

CHAPTER-2 LITERATURE SURVEY

Natural Gas is a vital component of the world's energy supply. It is one of the cleanest, safest, and most useful energy sources [1]. It was not so long ago that crude oil dominated the energy mix as the main fuel. Although the scenario has not altered much even today, the fact is that crude oil's share is shrinking the world over, with cleaner fuel options gaining preference. Heightened environmental concerns relating to global warming and air pollution, highlighted at the Kyoto and Bali summits, have furthered the search for, and possible switch-over, to cleaner energy sources which have far less emission of pollutants. With energy efficiency similar to crude oil and coal, natural gas clearly has an edge. It ranks third after crude oil and coal in terms of usage but has clearly gained at the expense of crude oil within the fossil fuel fraternity in the past three decades. Geographically, its use is confined to a few regions, viz., North America, Europe and Central Asia, and it will take some time to create adequate physical infrastructure in energy hungry countries like India and China to enable its mass usage [2].

There are a number of factors which have worked in favor of the demand for natural gas.. Among the more important ones are:

1. Greater willingness to use natural gas in electricity generation in the light of growing resistance to nuclear power.
2. Advancement in combine cycle technology, giving improved efficiency in electricity generation.
3. Conversion of existing systems to natural gas and expansion of the system, and
4. Disparity of cost between cost of gas and the effective cost of using oil and coal [3].

Natural gas requires a costly and widespread infrastructure for its transportation. It can be transmitted through pipelines or transported by ship in the liquefied state (LNG) [4]. Pipelines have for long been the primary means of transportation of gas over land or under water.

LNG supply chain is more capital intensive than onshore pipelines for the same capacity [5]. The unit transportation cost is consequently higher for LNG over shorter distances. For longer distances, unit transportation cost of LNG is lower than that of onshore pipelines, owing to the fact that LNG shipping cost is less sensitive to increase in distance [6]. There is a trade-off point between onshore pipelines and LNG is about 4000 kilometers. For distances below

4000 kilometers it is economical to use onshore gas pipelines, but if it is above 4000 kilometers LNG offers an advantage. The trade-off point between LNG and offshore gas pipelines is around 1500 kilometers, and LNG is more economical than offshore gas pipelines for distances greater than 1500 kilometers [7].

Asian economies including China, India and South Korea are currently growing at rates far higher than the US and Western Europe. This trend is likely to continue in the future, provided supply of energy is secure. Asian countries particularly China and India are expected to account for a major portion of the incremental energy requirements of the world [8]. China, India and other emerging Asian economies are together expected to account for 48 percent of the world's total incremental energy requirement between 2000 and 2020 [9].

Between 2005 and 2020, global consumption of natural gas is likely to grow at a compounded annual growth rate of about 2.7 per cent from about 2600 BCM in 2005 to around 3900 BCM in 2020[10]. Gas consumption in Asia will rise from approximately 340 BCM in 2005 to around 785 BCM in 2020. This would make Asia the fastest growing region in the world as consumption is expected to accelerate by 5.8 percent year-on-year from 2005 to 2020. Asia could have a gas deficit of 415 BCM by 2020. As a result, Asia has to significantly increase its indigenous production and secure adequate LNG and international piped supplies.

The geography of the Asian countries is acceptable for laying pipeline. However, political and economic compulsions are a matter of concern [11]. Countries which are gas rich have to decide on economic growth, while those which are starving for gas have to take risk and invest in the gas rich nations [12]. There are two relevant characteristics of cross border trade: it requires contracts to be drawn that establish property rights and responsibilities from within which are potentially different legal regimes. The difference between cross border trade and internal trade is the absence in the formal situation of a single overreaching jurisdiction [13].

An anticipated doubling of the global gas market every 25 years, combined with disparity in the locations of demand and supply, will continue to underpin cross-border trade. The supply of natural gas is, however, failing to keep up with demand, despite the abundance of natural gas globally [14]. Much of the natural gas is "stranded" because it is isolated from markets. New cross border gas projects are required to bring stranded gas to markets [15].

In the near future, the world will need more cross-border pipelines for oil and gas. Reserves close to traditional markets are getting depleted. Newer, more remote sources of oil and gas are required. Many of these will require pipeline delivery especially in landlocked areas, or if the fuel is natural gas, liquefied natural gas (LNG) projects are less attractive than pipelines, except for

distances exceeding 3,000 km [16]. Many gas markets have in the past been constrained by regulatory and institutional factors. In recent years these constraints have eroded. A potential “dash for gas” is furthermore being reinforced in many areas by a combination of gas sector reforms, gas-to-gas competition; electricity sector reforms. This leads to strong demand for combined-cycle gas turbine (CCGT) generation; and concerns about the environmental damage caused by the consumption of other hydrocarbons [17].

India's former Petroleum Minister Mani Shankar Aiyar first proposed the idea of Asian Gas Grid. Aiyar said “we are talking of a national gas grid but must also think of an Asian gas grid [18]. In Asia we have the possibility of linking each other not only through trade and investment but also by a gas pipeline network which has immense potential. Gas can be siphoned off when required and yet flow”.

The proposed Iran-India pipeline via Pakistan could be extended to South China via Myanmar, while a network of pipelines could link former Soviet republics of Kazakhstan and Turkmenistan with East Russia on the one hand and demand centers, India and China, on the other. Gas-rich Myanmar and Indonesia could also form part of the grid [19].

As India seeks to secure gas supplies from different regions, the minister urged an Asian dialogue to help access gas supplies from Iran in the west, Myanmar in the east and Central Asian gas from the north [20]. He also urged delinking the Asian gas economy from the Asian oil economy, developing gas as the favored fuel of the 21st century, as technology makes it feasible to substitute oil with gas.

Working on his idea, in 2005 Ernst & Young and Tractebel Engineers & Constructions did a study on a proposed 22,491-km Asian gas grid at an estimated cost of \$22.4 billion. A study by the firms identified Iran, Uzbekistan, Turkmenistan, Russia, Kazakhstan, Azerbaijan, Myanmar, Bangladesh and Afghanistan as potential sellers with 70 trillion cubic feet (TCF) of natural gas supply which would be markedly more than the 40 TCF demand generated in Turkey, Thailand, Taiwan, South Korea, Pakistan, Japan, India and China. The benefits of such a grid would be to the tune of \$55.37 billion by the end of 2025 assuming that importing countries get \$1 per million British thermal units and exporting countries get \$2, considering the benefits accruing through development in the downstream sector [21].

In order to meet the growing energy demand, Asian countries will have to find a common solution to meet this requirement [22]. Oil reserves are getting depleted and it is expected that within next 50 years, it would completely deplete. Hence, Asian Gas Grid would be the permanent solution. Some of the energy demands can be met from coal, nuclear, and other non- conventional source of energy, but natural gas is going to play a major role in fulfilling the

energy demand of Asian countries [23]. The creation of an Asian Gas Grid will not only lead to exchange of trade but also development of the electricity, petrochemicals and fertilizer industries.

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