VIRTUAL GAS PIPELINE AS A PRUDENT SOLUTION IN GAS INFRASTRUCTURE INVESTMENT IN SAUDI ARABIA

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Overview

The government of the Kingdom of Saudi Arabia has launched a Saudi Green Initiatives with a commitment to achieve a net zero emission by 2060. One of the programs is an ambitious goal to displace more than 1 million barrel per day of liquid fuels across the sectors of power generation and water desalination, industry and agriculture by 2030, of which mostly will be replaced by natural gas. This program will create new gas demand in many locations.

From the supply side, Saudi Arabia has the world's eighth largest natural gas proved reserves, and Saudi Aramco will expand the gas production capacity, such as developing a large Jafurah gas project with gas supply capacity ultimately by 2.2 billion standard cubic feet per day by 2036.

However, due to its capital-intensive nature, gas pipeline development to connect the supply and new demand centers carries a considerable risk. This is because the demand centers are often located far away from the existing Master Gas System (MGS) and multiple small volume customer bases with uncertain demand growth.

Virtual gas pipeline system can be a cost-effective solution compared to conventional gas pipeline to deliver gas to the new markets. It is an alternative system that allows gas transportation in the form of compressed natural gas (CNG) or liquefied natural gas (LNG). The main advantage of this system is its modularity and scalability which leads to flexibility in capital spending. The level of system capacity expansion and the amount of investments can be aligned over time in line with the actual growth of future demand. Consequently, the upfront capital investment risk from under-utilized asset can be minimized.

Methods

The study selects Al-Kharj and Sudair industrial cities in the Central region and Jeddah (2&3) industrial cities in the Western region as a hypothetical case study of new natural gas markets to assess the benefit of virtual gas pipeline system as an alternative to a conventional gas pipeline system in gas infrastructure development in Saudi Arabia.

Gas demand is estimated based on existing economic activity in the selected industrial cities and is assumed to grow to reach the plateau gas demand potential according to the total area of the industrial cities under various demand growth rate scenarios (represented by number of years during volume build up period). The system's start year is assumed the same in 2025 although, in reality, virtual gas pipeline system can be installed in shorter period of time due to modular design and much less civil works.

CNG is selected as a technology in virtual gas pipeline system as the distances are within a range between 120-280 Km from the MGS system supply points. LNG is more capital intensive and considered as a more cost-effective means for long distance gas transportation.

The study performs an assessment using Levelized Cost (LC) which represents Gas Throughput Tariff (expressed in $/MMBTU) between the two alternatives. LC is defined as the present value (PV) of all costs of delivering gas from a supply point to end-users divided by the PV of annual gas throughput volumes, with the equation as follows:

$$LC = \frac{PV\ (costs)}{PV\ (gas\ throughput\ volume)} = \frac{\sum C_t/(1+r)^t}{\sum V_t/(1+r)^t}$$

where Ct represents cost (covering both capital and operating components) in year t, Vt gas throughput in year t, and r denotes the required rate of return (applied discount rate) which is assumed at 10%. The sum is taken over the same length of project lifetime of 20 years for both options.

The data and information are sourced from public domain. The study does not represent in any way of Saudi Aramco view on the gas market expectation, cost estimates, and technical conventions.

Results

The outcome of the study demonstrates that virtual gas pipeline solution has (1) lower capital outlay prior to project commissioning (upfront capex). It leads to (2) - under the assumption of 10 years demand build up period - lower gas throughput tariffs for virtual gas pipeline system with a range between 10% and 62%. The smallest tariff difference is driven by a shorter distance and higher plateau demand, whereas the largest tariff difference is primarily influenced by high cost of land acquisition. The result also suggests that (3) the economics of virtual gas pipeline solution is less susceptible to any uncertainty of future demand growth.

Conclusions

Virtual gas pipeline system is a prudent solution in gas infrastructure development to supply small remote demand centers due to lower upfront capital expenditures. The system also offers a mechanism to build new gas markets by growing and consolidating a sizeable gas demand to become anchor buyers to support the viability of the development of conventional gas pipeline infrastructure, thereby de-risking the investment. The old virtual gas pipeline system can then be moved to other location to develop a new gas market.

There are more than 20 industrial and economic cities in the Kingdom located away from the existing MGS network. Virtual gas pipeline solutions, either using CNG or LNG technology, can support the expansion of gas to these remote demand centers in a more cost-effective way,

Another application of the virtual gas pipeline system is in serving as a gas system supply back-up during pipeline emergency situation.