Purpose

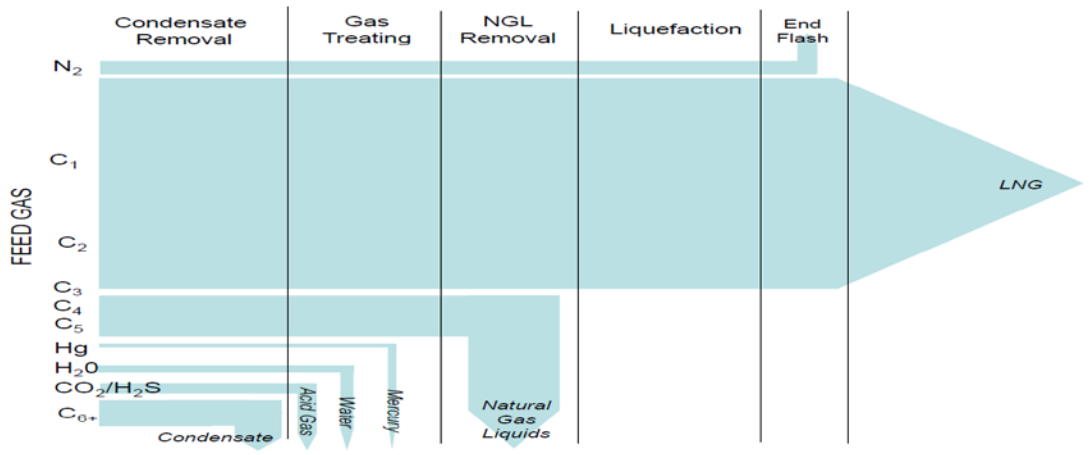
Demonstrate the economic viability of DPNG™ gas transport through a virtual pipeline for the elimination of stranded gas flaring.

Implimentation of an end-to-end business model to monetize stranded flare gas and all hydrocarbon emission.

Economic Comparison of Available Technologies

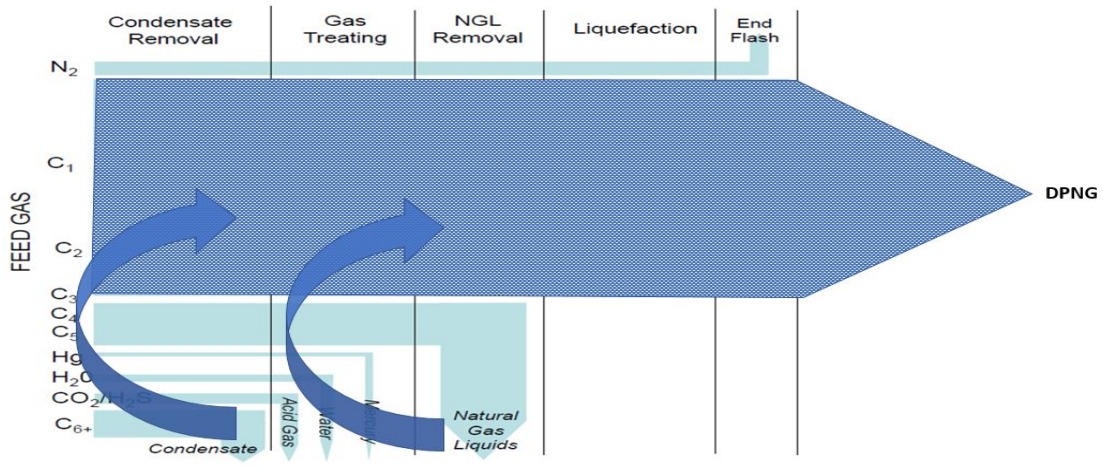
Integrating natural gas into a Virtual Pipeline (VPL) is not new, as CNG and LNG are proven technologies and have been operating successfully around the world for several years. The challenge these technologies have yet to overcome is the fact that both are uneconomical to install and operate on small to medium scale projects in remote locations. To focus on methane and ethane misses the revenue held in the high BTU - Value Added Natural Gas (VANG) components.

Considering natural gas transportation alternatives, all the existing technologies (LNG, GTL and CNG) require preconditioning and the removal of high energy hydrocarbons. Removal of these hydrocarbons such as liquefied petroleum gas (LPG) and natural gas liquids (NGL) reduce the monetary value of the cargo. Why not reverse the procedure and transport the full value of the gas stream to the market for processing and distribution?



Typical LNG Pre-Processing

LNG condenses the gas to 1/600th and CNG compresses to 1/300th of its original space requirements. Both proven technologies reduce natural gas space requirements so that a larger quantity can be loaded into a smaller area, but both have limited potential in the market. Every facet of LNG is expensive and CNG has a high weight-to-energy ratio making it difficult to transport enough gas volume per load to generate a profit.



High BTU-DPNG™

Dense Phase Natural Gas (DPNG) combines the revenue potential of high BTU natural gas with the space efficiencies of CNG. DPNG and single vessel gas transports produce the revenue to monetize flare and stranded gas without the use of a natural gas pipeline.

Gas Compression, Dehydration and Loading Hydrocarbons

The raw gas stream, when required, is to be compressed to approximatly 1270 psig (88 barg) and sent to a Natural Gas Dehydration Unit where the water content of the gas is reduced to 7 lb/MMSCF or less. The dried gas then proceeds through a final stage of compression where it reaches a minimum pressure of 3,100 psig (214 barq) and is loaded into the high-pressure DPNG Transportation Vehicle or Vessel (TVV). Any NGL's that are generated during compression are pumped back into the high-pressure stream and loaded into the TVV. Due to the fact, the hydrocarbons are transported in the single dense phase, all LPG's, NGL's and/or heavy hydrocarbons are "dissolved" into the high-pressure contained in the TVV.

Transportation of High Pressure Hydrocarbons

Several unique technologies exist in marine and over the road transportation of high-pressure gas. For marine transport, the analysis included a self-propelled barge, or a standard barge using tugs. The high-pressure storage options for both using a close-packed long pipe design. Options for over the road truck transport the analysis included using 40 ft modules with the vessels constructed from steel, composite/steel hybrid, and light weight composite vessels. Each of these vessels has different advantages and disadvantages. In general, the steel construction offers the lowest capital cost, but the weight is high when compared to other hybrid and composite

construction options. The most cost-effective modules use light weight composite vessel technology, several manufacturers have had their models approved by the US Department of Transportation. We have found that a 40 ft module with a capacity of 360 MSCF at 3,250 psig has proven the most cost effective in most situations. However, each model of the vessel by each manufacturer must be evaluated to ensure that the right equipment is chosen for each project.

Discharge of High Pressure Hydrocarbons

The gas is unloaded into a pipeline or into a Gas Processing Facility (GPF). As an example, if the inlet to the pipeline or GPF is 950 psig (65.5 barg), the discharge gas must be a continuously controlled to that pressure. As the gas is unloaded from the HP-TVV, the pressure will eventually decrease until it is less than 950 psig (65.5 barg) line pressure. At the point in which the discharge rate of the gas is too low or the pressure equalizes, one stage of compression will be required. As the pressure drops further, a second stage of compression will be brought online to compress the gas to the specified pressure. The TVV will be unloaded to approximatly 65 psig (4.5 barg). This equals to 98% of the total design capacity of the TVV and results in a reduction in recompression requirements at the unloading site.

Conclusion

With the development of DPNG™ through the use of a virtual pipeline, flared gas can now be economically captured and transported to market. Utilizing this process, exploration and production companies now have the flexability to venture into areas for future development without the possible production restrictions associated with flaring natural gas.