Recent advances in zero routine flaring initiative

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1st FERIA Conference

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Presentation outline

- Introduction
- Global Gas Flaring
- PhD case study for Nigeria
- Possible Routes/opportunities for utilisation
- Conclusions
Introduction

Global Energy Consumption

• Economic development and increase in population increases global demand and consumption of energy
• Increase in global energy demands increases global oil and gas production and consumption
• With global increase in Oil and Gas activities, the problem of Gas flaring activities grows

• Oil and Natural Gas remains the primary energy dominating globally.
• With cleaner energy sources required globally, Natural Gas and Renewable energy demands will continuously rise.

What is Gas Flaring and why is it done?

- Oil well: raw gas can be produced when crude oil is extracted

- Refinery: Gas production/refining equipment over pressurise during either
  - regular operation
  - start-up

- Pressure relief valves automatically open as part of the safety feature

- In common practice gas flaring is the safe disposal of unwanted associated natural gases
Global gas flaring: Overview

- 145 billion cubic meters of Natural Gas estimated flared in 2018
  - Approximately 5% of Global natural gas produced is wasted (~750 billion kWh of electricity which is more than African content electricity consumption per annum)
  - About $16 Billion wasted per year
  - About 350 million tons of CO$_2$ to be emitted to the atmosphere every year
  - Flaring has reduced by approximately 13% over the last decade, but the quantity is still high
    - Major flaring countries should tackle this issue: Russia on top followed with Iraq and Iran.
    - New regulations yet to develop in several countries
Project objectives/focus-Nigeria

- Reducing wasteful and undesirable practices of gas flaring
- Increasing value of a wasted resource—flared gas
- Improving energy efficiency and access to extra energy
- Reducing carbon emissions and its impact of flaring

Aimed at developing a systematic framework and management tool to enable the reduction of routine gas flaring in Nigeria, and to promote the economic benefit

- User friendly models for LNG, Gas to Methanol and Gas to Wire options
- Management framework linking to various regulations such as 2030 zero flaring initiatives
Methodology/tool development

- Non-realisation of the 2030 zero routine flaring initiatives.

- Lack of practical tools that integrate economic, technical, and regulatory factors into a gas flaring management framework.

- Lack of simple, relatively fast and user-friendly tool that performs techno-economic analysis on multiple gas utilisation processes.
NGCC cycle has been considered
AFAM and EGBIN power plant (having 624 MW and 1320 MW capacity respectively) in Nigeria

Gas to Wire (GTW) process

Plant selection Criteria:
- Plant design and capacity
- Cost performance
- Energy and process efficiency
- Environmental impact
- Field location

Gas Turbine Unit

Steam Turbine Unit
A Lurgi Low-pressure methanol synthesis is considered

METHANEX titan methanol plant (875,000 MTPD capacity) in Trinidad and Tobago.
Liquefied Natural Gas Process

- An APCI Propane mixed refrigerant (C3MR) liquefaction is considered
- LNG plant (23.3 MTPA) in Nigeria
- Qatar II LNG plant of capacity 7.8MPTA in Qatar.
Liquefied Natural Gas in Nigeria

- Amongst the world’s top five (5) LNG exporters
- Exported about 800bcf in 2013 (~7% globally traded LNG)¹
- Nigeria’s Bonny LNG Plant produces 22MT/yr LNG and 4MT/yr LPG
- Exports 500mcfd Natural gas

¹ Source: EIA (2015)
Other utilisation methods

Gas to methanol

- Convert Gas to methanol.
- Methanol and its derivatives play a vital role in the chemical/petrochemical industry. They can be used as fuel cells and cooking fuels.

Gas to Hydrogen

- Convert Gas to Hydrogen
- Hydrogen can be applied in power plant, fuel cells, refinery processes and methanol production

Gas to Fertilizer

- Convert Gas to Urea for fertilizer production in chemical industry
Case studies

- Three oil and gas fields A (offshore), B (Offshore) and C (onshore) was selected as case studies for analysis.

*Location of gas flaring fields for this study in the Niger Delta region of Nigeria (adapted from Schick, 2017)*
Key results

- GTM option as the most optimal for Field A due to its production of large gas volumes and high need of clean fuel in that specific region
- LNG for Field B due to proximity for the LNG infrastructure
- GTW utilisation option for Field C due to its proximity to the electrical grid and also high electricity requirements in that area
Summary

- A systematic ANG flaring framework and management tool has been created.

- The successful testing of the developed tool shows its feasibility in implementing at wider locations

- Technical and economic viability assessment helps operators to work towards the Zero Flaring scenario
Recent initiatives- Aramco

Flare gas recovery

Aramco is a signatory to the World Bank’s “Zero Routine Flaring by 2030” initiative and is committed to sharing best practices and knowledge in flaring minimization with peer companies. The Company’s flare gas recovery systems, asset integrity, energy efficiency, and leak detection and repair programs help mitigate its carbon footprint.

Peak Summer Production Program

Our Peak Summer Production Program provides additional volumes of non-associated gas to reduce the use of liquids in power generation during the summer. In 2017, we displaced 11.5 million barrels of crude oil equivalent, freeing up higher value liquids while reducing emissions. We also continued our collaboration with the Saudi Energy Efficiency Program to promote energy efficiency practices through awareness campaigns.
Recent initiatives - IEA & IEMA

Flare reduction initiatives

It can be challenging for individual and small-scale operators to deploy flaring reduction options if they cannot benefit from economies of scale. In some regions, the ownership of fuel streams may also differ, creating legal or royalty issues related to the conversion and sale of associated gas. This emphasises the importance of voluntary initiatives and regulations to encourage operators to work together to reduce flaring.

Various energy companies, governments and institutions have endorsed the Zero Routine Flaring by 2030 initiative launched by the World Bank and the United Nations in 2015.

For new fields, this initiative encourages operators to develop plans to use or conserve all the field’s associated gas without routine flaring. For existing fields, operators are asked to eliminate routine flaring when it is economically viable as soon as possible, and no later than 2030.

So far, 38 oil companies, 32 governments and 15 development institutions have endorsed the initiative. In February 2020, Occidental Petroleum Company became the first American company to endorse Zero Routine Flaring by 2030.

Is it achievable?

Effective and timely reduction of gas flaring will require a sustained, multi-pronged approach, involving close collaboration between governments, the oil and gas industry, and technology providers. In many countries, the right government regulations and policies can create the necessary incentives to harness, monetise and use the flared gas. In recent years, new technologies that utilise associated gas have also emerged; these include flared gas-to-power, using micro-turbines, and modular and skid-mounted flared gas-to-liquid technologies. The selection of the most appropriate gas utilisation option is however, greatly influenced by the volume and quality of the gas resource, its location, and capital costs.
Potential solution???

Hub Mechanism
• To reduce costs
• Share facilities
• Tax certification

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