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Approaches for Utilization of Natural Gas

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EXTENDED ABSTRACT

Oil and gas industry produces excess amount of associated and non - associated natural gas in exploration, drilling, transportation and processing of oil and gas. A significant percentage of these gases are wasted by burning, venting and flaring. A cleaned, purified and stabilized natural gas is subsequently used for industrial applications. The end use of the natural gas varies from being a feed stock in a fertilizer plant, combustion fuel for power generation to petrochemical and speciality chemical applications [1]. This research study looks into approaches and categories of natural gas utilization in conventional and unconventional methods. The aim is to understand natural gas utilization pattern to identify possible current and future natural gas usage than can be enhanced and optimised.

Many of current natural gas reserves are located in far off locations and have access and transportation issue making it economically less attractive. Additionally still 1/3 of the natural gas is stranded and not economically feasible to recover and use by current technologies [2]. Recent price crash in crude oil has decreased the attractiveness of these low value gas assets further [3]. The price of crude oil has fallen by approximately 50% from the average price in year 2014. As a result of oil price crash, international market is flooded with abundant quantity of cheap and affordable crude oil as well as liquid hydrocarbon fuels. Since crude oil is preferred choice of hydrocarbon, the demand for natural gas is going down further [4]. A direct result of the crude oil price crash, long term purchase sale and purchases of natural gases are being re-negotiated by consumers. Therefore there is need to find alternative usage of natural gas to maintain a health state of natural gas industry [5]. A typical summary of the natural gas consumption pattern in GCC is given in Table 1 and can be observed that more than 50 percent of natural gas continued to be used as fuel.

Table 1: Natural gas utilization in GCC countries

| S. No. | Categories | %age utilization |
|--------|---------------------------------|------------------|
| 1. | Feed stock for power generation | 50% |
| 2. | Fertilizer | <5% |
| 3. | GTL | 25 |
| 4. | Petrochemicals | 10% |
| 5. | Transportation fuel | 10% |
| 6. | Miscellaneous | <5% |

As can be inferred from Table 1, typical gas rich region like GCC countries continue to use natural gas as preferred choice of fuel for electricity generation and contribute more than two third of their energy feedstock. Application of natural gas in the form of compressed natural gas as transportation fuel is catching up predominantly due to tougher environmental regulation and climate change issues. Combustion of natural gas produces abundant quantity of CO₂ and other

harmful greenhouse gases and have negative environmental affect [5]. A significant portion of natural gas is converted into wide spectrum of petrochemicals and other speciality chemical through gas to liquid technologies. GTL is a proven technology that consist of converting natural gas into a syngas mixture that later is converted to liquid hydrocarbon using Fischer Tropsch or other techniques [6, 7, 8]. A typical GTL technological scheme is shown in Figure 1.

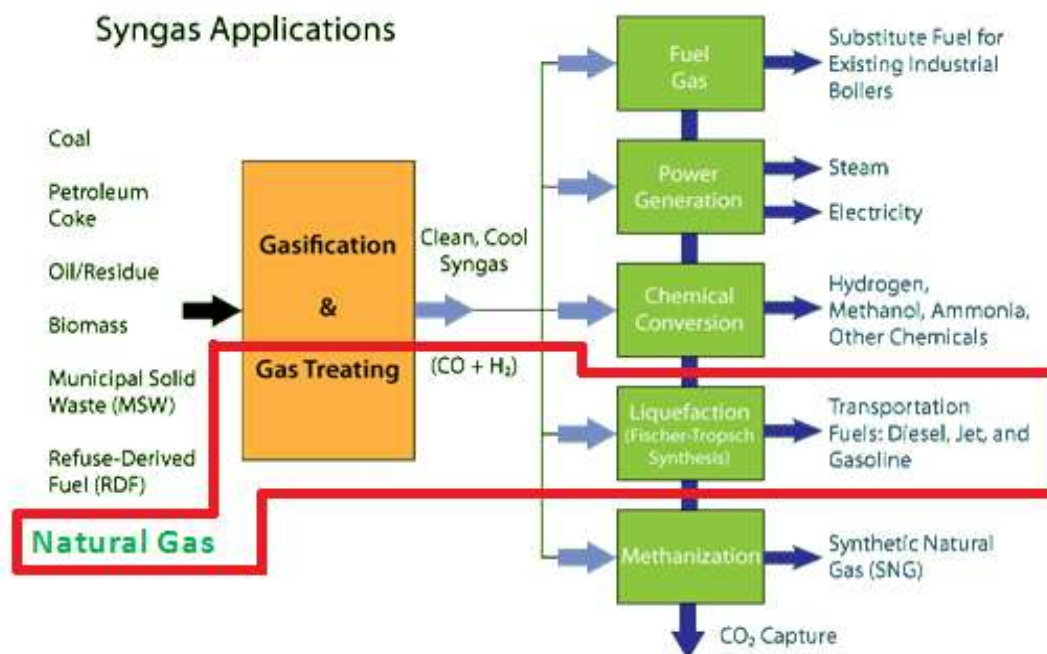


Figure 1: Routes for natural gas based syngas applications and uses

As can be inferred from above figure CO₂ is produced as a side product in this process and needs to be captured / mitigated / recovered to address the environmental concern.

Due to prolonged low oil prices and availability of liquid hydrocarbons as an alternative to the natural gas applications, there is a pressing need to find new and innovative application of the natural gas. The urgency to find an economically viable and sustainable method is highest as cost of gaseous hydrocarbon is falling further making remote natural gases and other process stream gases (by -products) even more undesirable and less attractive than ever. Another driver to the urgency of the solution is more stringent environmental regulations, which are being enforced in lieu of global warming and deteriorating environmental conditions. The paper present and highlight the finding of waste gas usage and future potentials of these applications.

Keywords: SOFC; Gas emission; Natural Gas; Fuel Cell; Environmental hazard; Power generation

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