



Zero Flared Gas in Egypt

Prepared by:

**Tarek El Barkatawy,
Chairman & MD Tanmia Petroleum**

**Mahmoud Fawzy,
Production General Manager**

Abstract:

Zero Flared Gas in Egypt is a concept aims to eliminate flaring the associated gas in the oil fields.

The flared Gas in Egypt is estimated at about 110 MMSCF/D (which is a total waste) distributed as follows: 58 MMSCF/D in the Western desert, 28 MMSCF/D in the Eastern desert, 14 MMSCF/D in the Gulf of Suez and 8 MMSCF/D in the Mediterranean Sea. Most of Which are scattered in the form of 0.5 to 3 MMSCF/D per location which does not make it financially viable to build a Gas plant to exploit this gas.

- The flared gas causes a great impact to the environment due to the carbon emission resulted from the flare. One MMSCF/D (Typically generators 3,000 – 4,000 Tons of VOC (Volatile organic Compounds) that causes 10 – 12,000 Tons of CO₂ emissions.
- The gas flared in most of the fields is an associated gas that was produced with the oil and was separated through a gas/ oil separation plant or simple early production facility.
- The associated gas are sometimes, referred to as wet gas due to the fact that some of its component are of a liquid nature that is valuable as a separate product and is profitable to remove from the natural gas.
- However, most of the flared gas volume does not justify building a gas plant to exploit it nor the valuable liquid components.
- Tanmia Petroleum Company being a field development company fully owned by the Government of Egypt took the lead to study and provide a comprehensive solution to this environment and financial loss problem.
- Tanmia has proposed a field proven mobile fractionation unit that extracts the NGL (Natural Gas Liquid) that is the liquid phase of the mixture and contains propane (C3), Butane (C4), Pentane (C5)..... etc.

The NGL (C3⁺) is then processed in another stage to produce:

- 1) LPG (Liquefied Petroleum Gas) which is an adjusted mix of (C3) and (C4) in addition to (2) condensate (C5⁺) that is used to increase the API degree of the crude oil.
- 2) This field proven technology has never been applied in Egypt.
 - The dry gas is planned to be fed into a Gas – Driven Generator set to generate the electricity required for operating the field.

- The ultimate objective is to reach Zero – flared gas in Egypt. The pilot project is planned for 1 MMSCF/D.

➤ **Pilot System Specifications:**

Tanmia offers to supply factory assembled Gas Processing System Package. The system is a gas processing unit designed to process 1 MMCFD as a pilot of raw wellhead gas. It will operate at 150 psig and at -20F based on ambient temperatures up to 113F.

The system will produce approximately 500 - 800 MCFD of dry generator fuel gas with a calculated Methane Number of 60 along with approximately 4500 - 5500 gallons of NGLs / day (these calculation may vary according to gas analysis).

The system is designed and manufactured in accordance with CSA, B51 & B52 and ASME B31.1, B31.3 & B31.5 and have been audited and certified by TSSA, Technical Safety and Standards Authority.

All of the electrical components used are CSA/ULC approved and the designs are to Canadian Standards Association standard C22.2 No.14-05 and Underwriters Laboratories Standard UL508A, our electrical/control system design process has been audited and certified by the Canadian Standards Association.

The system has a maximum operating concentration of 250 ppm of H₂S. Higher concentrations of H₂S may require pre-treatment of the gas stream.

The fully integrated package is mounted on a heavy duty structural steel frame, factory piped, wired with all controls. The complete skid is factory functional tested prior to shipping.

Approximate Dimensions / Weight: 40'L x 8'W x 9'-6"H /43000 Lbs.

➤ **Safety of the system:**

- ✓ No.1 priority is safe system operation with no possibility of affecting oil production.
- ✓ Tanmia proprietary Safety Protocol relies on the ability to control inlet gas supply.
- ✓ Automated supply and bypass valves that are controlled by safety system.

- ✓ Redundant bypass safeties including selectable burst disk.

➤ **System components:**

- **Inlet Gas Safety Valve System:**

In order to process flare gas at the Facility, a valving system must be installed that will divert the wellhead flare gas to the processing skid automatically.

To accomplish this, the system will include a complete Inlet Gas Safety Valve package with all necessary automated valves, safety bypass systems, and instrumentation.

The gas processing system will be configured to allow gas flow to the processing system when all systems are functional and in a safe operational condition.

If the gas processing system experiences a safety related or mechanical issue, or if the well has an upset, the system will be designed to divert all wellhead gas to a flare.

The components for the Inlet Gas Safety Valve System shall be installed by local production personnel in order to comply with site specific safety requirements and geographical constraints.

- **Compression Module:**

In order to effectively process gas and remove liquids, the majority of the heavier hydrocarbons must be removed from the gas stream.

To accomplish this, the first step is raw gas compression to an appropriate pressure for effective Natural Gas Liquid (NGL) recovery.

The Compression Module accomplishes this with proven screw compression technology. This module will operate at a suction pressure from 0 psig and system discharge pressure of 150 psig.

- **Refrigerated Liquids Stripping System:**

To accomplish effective removal of the heavy (C3⁺) hydrocarbons from the raw wellhead gas, the system employs mechanical refrigeration of the pressurized gas to condense liquids and separate them into a marketable stream of high quality NGL's.

This refrigeration system will be specifically designed and purpose built for the Egyptian flare gas observed at any facility.

This system will operate at a nominal system temperature of -20F but will have the ability to be adjusted for system optimization.

- **Hydrate Control System:**

If the system will work on raw wellhead, then Tanmia will include a methanol hydrate control system complete with enough methanol reservoirs as the associated gas is typically nearly saturated with water vapor and this component must be managed.

This system will start automatically and function continuously during regular system operations.

- **Liquids Storage:**

As the liquids are processed for transport for further processing, a storage vessel designed specifically for Natural Gas Liquids will be provided on site with capacity of 18,000 gallon for each 1 MMCFD of installed capacity. These storage vessels can either be skidded or configured with standard towing equipment for ease of transport.

- **Flow Control:**

This technology compensates for any ebb and surges in flows of flare gas from the facility and increases operating efficiency and utilization by making sure the system has sufficient gas to operate.

It also allows the system to bypass excess gas to flare when there is more flare gas available than the system can process.

It also allows multiple base processing systems to be operated simultaneously on a well site in order to match the installed treatment capacity to the output of the well.

Additionally, it provides the base processing system the ability to operate continuously and allows for very low turndown capabilities.

- **Electrical Input and Integration:**

Each flare gas processing system will be designed with a fully integrated safety system that receives power from an onsite generator and manages that power according to load and with the ultimate safety of the entire system considered.

The processing system's onboard control system will kill power to the system if an upset is detected. The flare gas system will be configured to operate with 380 Volt, 50 Hz power.

- **Generator Gas Delivery:**

Each base processing system produces a steady stream of dry residue gas that is ideal for generator fuel.

Power supply system that will operate in an uninterrupted fashion with the produced gas.

There is capability to provide a buffer quantity of fuel gas for a larger power system.

- **Remote Monitoring:**

A basic package could be included for remote monitoring of the system.

This system will include an Ethernet modem for data transmission and can provide the operator with real time monitoring of key system parameters.

- **Weather Protection:**

The Tanmia system will be built to operate in the Egyptian weather conditions but additional protection from direct sun is recommended. A roofed sun cover will increase reliability and performance of the system.

- **Potential upgrade of the system**

- **LPG production:** After eight months of continuous operation, Tanmia will be able to supply a technical and commercial proposal of upgrading the unit to produce LPG and condensate after successful commissioning of the base Processing System Skid model MRU-1000B.

Conclusion

➤ Ultimate Recovery

A single 1 MMSCFD unit operating for 1 year (PILOT PROJECT)

(Depends on the calorific value of the gas), could produce:

- Produces more than 1.3 million gallons or 31 thousand barrels of Y-grade NGL's.
- Prevents 3,856 tons of VOC's from being flared. (Volatile organic compounds)
- Prevents 11,500 tons of CO2 emissions.
- Captures enough BTU to provide the heat for 6,087 homes.
- Captures enough BTU to provide all the energy needs for 1,826 homes.
- Final Product Handling for NGL product in the first phase of the project, NGL's will be produced by the Tanmia system into the NGL storage tank. Tanmia has reached an agreement with Gupco to transfer this product to their's process facility at Plant 104.
- Final Product Handling For LPG and Condensate product once Tanmia installs and commissions the LPG upgrade system, there will be two products to manage downstream of the completed system. These products will be the produced LPG and the produced condensate. A storage tank will be required for segregated streams of LPG and condensate.

References:

- BERG Chilling System INC.
- GTUIT.
- GUASCOR