
Sulfur Free Gas Supply for Kuwait Refineries

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INTRODUCTION

Kuwait Oil Company (KOC) owns and operates a number of Gas and Oil fields and Pipeline networks in Kuwait and is responsible for exploration, development, production and operation of Kuwait's Hydrocarbon assets.

Entering Gas era, KOC adopted the concept of being a leader in penetrating the industry to achieve high quality production of gas, transport and market gas to cover entire needs for energy in State of Kuwait

Accordingly, KOC is committed to optimize the production and utilization of associated gas and maximize the production of non-associated gas in support of the energy requirements for the state of Kuwait.

KOC has three operational assets namely South & East Kuwait (S&EK), West Kuwait (WK) and North Kuwait. This paper focusses on the challenges encountered in achieving the development / strategic objectives in WK asset, which produces predominantly Sour Gas ($H_2S > 4$ mole %)

KOC's GAS BUSINESS

Vision:

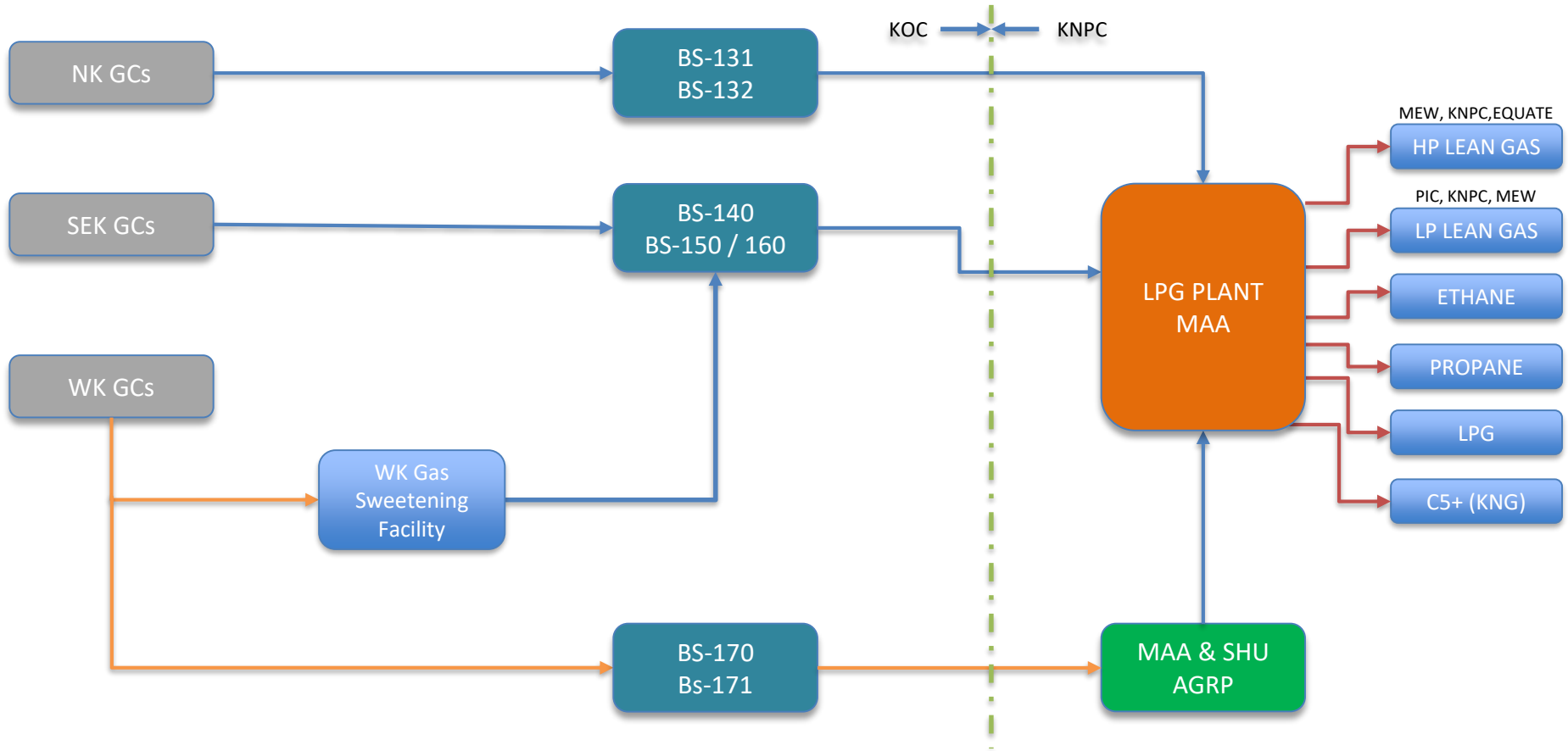
To become the gas business role model by excellence in the Gulf region. Move towards gas self-sufficiency and minimize consumption of liquid oils / value added HC products as fuels. Protect the environment & surpass international HSE norms.

Mission:

Continue to efficiently explore potential gas reserves & exploit existing gas reserves (maximize gas utilization/recovery of value added products and minimize flaring).

Provide targeted amounts of gas and condensate feeds & marketable fuel supplies to customers through sound operations, outstanding project development and follow-up, world class technical services and progressive maintenance programs with overall emphasis on HSSE.

GAS BUSINESS SCHEMATIC

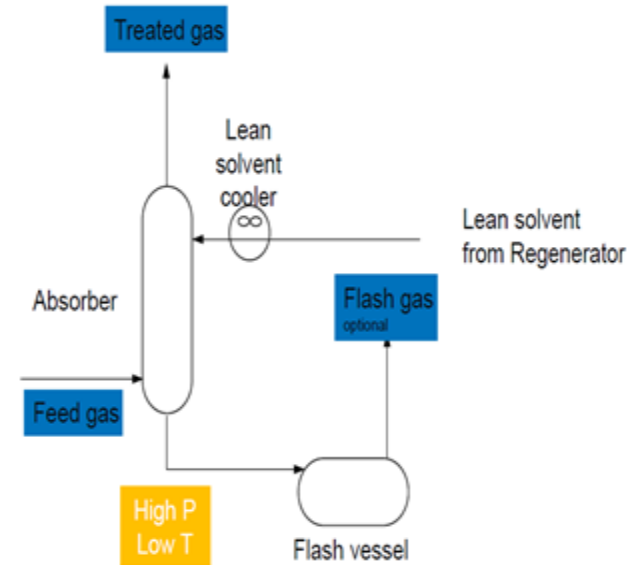


Challenges in Sour Gas Handling

West Kuwait Fields Produces Sour Gas with $\text{H}_2\text{S} > 4$ mole%. The Gas needs to be treated with Regenerative Amine based treating process for removing acidic impurities H_2S , CO_2 and organic Sulphur (COS , mercaptans, etc.)

Why Treat Sour Gas:

- Purification of process gas to meet specification:
- Personnel Safety
- Environmental Reasons
 - Sulphur emissions
 - Odor
- Equipment Protection
 - Corrosion Prevention



The Problem

- The produced WK Sour Rich Gas was earlier treated in the following facilities:
 - KNPC-Mina Ahamdi (MAA) Acid Gas removal Plant - AGRP-1
 - KNPC-Shuaiba (SHU) Refinery-AGRP

The problems encountered in the downstream treating are as follows:

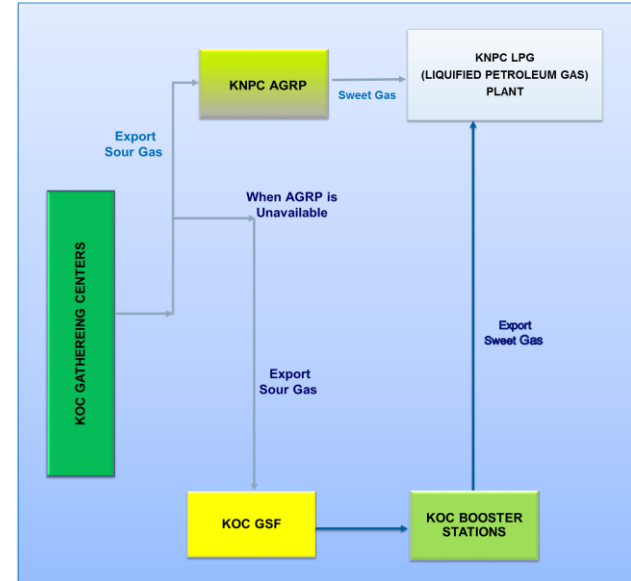
1. Limited handling capacity of existing AGRP-MAA
2. Planned / unplanned shutdown of AGRP
3. Non-availability of AGRP-SHU due to its retirement in March 2017
4. Delay in the availability of New and Revamped AGRPs at MAA (> Dec 2019)
5. Limited permissible utilization of Sour Gas Re-injection within WK fields.

CONSEQUENCE:

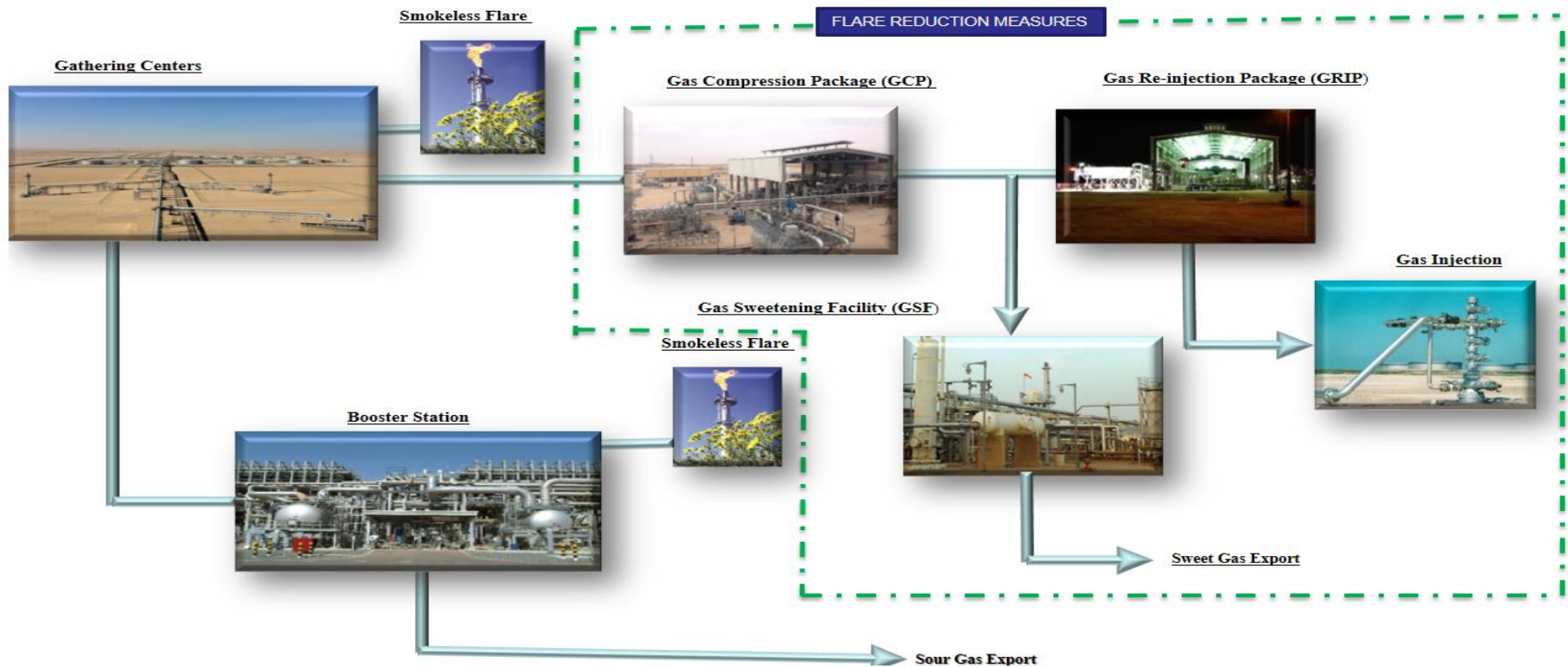
- **Flaring of Sour Gas, which exceeds Company global flaring target of 1%**
- **Results in oil cut-back from WK Asset**

The Solution

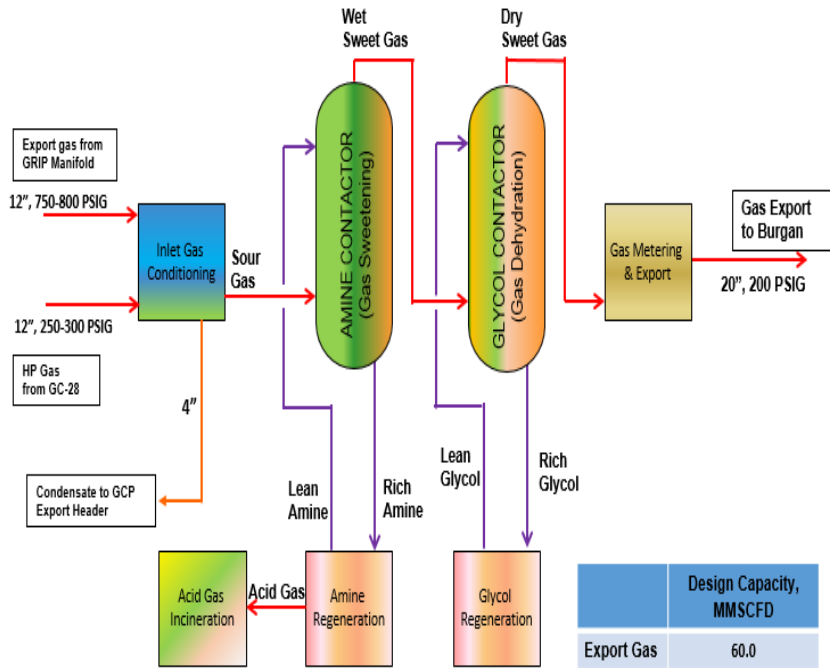
- Since, companies' baseline flaring target is highly dependent on actual AGRP-intake, the following facilities were commissioned / proposed:
 - Gas Sweetening Facility (GSF) in WK:
 - GSF is designed to process 60 MMSCFD sour gas produced from West Kuwait Gathering Centers and it produces Sweet Gas with 4 ppm H₂S & 1.5 % CO₂ from 4% H₂S & 12% CO₂ Bulk removal of H₂S, CO₂ and moisture from Sour Gas using Sweetening Process and Glycol Dehydration.
 - Gas Re-injection Package (GRIP):
 - GRIP is designed to compress 60 MMSCFD (4 X 15 MMSCFD) of WK export gas from sour gas to re-inject into dedicated wells for re-injection of gas to an isolated reservoir gas cap



Closer look at West Kuwait Facilities

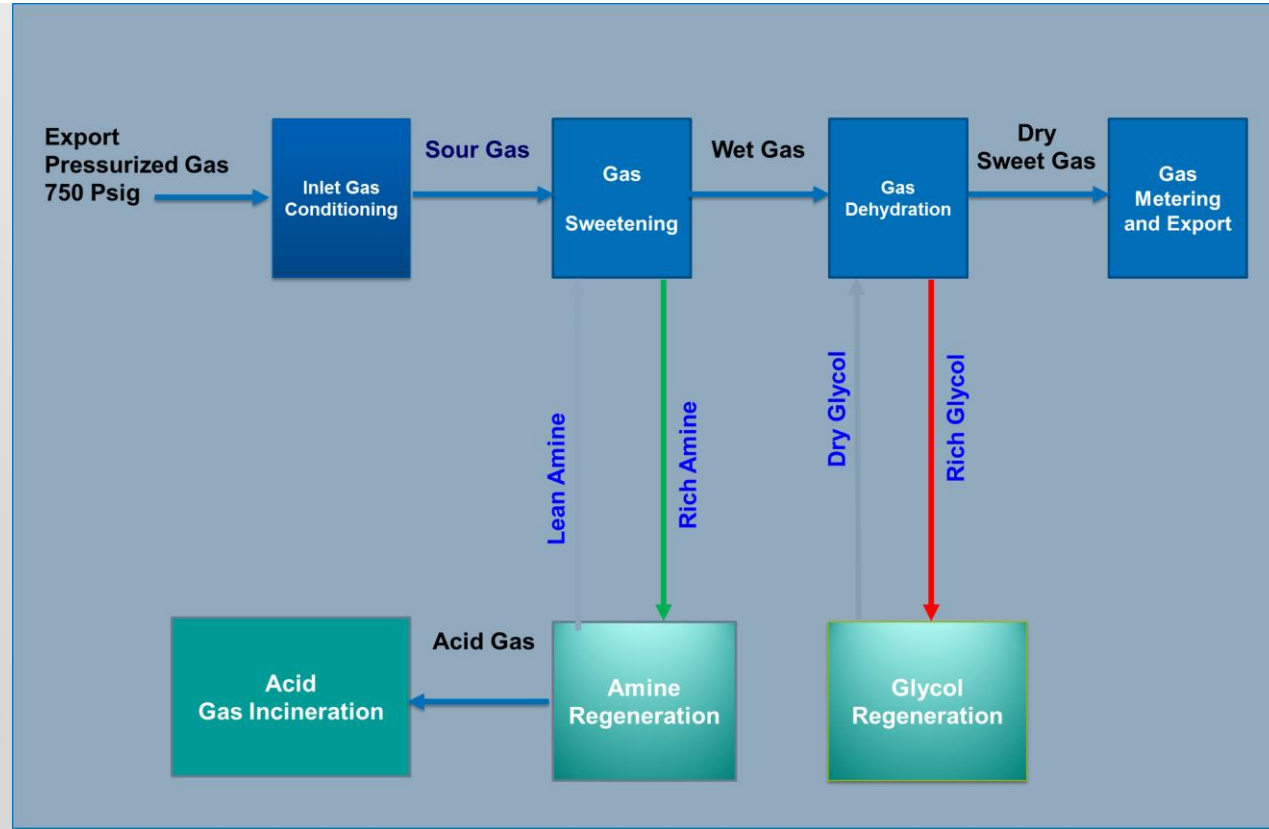
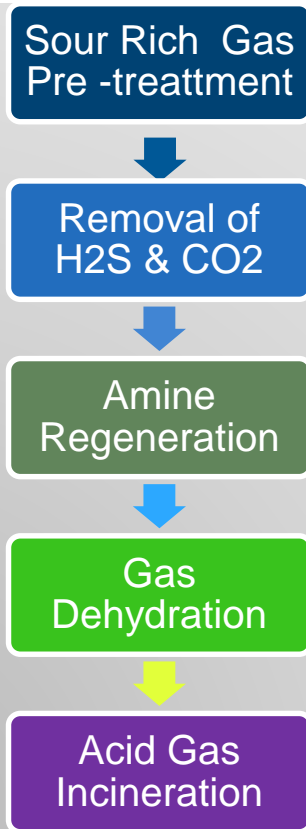


Gas Sweetening Facility



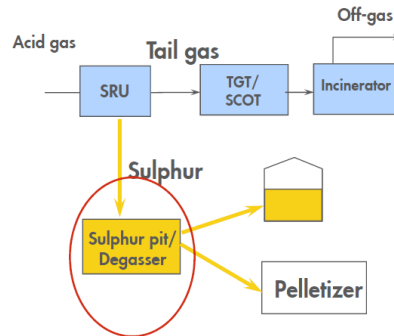
- GSF is designed to process 60 MMSCFD sour gas produced from West Kuwait Gathering Centers and it produces Sweet Gas with 4 ppm H₂S & 1.5 % CO₂ from 4% H₂S & 12% CO₂ Bulk removal of H₂S, CO₂ and moisture from Sour Gas using Sweetening Process and Glycol Dehydration.
- Since beginning in 2010, the facility has processed around 77.925 BSCF sour gas resulting in net reduction in flaring, helped in maintaining higher throughput of crude production and reduction of gas emission.

GSF Conceptualization and Development



Sour Gas Handling (Future Consideration)

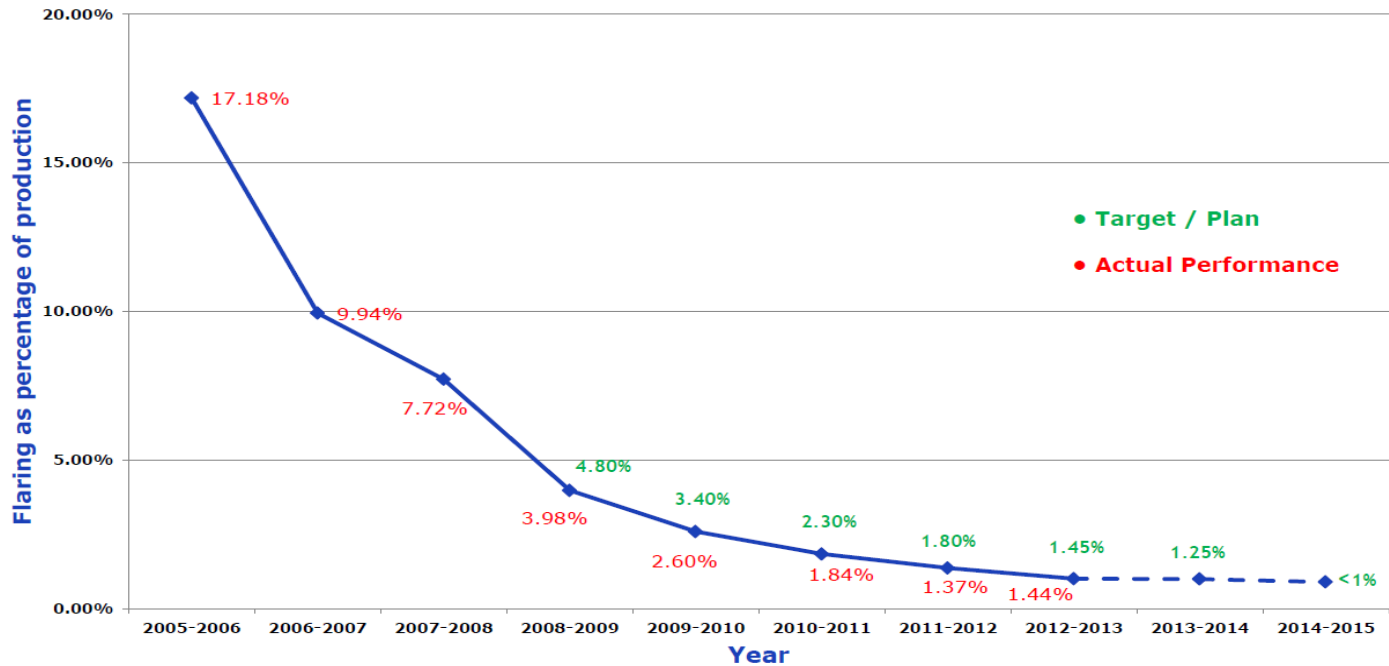
- In line with 2030 strategy, KOC is committed to meet strategic objectives of Company with respect to flaring reduction and oil production targets of West Kuwait on a consistent basis.
- Hence, considering the forecasted increase in sour gas production from West Kuwait fields, the following facilities are proposed:
 - Re-vamp of Existing GSF from 60 MMSCFD to 100 MMSCFD
 - New Gas Sweetening Facility at WK (Capacity 2 x 60 MMSCFD)
 - Sulphur Recovery Unit (Phase-II of New GSF)



Benefits

- To meet strategic objectives of Company with respect to flaring reduction and oil production targets of West Kuwait on a consistent basis
- To enhance flaring mitigation and gas processing capabilities at West Kuwait especially during KNPC AGRP expansion activities or emergency shut downs
- To facilitate future sour gas well testing facilities of Company at WK Fields
- To build first of its kind “Company owned, pre engineered, modular based integrated Sour Gas Sweetening Facility”
- Support in sustaining crude production and flaring reduction targets
- Estimated revenue by running existing GSF is: 85.5 Million KD/month

Gas Flaring History in KOC (As a % of production)



CONCLUSION

- The sour gas treatments has the key objective to match with capability of AGRP and in order to sustain the business continuation of Crude Oil Processing in KOC besides reducing the envisaged losses of sour rich gas with it's associated condensate & minimizing Sour Crude Oil differed during KNPC outage.
- In order to enhance flaring mitigation measures and gas processing capabilities at West Kuwait, a pre-engineered, modular based integrated Sour Gas Sweetening Facility, was built.
- The commissioning of the facility in the year in 2010 & operation of the facility to its full capacity of 60 MMSCFD of Feed Gas has realized the Cost of the Project within 2 months of operation.
- During planned or unplanned shut downs of AGRP , KOC Oil Gathering Centers capacity are now less constrained to reduction in capacity of oil processing or flaring of gas, which helped sustain the operating levels of facilities, delivering an exceptional environmental performance.

Thank You



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- Mahdi Ashkanani graduated from the University of Colorado – Denver, USA with a bachelor degree in Mechanical Engineering.
- Ashkanani holds a Master's degree in Mechanical Engineering from the University of Portsmouth, UK.
- Mahdi Ashkanani was a maintenance Mechanical engineer in the first 8 years being as an employee at KOC.
- His responsibility in the maintenance team includes corrective and preventive actions towards the equipment inside the Oil & Gas facilities such as Crude Gathering Centers & Gas Booster Stations.
- Mahdi Ashkanani recently is a senior Mechanical Engineer working at Operations Technical Services (GAS) handling Gas projects in all Kuwait oil fields.
- His job at the OTS (GAS) Team consist of participation in the overall planning of project, engineering and implementation as a technical support member.