

Master Gas System (MGS) – a Leap towards Zero Emission

Mahmoud A. Younis, PMP

Lowest flaring intensities in the world

DOI: <https://doi.org/10.5281/zenodo.7018563>

Published Date: 24-August-2022

Abstract: Climate change has been the major occurring event worldwide and manifesting itself through record breaking events from strong hurricanes and floods, to wildfires in several worldwide countries, and melting glaciers in North Pole. In 2021, the United Nations issued a report that showed climate change is happening faster than predicted, and to reduce or control this change, global warming greenhouse gas (GHG) emissions must be reduced to net-zero.

The two main sources of Greenhouse Effect are the increase in Carbon Dioxide and Methane gas in the atmosphere. Since 1970, Saudi Aramco was a pioneering oil and gas company to take extensive efforts to reduce carbon dioxide and methane gas in the atmosphere through a two-step approach: 1) reduction of carbon dioxide by switching to gas burning with full elimination of gas flaring into atmosphere, 2) “Net Zero” Greenhouse emission commitment by United Nations target date.

To achieve these 2 goals, Gas plants and processing facilities were built where Saudi Aramco created its Master Gas System (MGS), the most ambitious engineering project undertaken by the company in the region. Due to the Kingdom’s increased energy demand, Saudi Aramco has continued to expand the MGS network (Phase I and II) reaching new customers in Central and Western regions.

Recently, the Ministry of Energy and Saudi Aramco inaugurated the plans to start a new Jafura gas plant which will increase gas production by 3 billion standard cubic feet of unconventional gas. To accommodate the additional gas, mega expansion of the existing Master Gas System (MGS) will be undertaken to deliver gas to new customers throughout the Kingdom including the south regions, Shoaiba and Shoqaiq.

Keywords: Greenhouse Gases (GHG), Flaring, Emission, Net-Zero, Jafura.

1. INTRODUCTION

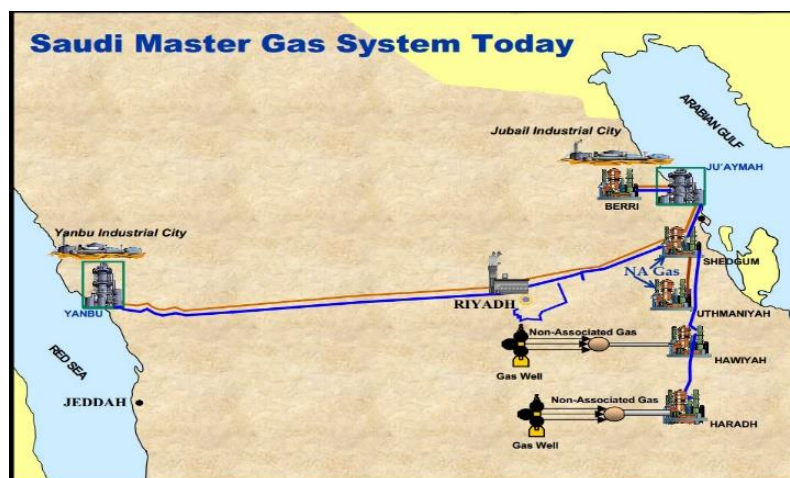
During the 1970s, there was huge economic growth in Saudi Arabia, leading to an increased acceleration in urbanization, industry, and consumer economy. Saudi Arabia recognized the need to diversify the economy and tap into new industries including the reduction in usage of costly liquid fuel in local markets.

One of the feasible solutions was to tap into the associated gas being flared off and wasted into the atmosphere, and use it as a low-cost and cleaner fuel for industrialization. Since then, Saudi Aramco developed gas processing facilities Kingdom wide to maximize the utilization of this cheap and cleaner fuel. Saudi Aramco succeeded in removing more than 100 million metric tons of carbon dioxide equivalent every year by eliminating flaring activities at most facilities. Saudi Aramco has already one of the lowest carbon intensity in the industry which was recognized by the World Bank in 2015. Saudi Aramco plans to reduce flaring to zero by year 2030 utilizing Fourth Industrial Revolution technologies in flaring and leak detection.

2. MASTER GAS SYSTEM EMERGES IN THE DESERT

Because of its characteristics, natural gas has been often considered as a “bridge or Transition fuel” to help smooth the transition from liquid hydrocarbons to a carbon-neutral energy future. Natural gas plants fill energy needs today while renewable or carbon-negative technologies are being developed and new green energy technologies being discovered.

During oil production, associated gas is produced from the reservoir together with oil and water. As more nonassociated and unconventional gas quantities were discovered and extracted, they all fed into a common sales gas stream through a network of pipelines for delivery to customers. Harnessing this new source of energy coupled with putting most flares off, Saudi Aramco created its Master Gas System (MGS), the most ambitious engineering project undertaken by the company in the region. The scope of these new gas facilities was unprecedented to the company, requiring advanced computer control systems, sophisticated equipment, new construction strategies, and state-of-the-art technologies. By late 1980s, Berri, Shedgum, and Uthmaniyah Gas Plants emerged from the sand dunes to supply up to 2 billion standard cubic feet per day (scfd) of gas to the MGS network.



3. EXPANDING THE MASTER GAS SYSTEM – PHASE I AND II

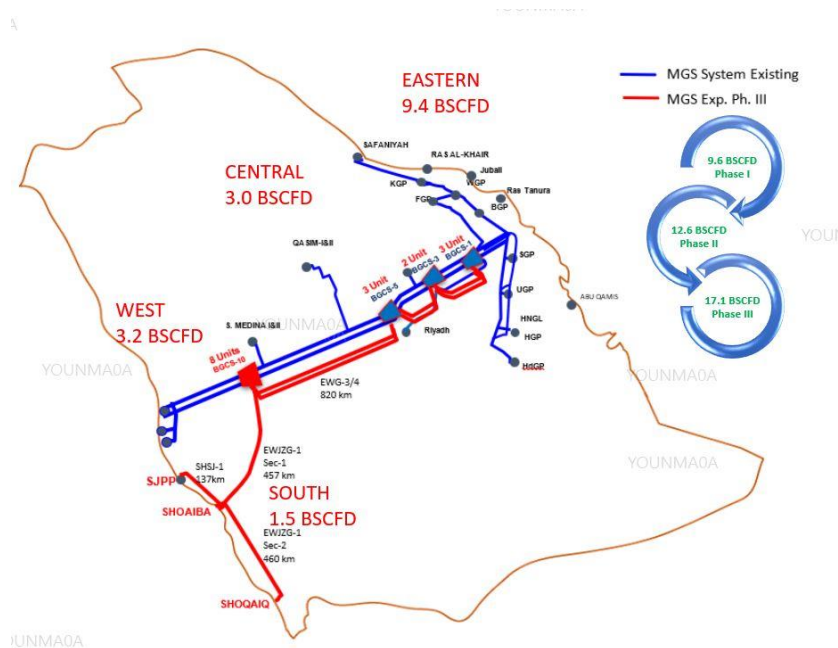
Due to the Kingdom’s increased energy demand, Saudi Aramco has continued to expand the MGS network reaching new customers in Central and Western regions. The company continued to build gas processing plans and facilities. Hawiyah Gas Plant, completed in 2001, was the first plant to be built exclusively to capture nonassociated gas to be followed by Haradh, Wasit, and Fadhili plants placing the company in the top tier of gas producers.

The company continued to expand the MGS pipeline and compression capacity through MGS Phase I to reach gas production capacity of to 9.6 billion scfd. In 2015, the MGS expansion journey continued through Phase 2 program, which will increase the total MGS network capacity to 12.5 billion scfd by adding more than 800 km of 56” diameter pipelines along the East-West corridor and with the addition of a new gas compression plant.

4. MASTER OF THE MASTER GAS SYSTEM – MGS PHASE III

Recently, the Ministry of Energy and Saudi Aramco inaugurated plans to start the new Jafura gas plant, which will increase the company’s gas production capacity by 3 billion standard cubic feet of unconventional gas. The Jafurah field — which lies southeast of Ghawar, the world’s largest oil field — holds an estimated 200 trillion cubic feet of unconventional gas, and is capable of producing 130,000 barrels per day of ethane and 500,000 barrels per day of gas liquids and condensates.

To accommodate the additional gas production and efficiently meet the Kingdom's energy demand by displacing liquid fuel with sales gas, this mega expansion of the existing MGS is required to meet the increased transmission requirements, including a new sales gas supply to the Shoaiba and Shoqaiq regions, eventually aiming to cover the gas requirements up to 2030. The MGS III program will add more than 3000 km of pipeline with more than 15 compression trains to supply existing customers and more than 30 new industrial facilities in the Eastern, Central, and Western regions, resulting in more than 1 million barrels of liquid fuel replacement by 2030.



The development of the Jafurah field and the expansion of the MGS will have major ramifications, not just on the existing gas network capacity, but also help the drive toward a cleaner energy mix, and contribute to the global gas market, helping to reach the net-zero emission goal set by the country.

REFERENCES

- [1] Naimoli, Stephen, & Ladislaw, Sarah (Oct 2019). Oil and Gas Industry Engagement on Climate Change, Drivers, Actions and Path Forward, CSIS Report.
- [2] Burrows, David, (2022). How Can Transit & Rail Systems Cope with 1.5C? Gannett Fleming.com, Jan 15, 2022
- [3] Kann, Drew, (2020). CNN Greenhouse Gases and Global Warming, Feb 19, 2020
- [4] Baldauf, Scott, (2020). Aramco deepens focus on Climate Actions, CEO tells B20 summit, The Arabian Sun, Oct 28, 2020.
- [5] IEA (International Energy Agency) (2020), *World Energy Outlook 2020*, <https://www.iea.org/reports/world-energy-outlook-2020>.
- [6] McKibben, Bill, (2018), Why natural gas makes global warming worse, www.GreenBiz.com, April 9, 2018