherry Haller Bursey, Hazed and Confirsed: Clean Air Act Develop Gas Industry, 51 Rocky MTN. MIN. L. INST. 12-1 (2005

[143] See EPA, Summary Of the Comprehensive Environmental Response, Compensation and Liability Act, available at http://www.epa.gov/lawregs/laws/cercla.html.

hazardous substances, which could include spills of hydraulic fracturing chemicals. Such releases are subject to reporting requirements, and EPA has authority to undertake investigations, obtain information and pursue potentially responsible parties. Indeed EPA has recently used this authority with respect to alleged hazardous substance releases from several oil and gas well sites, though it is unclear what, if any, role hydraulic fracturing played'.

Emergency Planning and Community Right-to-know Act

The Emergency Planning and Community Right-to-know Act “CEPCRA" helps communities plan for emergencies and obtained information on chemical hazards. Among other things, it requires facilities to notify state and local emergency planning authorities if certain hazardous or extremely hazardous substances are released in specified amounts. It also requires facilities to meet inventory reporting requirements if they store or use more than 500 pounds of an extremely hazardous substance or 10,000 pounds of other hazardous chemicals'. These requirements would apply to hydraulic fracturing operations if such operations trigger the release, storage, and use substance and quantity thresholds; this may be more likely at service company facilities than individual well sites.

Other Regulatory Actions

A number of other federal regulatory actions regarding hydraulic fracturing deserve brie mention. In early 2011, the Secretary of Energy created a blue ribbon panel to identify' "immediately steps that can be taken to improve the safety and environmental performance of tracking." The resulting " 90-Day Report recommends 20 actions, including improving public information, reducing air emissions, adopting best practices for we construction, requiring background water quality measurements, and disclosing fracturing fluid chemicals.

In November 2011, EPA released its plans for a comprehensive, multi-year study on the potential effects of hydraulic fracturing on drinking water_. This study will address the full range of such effects from water acquisition through chemical mixing and fluid injection,

flow-back management and disposal . The research will include data analysis case to studies, scenario evaluations, laboratory studies and toxicity assessments. In December 2012 EPA issue an interim progress report which drew no conclusions but summarized the study's progress through September 2012. The final report is due in 20145.

Also in November 2011 EPA granted part of a petition submitted by several environmental organizations requesting that it conduct rulemaking under Section 8 of the Toxic SUBSTANCES CONTROL ACT 6 to develop rules for obtaining data on chemical substances and mixtures used in hydraulic fracturing. In granting the petition, EPA stated that it expects to focus on "providing aggregate pictures of the chemical substances and mixtures used.'" EPA has nor yet indicated from whom it will seek this information, nor has it initiated rulemaking on this subject.

In April 2012 President Obama issued an executive order on unconventional natural gas development[144]. The order states that it is "vital that we take full advantage of natural gas resources.'" while protecting "air and water quality, and public health and safety." In describing the federal government's role, it includes supporting research and development and seeking sensible, cost-effective standards to implement federal law and augment state regulation, It also establishes a working group to coordinate the ongoing efforts of 13 federal agencies that have some involvement with unconventional gas development. Although the order does not address hydraulic fracturing specifically, the guidance it provides is applicable to this topic.

UNITED KINGDOM

There has been continued debate in the UK about the method of hydraulic fracturing since the Department of Energy and Climate Change (DECC) published an independent export's report recommending measures to mitigate the risk of seismic tremors From hydraulic fracturing ("fracking") methods in April.

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[144] Ezekiel J. Williams, Ducker, Montgomery, Lewis & Bess, Environmental and Liability issue Revised Version in First Quarter, BLOOMBERG BNA, Jan. 22, 2013, http://www.ban.com/bIm-pull-back-n17179871950/.

A new joint report from the Royal Academy of Engineering and the Royal Society (Joint Report) calls for fracking in the UK to be closely monitored in order to mitigate the risks involved in the process-. This would require the implementation of a strong regulatory system. The Chairman of the panel, Professors Robert Mair, explains that "(the risks associated with fracking can be managed efficiently in the UK, provided operational best practices are implemented and enforced through effective regulation.'[145]

Proponents of fracking point to the effective monitoring of wells as a mean to minimize the risks of pollution associated with the process[146]. The joint Report states that the priority must be to maintain the integrity of the wells throughout their lifetime. It also suggested that any tremors caused by the operations would be of a smaller magnitude than those of natural earthquakes and those produced in coal mining[147].

Cuadrilla Resources Ltd. the company whose fracking operations, as is claimed, triggered minor earthquakes in Blackpool, have said that they agree to the recommendations made by the DECC in April 2012. It temporarily suspended the drilling activities following the earthquakes; however the company later resumed work on other sites in the North West of England, with an aim to begin gas production as early as May 2014. Fracking at the Press Hall well, which, as is claimed triggered the earthquakes, is not being relooked[148].

However, the head of the Environment Agency, Lord Smith, has lately supported the use of fracking in the development of shale gas. With protection from the possibility of pollution and earthquakes provided by high standards of practice and effective regulation, fracking could provide the UK with a "useful energy resources",

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145 See, http://blogs.telegraph.co.uk/news/j amesdeingpole/100168298/david-camerons-shale-gas-lifeline.

146 See, hap://www.guardian.co.ukienvirnment/20 I 2/j un/shale-gas-fracki ng-expanded -regulated.

147 See, http://telegraph.co.uldscience/science-news/9362608/Fracking-should-go-ahead-in-britain-report-says.html

148 See, http://www.guardian.co.uldenviroment/2012/jun/29/shale-gas-fracking-expanded-regulated

particularly at a time when there is an increasing need to "spread across different (energy) sources[149].

A new report released by the Institute of Directors (loD) has stated that exploiting the UK's shale gas reserves could not only help to create 35,000 jobs but would also help to meet carbon emissions targets, In addition, the loD believes that even if the UK is only half as successful as the US at producing shale gas, the country could meet 10% of its gas demand for the next 103 years from shale. The report highlighted the success of fracking in the US, which now sees 22% of its gas created from domestic shale production and US natural gas prices are at a 10-year low[150].

However, there remain strong opposition to fracking in Britain, with major opponents claiming that questions persist over the safety and economic efficiency with which shale gas can be extracted. A number of environmental groups, such as Friends of the Earth and Greenpeace, have argued that the current regulatory infrastructure is insufficient for fracking to take place safely, and that more research needs to be completed into the environmental impact of such operations.

The Government it seems is still diverged in its opinions over fracking and is also experiencing difficulty in drafting the regulatory system that is necessary to monitor fracking operations. Ed Davey, Secretary of State for Energy and Climate Change recently said, "until we have inure certainly about the potential scale and costs of shale gas production in the U K it is unwise to assume it will be some kind of silver bullet.

Despite environmental and regulatory concerns, George Osborne has recently proposed generous tax breaks for shale gas production5. This could infer that the Government is warming up to the idea of shale gas extraction in the UK and is encouraging oil and gas companies to explore for and produce shale gas so in order for it to become a new element in the UK's energy mix.

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[149] See, http://decc.gov.uk/en/content/cms/news/pn12_047/pn12_047.aspx

[150] See, http://www.ft.com/cms/s/O/da4 I 72e2-113 f-11 e2-8d5 f-00144feabdc0.html #ax77'94hoVydg

EUROPE

Mainly, each country in Europe determines the regulations that apply to shale gas activities on their territory. However there are a number of EU legislations that is applicable in all Member States, including:

Hydrocarbon Directive: Lays down conditions for granting and using authorizations for the prospection, exploration and production of hydrocarbon that are fully applicable for shale gas[151].

Water Framework Directive: Lays down requirements for surface waters to achieve good ecological and chemical status and for reversal of human induced pollution under specific circumstances.

REACH Regulation (Registration, Evaluation, Authorization and Restriction of Chemical Substances): Ensures effective management of risks associated with chemical substances through reporting of information along the supply chain and phasing-out of dangerous substances.

Habitats Directive and Birds Directive: Sets up a system of strict protection of sites and species that applies to all activities including extractive industries.

Groundwater Directive: Covers all potential sources of water contamination. Requirements include establishing groundwater quality standards, carrying-out pollution trend studies and reversing pollution trends.

Mining Waste Directive: Lays down risk-focused provision covering planning, licensing, operation, closure and after care of waste facilities.

CHINA

Shale Reserves

China's natural resources reserves are estimated at 134,420 trillion cubic meters, with approximately 25 trillion cubic meters of technically recoverable shale gas. Being the largest shale gas reserves in the world, the distribution is majorly across the Sichuan basin, the Tarim basin, the Ordos Basin, the western Hubei-Eastern Chongquing area and the provinces of Guizhou and Hunan .

[151] See, http://www.shalegas-europe.eu/en/index.php/resources/regulations/which- regulations-apply

In 7011, the National Development and Reform Commission (NDRC) announced that the government targeted to increase shale gas production to 6.5 billion cubic meters annually by 2015 and 100 billion cubic meter annually by 20202.

On December 31, 2011[152], Ministry of Land and Resource (MLR) announced the legal status of shale gas as the "172th independent mining resource". The result of such legal qualification is that shale gas is now exempted from the restrictive legal regime currently in effect for exploration and hydrocarbon production in China3.

Furthermore, the revised Foreign Investment industry Guidance Catalogue (the "Catalogue"), which took effect on January 30, 2012, specifies that foreign investments in the exploration and development of shale gas and shale liquids now fall in the "encouraged" category of the Catalogue, which allows foreign investors to set up joint ventures with their Chinese partners and to enjoy certain administrative and tax benefits[153]. In Five Year Plan on Shale Gas from 2011-2015.

Following the launch of China's 12th Five Year Plan, which shows the Government's initiatives for the development and utilization of shale gas and other types of unconventional gas, in March 2012, the National Development and Reform Commission (NDRC), the Ministry of Finance, the Ministry of Land and Resource (MLR) and the National Energy Administration (NEA), jointly released a development plan designed for China's shale gas development activities and initiatives from 2011 to 2015.

Providing background information on the current status of China's shale gas prospects, the plan also lays out an overall target and four milestones to be achieved by China from 2011 to 2015, including[154]:

. Completion of a nationwide shale gas survey and appraisal;

- Production output to reach 6.5 billion cubic meters by 2015;

[152] 'Alberta China Office, Shale Gas Development in in China-1, availableat http://alberatcanada.com/china/documents/ShaleGasDevelopmentInChina.pdf.

[154] ibid

- Development of appropriate methods, technologies and equipment for China's shale gas survey, appraisal, exploration and production;

- Establishment of technical standards, rules and policies regulating the following activities in relation to China's shale gas development, such as reserve survey, appraisal and certification, test and analysis, exploration and production and environmental measurements.

The Government will adopt five steps to achieve the target and milestone set out in the Plan:

- Increasing Government investment in shale gas survey and appraisal

The Government has decided to set up designated funds to support shale gas survey and appraisal; selection of shale gas trail areas and exploration technology demonstration projects; shale gas geology study; and international co-operation'.

Developing shale gas technology

The Government sought to increase support for innovation and improvement of shale gas technology, classify shale gas technology research and development as an important national project, promote the shale gas exploration demonstration project, encourage the shale gas research and development activities and international co-operation and exchanges'.

- Developing new shale gas exploration and production systems

The Government plans to accelerate the process of allowing substantial investors of various backgrounds to participate in China's shale gas development, and will set up the relevant qualification standards and tender regulations for shale gas mineral right auctions. The present mechanism and contract management system are also required to ensure the holders of oil and gas and coal mineral rights and/or exploration licenses will invest and develop shale gas reserves within the same block which they were awarded originally, for the exploration and production of oil and gas or coal'.

- Introducing incentive policies

The Government entails studies and introduction of shale gas following the example of the subsidy policy for coal-bed-methane projects. Legitimate holders of shale gas exploration and development licenses can access this incentive'.

- Improving shale gas infrastructure

Solution for improving shale gas infrastructure will depend on the location of the reserves. For reserves close to the existing natural gas pipeline network, the Government will encourage construction of transportation pipelines at the shale gas production field connecting to the existing natural gas pipeline network. For reserves far from existing natural gas pipeline networks, or new wells, (production output of which is ramping up), the Government will encourage the construction of small-scale LNG or CNG facilities tocapture the gas produced to avoid flaring the gas. The construction of transmission pipelines will take into account the production phase of the relevant shale gas wells.

This plan is intended to build to solid foundation for the 13th five-year plan for China's shale gas development. Building on the results of the Plan (including completion of a nationwide survey of the shale gas reserves and development of suitable shale gas technology), the Government will stimulate or encourage greater investments in shale gas reserves from 2016 to 2020, including expanding the production scale in 19 exploration blocks so the total shale gas output by 2020 could reach to 60 to 100 billion cubic metres.

- Financial Subsidy from Chinese government[155]

The Ministry of Finance and the National Energy Administration (under NDRC) jointly released a notice dated November 1, 2012, which stipulated companies will receives a subsidy of Yuan 0.4 (6 cents)/cubic meter of shale gas production from 2012 to 2015.

The notice maintained that the '`subsidies will be adjusted in the development of the shale gas sector", adding the finance bureaus at the local government level will be development in each region.

155 See, http://www.martindale.com/natural-resources-law/article_Norton-Rose-Canada-LLP_109789.htm

Applications for investing have to be submitted to the local finance bureaus before the end of January every year. Companies also have submit reports on the previous year's and development plans, including coring and logging data.

- Two Rounds of Bidding by Ministry of Land and Resources (MLR)[156]

China has launched 23 exploitable shale gas blocks in total until the end of 2012. China's first round auction of exploration rights for four shale gas blocks was held in June of 2011 by inviting six state-owned enterprises to participate Usually the bidding process begins with a preliminary review, followed by a detailed review of the invested capital, equipment, personnel, hydraulic fracturing technology at a later stage. Based on the winning bids in the last round, bidders who committed to drill the most wells with the largest capital investments are selected. Both CNPC and Henan provisional Coal Seam Gas Development and Utilization Co., Ltd. In the last round entered into a Transfer Agreement of Shale Gas Exploration Permit with the MLR ("Transfer Agreement"). The content of such Transfer Agreement was not released to the public. However, an exploration permit valid for three years was granted with possibility to extend.

The second round of bidding was held in October 2012. The blocks covered 20,002 square kilometers in Human (5 blocks), Guizhou (5 blocks), Chongqing (3 blocks), Hubei (2 blocks), Henan (2 blocks), Jiangxi (I block0, Zhejiang (1 block) and Anhui (1 block). Among these blocks, 11 blocks are larger than 1,000 square kilometers. Hefeng Shale Gas

- Block in Hubei is the largest block, covering an area of about 2,306 square kilometers.

Similar to the previous round, each bidder is required to have a registered capital of more than 300 million RMB and must possess oil and gas exploration qualifications or partner with an entity with such qualifications. A maximum of two blocks is allowed each bid. A total of 83 enterprises participated in the second round, and a third of them are from private enterprises.

[156] ibid

Result of the second round was announced on December 7, 2012 with two Chinese private firms and fourteen state-owned enterprises as successful bidders. Huaying Shanxi Energy Investment Co., Ltd., a subsidiary of Wintime Energy Co., Ltd., and Beijing Taitantongyuan Natural Gas Technology Co., Ltd., two private enterprises, won the biddings of two blocks in Fenggang, Guizhou. A total of 14 state-owned enterprises got the remaining 17 blocks. Most of them are engaged in electricity or coal mining. Huadian Corp, China's electricity giant, turned out to be the largest winner with three of its subsidiaries seizing exploration rights of four blocks. None of the traditional oil companies won the bidding and CNPC was only awarded the 3'd candidate for a Shale Gas block in Human.

The successful bidders are obliged to establish an exploration company and start evaluation on the designated area before forwarding the exploration proposal. The proposal will include key statistics on gas condition, storage condition and effectiveness to transform the formation, and then followed by the selection of the drilling site and appropriate directional drilling equipment, optimum fracturing design as well as the complete methods.

CHAPTER 10

CONCLUSION

CONCLUSION

No energy produced, anywhere in the word, is produced without risk and without taking a toll on the environment. The extraction, processing and transportation of natural gas all affect the environment. However, expansion of the supply of natural gas permits the displacement of more polluting forms of energy. With the shale gas boom continuing to gather steam, hydraulic fracturing will likely remain a focus for environment and citizen groups concerned about the potential environment impacts associated with shale gas development. Industry is well aware that failure to manage some of the impacts surrounding the development of this resource such as water use and contamination concerns, the public disclosure of the composition of fracking fluids, and fugitive emissions will seriously hamper efforts to fully develop this resource.

But with evolving technology and greater demand for energy, state regulators and legislators will have a major role in monitoring the course for fruitful exploitation of this precious resource along with developing regulations and protocols that will minimize shale gas's environmental footprint. Any long term impact that it might have can be mitigated by using state-of-the-art technology along with strict regulations. With time, experience and investment, the technology and practices necessary to achieve shale gas in a safe and environmentally acceptable manner will become the industry standard.

Certain improvements have to be made in the system so as to effectively exploit shale reserves of the world. First, companies need to be given incentives to invest. Government must work to attract players who bring vast experience foe these of projects, financing must be available and market and physical infrastructure must support efficient consumption. Secondly, governments must have strong regulatory schemes to oversee the exploration and development of unconventional natural gas. Because there are environmental implications for poor drilling practices, and because many of these reservoirs are close to human population centers, it is important that government work with the energy sector to ensure that all parties work towards good environmental stewardship. Most importantly, stable legislation will play a large role in unconventional gas development. The more a country sees a need for unconventional gas, the less critical many of the perceived barriers will seem. As unconventional gas becomes increasingly commercially viable, countries will turn to it to achieve energy self-sufficiency. Overall, trends are emerging that indicate that unconventional gas will succeed in changing the way the world thinks about natural gas.

There is a strong need for innovation and the development of viable renewable energy sources. Recent technological advances now allow natural gas supplies - previously believed inaccessible or nonexistent — to be discovered, mined, and processed for both industrial and consumer use. The technology, a controversial process that is alternatively called hydraulic fracturing, fracking, hydro- fracking has greatly expended natural gas production in the United States. Presenting a balanced discussion, this study proposes to deal with different aspects of hydraulic fracturing used to extract natural gas, along with gas exploration and production in through strict policy implementation.

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