

## CHAPTER 1

### INTRODUCTION

The twentieth century has been characterised by the power and flows of hydrocarbons for energy; and silicon for the semiconductor & computer driven world. Two materials, which collectively have changed forever, the way the world lives. But while there are no global shortages of silicon ever reported, petroleum & energy estimates are regularly prepared & put forth for the world at large, to indicate 'finite' and short lived/ limited fossil fuels reserves. It is yet another matter completely, that these reserves generally tend to increase rather than diminish over time. In turn, these forecasts and the prevailing economic environment coupled with the security scenarios, become the drivers for setting global oil & gas prices, in a classical supply - demand relationship. Hence the wild swings in the international prices of oil, since inception. When oil prices dip significantly, oil producing countries, with considerable dependence on such oil production are affected; when the price of oil & gas rises substantially, the importing & consuming countries bear the brunt.

Over time, countries have made substantive investments in reducing their dependence on conventional energy sources and have attempted to create alternate energy sources, to overcome the problem of energy availability. Nuclear power, wind power, solar energy, tidal energy etc are some of alternate forms that have been mainstreamed in different countries, as energy sources. Contemporary technologies are driving innovations in the automotive energy space, with hybrid-electric engines becoming available in a few cars, hydrogen cell based power

packs under trial and evaluation and alternate fuel compositions, bio fuels, etc have made the world look at other than conventional oil & gas.

In the continuing quest for oil & gas, entrepreneurs and innovators have also looked at finding new oil & gas fields, as well as new ways of extraction of these sources, to augment available sources. Relentless efforts and technological prowess of oil & gas companies have paid off. A lot of 'unconventional' oil & gas sources have been developed in the last decade. Amongst these, Shale Oil and Gas, also referred to as 'Shale plays' have begun to be produced, are commercially viable and already are contributing to an ever increasing output of oil & gas, especially in the US. In the last decade, U.S. Shale Gas and Tight Oil production has skyrocketed. As per EIA estimates, between 2005 and 2014, production of crude oil has risen by nearly 65 percent and natural gas output has increased by a third, due to Tight Oil and Shale Gas development in the U.S. (EIA, 2014a). Similarly, as per BP estimates, Shale Gas supplies, from Pennsylvania match the entire natural gas export capacity of Qatar, the world's second largest natural gas exporter in 2012. (BP, 2014)

The increase from light tight oil production in places like North Dakota and Texas over the last five years is equivalent to Iraq's current production levels. These increased energy supplies have fed not only national but global markets, helping to offset other market disruptions and stabilize prices, to the benefit of many. According to a one preliminary assessment by Advanced Resources International, and published by US Energy Information Administration in 2013, 137 Shale formations in the United States and 41 other countries hold around 10 percent of technically recoverable global crude oil and 32 percent of global natural

gas. (EIA, 2013b) Shale deposits outside the countries assessed will add to these recoverable assessments, further. For a world increasingly dependent on energy to drive economic growth and prosperity, this is excellent.

Should the possibilities play out; the strategic implications can be significant. Countries, which have been traditional importers of oil & gas, can invert the conventional paradigm of this producer-consumer relationship, and potentially alter the directions of 'energy flows'. This can create strategic shifts, especially for countries that are net importers of oil & natural gas, like India, which imports close to 78 % of its requirements. (Petroleum Planning & Analysis Cell, 2014b)

It is usual now for economic assessments worldwide, to articulate on India as one of the fastest growing economies with the potential to become one of the major economies in the world, in the next three to four decades. But it is also a foregone conclusion, that economic & industrial growth is predicated on assured energy supplies, amongst the myriad other prerequisites. The International Energy Agency has estimated that India's energy requirements out to 2040 will more than double, from present day consumptions, notwithstanding variations in the energy mix (IEA, 2012). In 2013, India imported 190.5 Million Tonnes of Crude Oil and 17.8 Billion Cubic Feet (Bcf) of Natural Gas (BP, 2014) .

Traditionally, India has been dependent on the Middle East for the lion's share of its oil and natural gas. Oil imports at 124.6 Million Tonnes in 2013 were about 65% of all oil imports; similarly, about 87 % of natural gas imports were largely from Qatar, at 15.5 Bcf (BP, 2014). However, with unconventional oil and gas being assessed as available in many countries, distributed all over the world,

the prospects of such traditional energy flows altering have become more promising.

Since there is no option for India, but to import oil & gas in significant quantities, in this context it is important to continuously study the evolving dynamics of new sources of oil and gas, globally, and as these may impact India. Imported sources of energy can become a major component of a country's energy security, subject to some conditions being met. These are, firstly peace & stability in the region, adequate energy availability and security of such energy flows. India's case is no different.

Traditional oil & gas exporting economies have had their own international alignments and geopolitical dynamics. A conflagration in the Middle East is certain to impact the oil dynamic and spook oil prices, worldwide. This spooking directly impacts demand and supply forecasts, and often leads to 'premiums' in costs and availabilities, directly affecting oil supplies. The international embargo of Iranian Oil in the last four years, in the wake of US geo-political pressure, has had a direct impact on India.

Oil, per-se, has become a 'weapon' in the last sixty-seventy years or so. Its denial sometime impacts countries much more than is commonly envisaged. Germany attacked Russia, (its ally in the Second World War), in its quest to capture the Caspian oil fields, and failed, leading to its defeat, a strategic miscalculation. The Arab-Israeli Wars were other manifestations, amongst a long list of energy related conflicts, in addition to two 'Gulf Wars'!

Currently, major geopolitical changes are occurring. A number of oil producing countries in the 'Middle East' i.e. West Asia & North Africa have

witnessed, in what has been termed the 'Arab Spring'. Conflicts are presently raging within Iraq and Syria. These have major impacts on geopolitics of the region. A destabilisation in the region, coupled with a slight reduction in global demand for oil & gas, and on the other hand, overcapacity in its production has set the stage for realignment of the traditional 'producers versus consumers' relationships, and pricing trends, globally. We are currently witnessing these.

This Shale Oil and Gas revolution, should it continue, has the potential to alter present geostrategic dynamics, in terms of energy flows, peace & stability, supply and demand dynamics; oil and gas prices and market shares, globally. It need not be that India needs to have Shale Oil & Gas fields. Any change in global supply of such fuel, is bound to impact the extant dynamics. There are indications that it may already have triggered off change due to a Shale Oil & Gas glut in the US.

For India to grow into 'its rightful place under the Sun', it must make prudent, long term choices in its preferred energy mix, to include nonconventional sources and improve efficiencies.

### **Statement of the Problem**

Energy security is about energy flows, regional stability, and availability. Thus, India needs to position itself suitably for the long term, in a geo-strategically advantaged position, to take into account the dynamics of a new source of unconventional oil and gas i.e. from Shale Oil & Shale Gas with a view to ensure energy flows, regional stability and availabilities.

## **Objectives of Research**

The objectives of this research are:-

- (a) To examine the possibility of Shale Oil and Gas becoming a 'game changer' in the global oil & gas scenario.
- (b) To study the likely impact of such a Shale Oil & Gas scenario may have on the Indian economy.
- (c) To study/ understand the likely geopolitical & geostrategic implications of such 'Shale plays' in general & India in specific.

## **Rationale /Justification for Research**

Energy security is about energy availability. It is about energy flows and it is about peace & stability in the regional & global context. In the world today, energy has a geopolitical and geostrategic context. To illustrate, the US had enunciated the famous 'Carter Doctrine' in 1980 to defend US national interests in the Middle East, (Carter, 1980) due to US dependence on Middle East Oil. After enunciating the doctrine, they put the US Sixth Fleet into the Persian Gulf, to guarantee energy security, i.e., peace & stability while the Middle East nations pumped out oil and gas, continuance of energy flows to the US and its allies. Clearly, a geostrategic implication, manifested.

Should the Shale revolution result in a sustained indigenous production of oil and natural gas within the US, it may propel the US into an age of energy independence' as is being projected. Consequently, as the world's sole superpower, it may further rethink its geostrategic role in the Middle East, having

already announced the 'Pivot to Asia' strategy. Such geostrategic shifts are likely to have major implications for India. India is the biggest oil and gas importer & consumer in the region, next only to China and Japan.

### **Geostrategic Dynamics**

Geostrategic dynamics are likely to be impacted by comparative and absolute economic growth in the region; oil & gas production in the region, directions of energy flows, global prices of crude and natural gas, and peace & stability. Substantive Shale Oil & Gas production, which may become a sizeable proportion of conventional oil & gas production, is likely to affect all of the foregoing issues that affect geostrategic dynamics.

Should India play a greater role in the India Ocean, to ensure peace & stability, and ensure safe & secure shipping lines of communication, from where about 50-60% of the global shipping is projected to pass? Should India increase its military spending to bolster its Navy, to play an increasingly prominent role? Should India align itself more closely with the US, and collaboratively patrol the high seas? Should India play the role of a regional power, and put troops on the ground, in increasingly troubled states like Iraq, due to the US moving out. Is it a consequence of their anticipated energy independence? Should India review its strategic posture in Arunachal Pradesh, since China has expressed renewed interests in Arunachal Pradesh, post reports of oil & gas finds there? Should India sign long term energy contracts with selected, non traditional oil/ gas producing countries, in anticipation of production increases? Should India invest in overseas Shale development? Should this investment be equity based, or

should India look to buying out oil & gas fields, overseas? These are some of the issues that need consideration.

These are some of the geostrategic implications that may come to bear. It is entirely possible that Shale revolution may be a short lived one, given the depressed oil prices, as of now. Or that Shale estimates may go awry, globally. It is in this scenario that a study may prove relevant. It may help prepare the ground for informed choices by India strategically.

This research thus attempts to examine and seek out some of the answers, which may subsequently help in identifying & suggesting the choices that India can make.

### **Research Questions**

- Q1 Will Shale Oil & Gas impact the global dynamics of 'conventional' oil & gas? Under what conditions can it become a game changer?
- Q2. How is Shale Oil & Gas likely to impact India's economy? Will it result in a reduced import bill etc?
- Q3. What strategic choices can India make, to further its energy security & national interests?

### **Scope/ Limitations/ Delimitations**

**Delimitations** : Shale Oil also includes Tight Oil, sometimes also classified as Light Tight Oils. Similarly is the case with Shale Gas. Tight Gas will also be treated interchangeably with Shale Gas.

**Limitations** : Data is being sourced from established primary sources, as specified. These are considered reliable & established sources of energy data, worldwide. Data is not proposed to be collected, due to the economic value of the topic and its designed opacity by vested interests. Published data/ from database & interactive data builder sites has been sourced.

Secondly, the focus of this dissertation is on the oil & gas part of the energy spectrum, and not all forms of energy.

### **Research Methodology**

The research methodology proposed to be adopted is qualitative, exploratory type research, and will involve the following: -

(a) Data will be sourced directly from established, credible and reputed primary sources as under :-

- (i) US Energy Information Administration (EIA) Reports.
- (ii) EIA web based data site International Energy Statistics.
- (iii) International Energy Agency Statistics.
- (iv) BP Energy Statistics.
- (v) OPEC Database.
- (vi) Petroleum Planning & Analysis Cell, (PPAC), Ministry of Petroleum & Natural Gas, Government of India.
- (vii) IMF Database.

(b) **Other Data Collection Methods:** From secondary sources through library research, study of books, research papers, articles in newspapers, published & unpublished government reports and various relevant online sources.

(c) Inferences will be drawn based on exploratory research, analysed & views/ conclusions will then be presented.

### **Chapterisation**

Chapter 1 : Introduction & Methodology of Research.

Chapter 2 : Shale Oil & Gas.

Chapter 3 : The Economic & Political History of Oil.

Chapter 4 : Shale Oil & Gas - a game changer or otherwise.

Chapter 5 : Shale Oil & Gas: Impact on the Indian Economy

Chapter 6 : Shale Oil - Strategic Implications for India & Choices for Energy Security.

Chapter 7 : Conclusion

## Review of Literature

Daniel Yergin, in his Pulitzer Prize winning book *The Prize: The Epic Quest for Oil, Money, and Power* has chronicled a history of oil and weaves in a convincing argument of how oil is inextricably tied to all parts of global politics, strategy, economy, culture, and everyday life.

The book traces the journey of oil, from the original American oil field discoveries and the resulting dynamics of oil that have followed thereafter. The historical journey from the late 18<sup>th</sup> century is traversed onto pre 1<sup>st</sup> World War period. Here, the history & geo-politics of various 'Oil Concessions' with various oil producing regions e.g. in the Caspian, Arabian, Persian and the then Mesopotamia have been traced. Yergin has also traced the geostrategic importance of the Middle Eastern countries & their historical evolution, born or rather created as a result of the 'Sykes-Picot Agreement' and the 'bounty sharing' of the Allies' post 1919. He has also opined that the World War II was an oil based outcome, and possibly Germany too, could have won the war, had it been able to claim the oil fields in the Caspian, Balkans & Romania .

Primacy of oil as the compelling argument for the numerous wars & conflicts in the Middle East has been succinctly put forth in this book. Oil as a tool for resurgence of Pan Arab nationalism has been yet another thread of his argument. To sum up, Daniel Yergin has successfully argued that oil has been the underlying *raison d'être* for much of the geopolitics that have shaped the world in the last century. It is, as per the author, the *casus belli*, for most of the major conflicts & wars in the 20<sup>th</sup> century, as well as some of the present ongoing conflicts (Yergin, 2008). However, Shale (Shale Oil, gas etc) while finding

mention, are only referred to in passing, and that too in the context of the process of recovering oil by heating pulverised Shale rock, which is not quite the Shale Oil (or *tight oil* as is referred to these days) , but what is referred to as 'Oil Shale'.

Daniel Yergin, in his recent book, *The Quest: Energy Security and the Remaking of the Modern World*, in 2011, once again, has explained the connections between forces of economics and geopolitics with modern history, the science of energy production & climate change. Yergin attempts to answer three questions in the book. Namely, will adequate energy be available to meet the needs of the world, and if so, at what cost? How can the extant energy system be made more secure? What are the likely impacts of climate change & concerns of environmental impact, on energy itself? The book traverses a large swathe of topics, starting out from conventional oil & gas, to renewable and sustainable energies for the future. In this book, Yergin has postulated that gas, rather than oil as an energy source is likely to become a game changer in the future, and has written about the increasing offshore discoveries of gas fields in the Persian Gulf, especially off Qatar, and in the Mediterranean, off the Israeli coast. Geopolitics of select regions has also been developed by him in the book. His treatment of 'pipeline politics', both of oil and gas pipelines is interesting and does get somewhat close to 'power plays' between stakeholders in the region, but then he stays away from focussed geostrategic analysis, rather, refocusing on political actors and multinational/ national oil & gas players. China figures in some energy discussions, however, India is given passing references, largely limited to its growing import requirements of oil & gas (Yergin, 2012).

Amy Myers Jaffe and Robert A. Manning, in their article 'The Shocks of a World of Cheap Oil', published in *Foreign Affairs* in 2000, wrote that the US must prepare itself for the resulting implications of internal instability of oil producing nations, especially in the Central Asian and Persian Gulf regions, prognosticating a somewhat 'perilous future' for some of these countries. Though at that time, the argument that pain would result as a consequence of low oil prices, as oil was then comparatively cheaper, the import of their article is still relevance today. Even with high oil prices, a lot of pain amongst this 'arc of instability' in the Middle East remains. This article largely expanded on economic and political aspects. It also looked at the politics of oil security, in the context of growing demand from Asia and its dynamics. It also flagged the concerns, of the American military role of 'guardian of the Gulf' in view of reducing US dependence on Gulf Oil. The article concluded by emphasising the continued geostrategic importance of the Gulf in the future. However, it also suggested burden sharing by emerging Asian economies for oil based energy security in a collaborative manner. (Manning, Jan - Feb 2000).

Ian Bremmer, in his article 'Oil: A Bumpy Ride Ahead', published in the *World Policy Journal*, in 2008 wrote that a decade later, hydrocarbon alternatives would become available in commercial quantities. He also forecasted that political factors and growing global demand, especially from Asia would continue to pressure pricing. As per Bremmer, growing oil dependence would engender instability across regions & states. In such a context, he postulated that hydrocarbon alternatives could help alleviate such risks. He concluded by stating that necessity was the mother of invention and so, in the face of global demand

side pressures on price and availability, alternative energy sources would be found and developed (Bremmer, 2008 ).

Vijay V. Vaitheeswaran, writing in the *Foreign Policy Journal*, in an article titled 'Oil', argues that the best case to be made out against those who are proponents of the 'end of global oil' is to develop unconventional hydrocarbons, i.e. Shale, tar sands etc. And use these for transportation requirements, globally. He contends that adequate deposits of these are available, and are awaiting development, albeit at higher environmental & economic costs. And he goes on to assert that these very concerns would result in technological developments & breakthroughs, to eventually allow extraction of clean fuels. He has also flagged the implications of pipeline politics. He concludes his article by surmising that China, as the fastest growing energy consumer, will invest and help in developing the next generation of energy technologies (Vaitheeswaran, 2007) .

Leonardo Magueri, in his book *The Age of Oil: The Mythology, History, and Future of the World's Most Controversial Resource* (2006), has written on the influence of Oil on all aspects of world history, economics and geo-politics. However he also debunks, or rather explains some myths, as he terms them, which have been ascribed to oil in general. He concludes his view, that the oil cycles of boom and bust, i.e. over and under capacity and the associated price fluctuations, fears of oil & energy security etc are cyclic in nature and there for nothing to get worried about. In effect, nothing fundamental was about to change (Maugeri, 2006).

Leonardo Magueri, in his later paper - Oil: The Next Revolution published at the Belfer Center for Science and International Affairs, John F. Kennedy

School of Government, Harvard University, evolves his position on some aspects. He surmises that oil and natural gas based liquid supply capacity is growing at unprecedented levels and may outpace consumption. This global capacity addition, in his view, is a result of unparalleled investments in the last decade, globally, since 2003, and 'de-conventionalization' of oil supplies i.e. increasing sources of oil & gas from 'US Shale/ tight oil, Canadian Tar Sands, Venezuela's extra-heavy oils, and Brazil's pre-salt oils' (Magueri, 2012).

A similar view is also emerging from various reports & more recently from the ubiquitous *US Energy Information Administration's* report 'International Energy Outlook 2013' (EIA, 2013a) .

In his book *No War for Oil: U.S. Dependency and the Middle East*, Ivan Eland, a foreign-policy analyst at The Independent Institute, Washington DC has taken a differing approach to the problem of secure access to oil, globally. Eland, in the first part of the book, begins with the history of oil in the 20th Century. He too, just like Daniel Yergin in his book *The Prize* recounts the troubled legacy of wars and military actions undertaken to secure access to oil. To him too, the main rationale for going to war, and for so many a geo-political compulsions, has been the one commodity –oil. However, later on he reaches a conclusion that is completely different from the one Daniel Yergin has concluded. Eland contends that the American foreign policy and its state instrument, the US military is now not needed to protect the world's oil-rich regions, or for that matter oil. Rather, economic and markets forces, by themselves may be adequate to safely guarantee oil security. In effect Eland, while historically chronicling oil as a strategic commodity, has now theorised that oil is not a strategic commodity and

thus a number of assumptions on this count are faulty and misleading. He bases his argument primarily on two precepts; firstly, adequacy of US oil, or at least growing production of oil within the US, especially for the US military and secondly, abundance of oil nearby, in Canada & Mexico. As a consequence, in one of his themes in the book, he argues that there is a case for America reducing the size of its Armed Forces, by as much as half (Eland, 2011).

Sarah O Ladislaw, and Maren Leed, in their paper 'Geostrategic Implications of Unconventional Oil and Natural Gas' base their ideas upon the remarkable surge in unconventional oil and gas development in the US. The commercial viability and potential for transferring such technology, in their view, may alter the global energy landscape substantially. While they do not take a position as to whether these are long-term geostrategic implications or not, they do argue, that some global trends are becoming visible. Notable, are a broad reduction of conventional oil & gas demand by the OECD countries and other oil producers, due to a number of reasons. On the flip side, a clear increase in oil & gas demand is evident from Non OECD countries, including China & India. So a clear shift in the global energy landscape has emerged. This paper makes some key points. The first one is that trends of unconventional oil and gas need to be seen in conjunction with other trends in the global energy dynamics. These include decline of OECD economies' energy consumption due to economic recession, better efficiency and increased reliance on alternative fuels, the post-Fukushima environment for nuclear energy generation, investments in deepwater, arctic, and other oil and gas resources, environmental stewardship, climate change, and the desire for clean energy technologies. The second point that the

authors make, is that production and sustainability of these resources is yet to be established.

The third point that the authors make, is that post the Arab oil embargo of 1973, the US has created global energy institutions and has set up its Strategic Petroleum Reserve (SPR), due to its preoccupation with the geo-strategic implications of imported oil & energy requirements. In this context, the authors argue, that the remarkable surge in US oil & gas output including non-conventional oil & gas development has the potential to become a game changer. From being a major oil & gas importer, quoting various assessments, they surmise, that US will energy self sufficient and may be a net energy exporter by 2030. Of this increase, the authors assert, that the greatest growth of hydrocarbons is likely to come from unconventional oil & gas production. All these events, they argue, will induce geo-political shifts in energy relationships. Relative power shifts are forecast, both globally as well as regionally. The authors also deduce that global gas prices may reduce (Ladislav, 2013).

Joseph S. Nye, in his editorial in the op-ed page of the *Wall Street Journal*, has written that the real geo-political shift currently underway globally is the Shale energy revolution, which has taken off only in the last decade or so. He lays emphasis on the point that while the technologies involved in 'fracking' may not be new, rather it was the ground-breaking application by the American private enterprise, to extract oil & gas from Shale rock that has led to such spectacular results. He tends to disagree somewhat, with Eland, with regards to US self sufficiency of oil. Self sufficiency of US with regards to gas, abundance of oil, including cheaper conventional oil, as per him, are already resulting in reduction

in the cost to American companies & consumers alike, and tend to reduce US energy dependence on 'imports'. He has also pointed out the geostrategic cloud that is starting to establish, to quote him

*"The ability of the U.S. to use oil sanctions to bring Iran to the bargaining table on nuclear issues depended not only on Saudi willingness to make up the million barrels of oil per day that Iran lost, but also on the general expectations that were created by the Shale revolution."* (Nye, 2014)

Leonardo Magueri, in his more recent paper 'The Shale Oil Boom, A US Phenomenon', published in June 2013, has looked at the various issues that presently afflict the Shale revolution, e.g. the central question *per-se*, whether the Shale Oil boom is a wave capable of influencing /altering the global energy outlook, or is it just a transitory bubble ! He postulates that Shale Oil plays are likely to significantly alter the US energy outlook. The other significant theme that he asserts is that this Shale boom, as of now, appears to remain limited to the US, and may not get replicated globally, to quote (Maugeri, 2013)

*"other factors that will make the global replication of a U.S. style Shale boom difficult, including an absence of private mineral rights in most countries, as well as the absence of the U.S. independent companies whose guerrilla-style operational mindset has proven essential to the exploitation of Shale formations"*.

The other seminal point he makes is that in the event of the US reducing net imports of oil, overall price of oil is likely to fall. In such an eventuality, the cheapest oil would still come from the Middle East, while oil from US neighbours like Canada and Venezuela may be costlier. In effect, US may continue to import some oil from the Middle East (Maugeri, 2013).

U.S. Energy Information Administration, in its report '*Annual Energy Outlook 2014*', indicates higher growth & production of US crude oil, due to multi-fold increase in 'tight oil' i.e. Shale Oil output. Other oil, gas & other energy statistics are also included. Growth in crude oil production from tight oil and Shale formations have supported a nearly fourfold increase in tight oil production from 2008, when it accounted for 12% of total U.S. crude oil production, to 2012, when it accounted for 35% of total U.S. production (EIA, 2014a).

Shebonti Ray Dadwal, in her monograph, published by the Institute for Defence Studies and Analyses, has looked at the phenomenon of America's 'energy independence'. The author delves into the emerging energy landscape as a consequence of US technology and its energy policies. Dadwal has looked into two aspects - claims of 'energy independence' and secondly, the likely geopolitical implications of such independence. This analysis, however, does not take into account the 'Russian' dimension. The Persian Gulf region too has been analysed in context of America's 'energy independence'. However, recent events in West Asia and consequent US response in Syria & Iraq is rather different to what has been surmised by Dadwal. China has been analysed, especially with regard to its energy policies in place and its quest for conventional, unconventional and renewable energy supplies. The Indian context however, needs further analysis (Dadwal, 2013). Since China & India are major energy importers & their increasing requirements are likely to result in competition for resources. Geostrategic implications of such competition in the region, requires further analysis.

Institutional literature & reports on India's energy requirements & energy security have also been reviewed. The Energy and Resources Institute (TERI) New Delhi, in its report 'India's energy security: new opportunities for a sustainable future', published in 2010, has made a strong case for addressing not only the supply side issues, but more importantly, demand side issues. The report lays great emphasis on improving efficiencies and resultant reduction in demand growth. Sustainability is the prescriptive theme, and 'bio-fuels' are suggested as a viable alternative for contribution to India's sustainable energy security. When analysing demand side aspects, the report suggests rational pricing & competition as a key driver. While acknowledging India's growing requirement of oil & gas as essential, it suggests a review of the economics of long term contracts vis-à-vis equity investments in oil & gas abroad. On gas, the reports talks of transparent bidding & auctioning process & pooling of gas from all sources as key to efficient use. It also mentions, but in passing, the need to increase sources of gas & unconventional sources, but without any further specifics. The report also suggests increase of oil production using "*microbiologically enhanced oil recovery processes*". It concludes by emphasising on the need for a rapid electrification of the country, to be largely met by renewable energy sources i.e. solar energy, wind energy, biomass and hydroelectricity for ensuring long term energy security(TERI, 2010).

The Energy Information Administration country specific analysis brief on India, released in 2014 also covers major aspects of India's energy landscape. The present supply and demand sides of energy, to include oil & gas have been documented. It puts India as the worlds' fourth largest energy consumer, after China, the US & Russia (data as of 2011). It also talks of India's per capita

energy consumption as a third of the global average, and therefore surmises a growing long term energy demand in its path of economic development. The report has also highlighted the growing gap between India's domestic production of oil & gas vis-à-vis imports and increasing import dependence. The report also flags the issue of decreasing domestic natural gas production. The report, however, does not focus on unconventional sources of energy, other than in passing. The geopolitical or strategic context is not part of the report (EIA, 2014b)

The latest snapshot released by Petroleum Planning & Analysis Cell (PPAC) under the Ministry of Petroleum & Natural Gas in July 2014 has documented indigenous production levels as well as quantum of imports and has put the July 2014 import dependency at about 79%. It also indicates India's vulnerability to foreign exchange and international crude price fluctuations, by quantifying the impact on India per US\$ variation. While the indigenous nascent coal bed methane output has been included, Shale Oil or gas does not find mention. The snapshot is economic and statistical in content (Petroleum Planning & Analysis Cell, 2014a).

It is quite clear from the foregoing, that a lot of published material and secondary sources, as well as online material are available, on conventional oil & gas. The geopolitical implications too have been well analysed. However, since Shale Oil & Gas are relatively new phenomenon, published material is scarce. In any case, the geostrategic impact of Shale Oil & gas, especially on India & the region has not been found published and thus a research gap exists.