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# Shale Gas : A Review of the Economic, Environmental, and Social Sustainability

**Gaurav ojha, Ravi Prakash Maheshwari**
Department of Civil Engineering Department at Government Engineering College Banswara
Email :- ojhagaurav10@gmail.com, rpmaheshavari@gmail.com

***Abstract :*** ***The growth of the shale gas industry in World has raised expectations that other nations could boost domestic gas production, leading to lower energy prices and improved energy security. Furthermore, sustainability implications of shale gas development remain largely unknown. In an attempt to find out if and how shale gas could be exploited unsustainable way ,this paper reviews the economic, environmental, and social aspects of shale gas. These include costs ,energy security ,employment, water and land pollution, greenhouse gas emissions, earthquakes, and public perception. The literature suggests that it is possible to develop shale gas in a sustainable way ,but its future will depend on the industry being able to address the environmental concerns, the political will to see the industry through maturity, and public support, with the latter most likely being the biggest determinant.***

Key Words :- Economic costs , Energy security , Life cycle assessment , Social sustainability , Shale gas

**Introduction:**

Recent estimates of large shale as reserves across the global have raised expectations for cheap energy and improved security of supply, particularly as the consumption f natural gas is expected to triple by 2035. It is estimated that shale gas could add 7299 trillion cubic feet (tcf) to global gas reserves by comparison, conventional gas reserves are estimated at 6614 tcf. A critical factor in gas consumption is that 73.5%ofgas is traded (68%bypipelineand the rest as liquefied natural gas (LNG)), which means that there is a high dependency on imports for many countries.[5] For example, nations such as Japan and South Korea import all their gas consumption, whereas the UK relies on imports for 55%ofi its demand.[4–6] A high dependency on imports can lead to high energy prices. For instance, the 2012 gas prices in Japan and the UK were US$15.89and US$8.97 per GJ, respectively.[5] By contrast, the price of natural gas in the US, which is almost self-sufficient in this fuel, was US$2.62 per GJ.[5] The latter is a direct consequence of the exploitation of shale gas in the US, which is still the only country to produce it commercially on large scale, despite 41 other nations having shale gas reserves.[1] As shown in Table 1, 31 of these are or were actively looking into exploiting their reserves and are at different stages of development. The remaining 11 nations re undecided on whether or not to develop shale gas, either because their (estimated) resource is small or because their conventional gas reserves are much larger (Russia). However, shale gas is controversial, with many people being opposed to it because of various sustainability issues associated with its exploitation and utilization.[7] In many cases, the environmental legacy associated with the extraction of gas from shale overshadows the economic benefits, including groundwater and drinking water contamination as well as earthquakes.[8] This is due to combined use of horizontal

drilling and hydraulic fracturing toe extract it from rock deep in the ground, which requires the use of water and chemicals (see Figure 1). Social and economic concerns have also been raised, including noise, increased traffic, and possible conflicts of interest associated with royalties from miner

The growth of the shale gas industry in the US has raised expectations that other nations could boost domestic gas production, leading to lower energy prices and improved energy security. However, the degree to which the US experience is transferable to other countries uncertain. Furthermore, sustainability implications of shale gas development remain largely unknown. In an attempt to find out if and how shale gas could be exploited in sustainable way, this paper reviews the economic, environmental, and social aspects shale gas. These include costs, energy security, employment, water and land pollution, greenhouse gas emissions, earthquakes, and public perception. The literature suggests that it is possible to develop shale gas in sustainable way, but its future will depend on the industry being able to address the environmental concerns, the political will to see the industry through maturity, and public support, with the latter most likely being the biggest determinant.

**Synopsis:-**

**What is shale gas?:-**

Basically, it is natural gas – primarily methane – found in shale formations, some of which were formed 300-million-to-400-million years ago during the Devonian period of Earth's history. The shales were deposited as fine silt and clay particles at the bottom of relatively enclosed bodies of water. At roughly the same time, primitive plants were forming forests on land and the first amphibians were making an appearance.

Some of the methane that formed from the organic matter buried with the sediments escaped into sandy rock layers adjacent to the shales, forming conventional accumulations of natural gas which are relatively easy to extract. But some of it remained locked in the tight, low permeability shale layers, becoming shale gas.

**How is Shale Gas Produced? :-**

Shale gas formations are "unconventional" reservoirs – i.e., reservoirs of low "permeability."

Permeability refers to the capacity of a porous, sediment, soil – or rock in this case – to transmit a fluid. This contrasts with

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a "conventional" gas reservoir produced from sands and carbonates (such as limestone).

The bottom line is that in a conventional reservoir, the gas is in interconnected pore spaces, much like a kitchen sponge, that allow easier flow to a well; but in an unconventional reservoir, like shale, the reservoir must be mechanically "stimulated" to create additional permeability and free the gas for collection. In addition to shale gas, other types of unconventional reservoirs include tight gas (low-porosity sandstones and carbonate reservoirs) and coal bed methane (CBM – gas produced from coal seams).

**What Challenges are Associated with Shale Gas Production? :- "A closer look on it's all aspects".**

**Air :-**

• Air quality risks from shale oil and gas development are generally the result of: (1) dust and engine exhaust from increased truck traffic; (2) emissions from diesel-powered pumps used to power equipment; (3) intentional flaring or venting of gas for operational reasons; and, (4) unintentional emissions of pollutants from faulty equipment or impoundments.1

• Natural gas is efficient and clean compared to other fossil fuels, emitting less nitrogen oxide and sulfur dioxide than coal and oil, no mercury and very few particulates. However, the drilling process potentially can release chemicals such as benzene as well as methane, a very reactive greenhouse gas. Data in this area is lacking and currently under study.

• The Environmental Protection Agency (EPA) in 2012 finalized New Source Performance Standards that set the first air pollution standards for natural gas hydraulic fracturing operations. The new rules, which also include performance standards for other modified oil and natural gas operations, are slated to become effective in 2015.

**Water :-**

• As with conventional oil and gas development, requirements from eight federal (including the Clean Water Act) and numerous state and local environmental and public health laws apply to shale gas and other unconventional oil and gas development. Consequently, the fracturing of wells is a process that is highly engineered, controlled and monitored.

• Shale gas operations use water for drilling; water is also the primary component of fracturing fluid.

• This water is likely to come from rivers, lakes, ponds, groundwater aquifers, municipal supplies, reused wastewater, or recycled water from earlier fracturing operations. Operators are guided by all applicable laws and regulations in water acquisition.

• As much as 10 million gallons may be pumped into a single well. Although this amount is relatively small when compared to other major water uses (such as agriculture), its cumulative effect could impact aquatic habitats or water availability, especially where water is a limited resource.

• A number of studies and publications caution that surface and groundwater contamination remains a risk; some studies document contamination from above-ground chemical spills, leaks, wastewater mishandling and other incidents. How significant these risks are over the long term is presently unclear and in need of continued study.

**Induced Seismic Events (Earthquakes):-**

• Induced seismic events are earthquakes attributable to human activity. The possibility of induced seismic activity related to energy development projects, including shale gas, has drawn some public attention.

• Although hydraulic fracturing releases energy deep beneath the surface to break rock, studies thus far indicate the energy released is generally not large enough to trigger a seismic event that could be felt on the surface.1

• However, waste fluid disposal through underground injection can "pose some risk for induced seismicity."2

• According to the National Academies of Sciences (NAS), accurately predicting seismic event magnitude or occurrence is not possible, in part because of a lack of comprehensive data on the natural rock systems at shale gas and other energy development sites.

• NAS said further research is required to "better understand and address the potential risks associated with induced seismicity."

**Fracture Fluids:-**

• Shale fracture fluid, or "slick water," is largely composed of water (99%); but a number of additives are mixed in with it to increase the effectiveness of the fracturing operation. These additives vary as a function of the well type and the preferences of the operator.

• Hydraulic fracturing fluids can contain hazardous chemicals and, if mismanaged, spills could leak harmful substances into ground or surface water. However, good field practice, governed by existing regulations, "should provide an adequate level of protection" from fracturing fluid risks.

**Surface Impacts (non-water):-**

• There are many local economic and energy benefits from shale gas development; there is also an inherent risk of increased traffic or other habitat disturbances that could affect residents, agriculture, farming, fishing and hunting.1

• Shale gas development can lead to socio-economic impacts and can increase demands on local infrastructure, traffic, labor force, education, medical and other services.2 Federal and state laws are designed to mitigate the impact of these challenges.

• The rapid expansion of shale gas development and hydraulic fracturing has increased attention on potential effects on human health, the environment and local wildlife habitat. Vegetation and soils are disturbed where gas wells require new roads, clearing and leveling.

• The degree of surface impacts can be affected by many factors, such as location and the rate of development; geological characteristics; climatic conditions; the use by companies of new technologies and best practices; and regulatory and enforcement activities.

• Advanced horizontal drilling and hydraulic fracturing technologies increasingly allow energy companies to access far more natural gas with fewer wells and disturbed acres.

**CONCLUSIONS**

After the detailed study it can be briefly stated in general terms by reporting that it can't be done in India in full fledged manner because we are lacking of technique due to many reasons like over population, many natural habitat lives there some of them are endangered species.

But even though we are having so much problem to extract shale gases ONGC is trying to somehow to extract shale gases over there but it will took time to extract such a huge amount.

Dispite of having that much disqualify some how it is good in various aspects.

Shale gas is having a beneficial impact on supplies and consumer prices for natural gas, as well as additional environmental benefits:

• Natural gas provides a quarter of overall U.S. energy;

• It is used to generate a quarter of the nation's electricity. Net generation from natural gas-fired power plants increased 35 percent between 2005-2012, coinciding with a continuous upsurge in shale gas supplies;

• Natural gas provides heat for 56 million residences and businesses;

• It delivers 35 percent of the energy and feed stocks needed by U.S. industry;

• Onshore consists of around 7,000 companies, including 2,000 drilling operators and hundreds of service companies;

• It directly employs over 2 million Americans who earn over $175 billion in labor income;

• Shale gas generates over $250 billion annually in government revenue via corporate income taxes; severance taxes; royalties on federal lands; sales, payroll, property, use and excise taxes;

• Combined with the continued displacement/ retirement of coal power plants, greater shale gas use has helped the U.S. achieve approximately 70 percent of the $CO_2$ reductions targeted under the Kyoto Protocol as of 2012; and,

• According to a 2011 report, the shale gas industry supports more than 600,000 American jobs today (growing to 870,000 jobs by 2015) and contributes $118.2 billion to the nation's Gross Domestic Product.

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