Reduce Your GHG Emissions

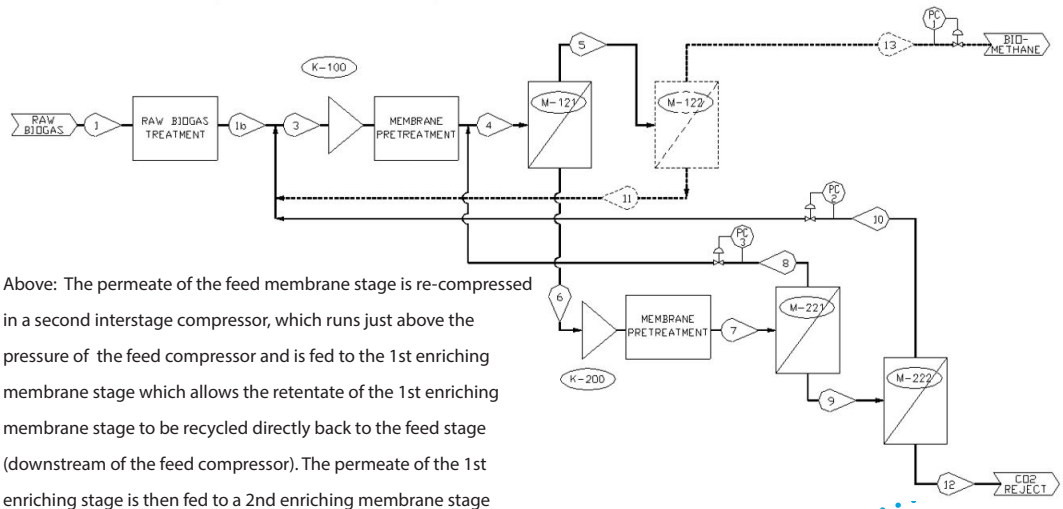
Higher CH4 Recovery, Optimized Power Consumption

Background

With increased global focus on reducing greenhouse gases (GHG) to slow down the impact of global warming, it is critical for the biogas sector to examine emissions, namely, methane (CH4) and carbon dioxide (CO2). Biogas upgrading typically focuses on the separation of CH4 from CO2. Membrane separation technology can achieve methane recoveries up to 99.5%, which meets the majority of local and national emission laws. However, certain regions and localities have enacted, or are moving towards, more stringent emission laws to further reduce climate impact. An OEM partner of Air Products Membrane Solutions was tasked with meeting local German emissions targets requiring >99.8% CH4 recovery from their biogas upgrading plant. One common practice to meet high CH4 recovery is to increase recycle rate for the membrane system. This practice leads to increased power consumption (increased OPEX) and a larger compressor sizing (increased CAPEX), making this solution economically uncompetitive. Another option is to reduce the CH4 slip through the CO2 vent. This method involves the use of a regenerative thermal oxidizer (RTO) unit to break down CH4 into less harmful CO2 and H2O before releasing the gas to the air. However, this method sacrifices valuable biomethane and requires additional equipment investment, creating another economically uncompetitive option.

Solution

Air Products Membrane Solutions developed a novel interstage compressor solution that meets the challenge: simple design, increased CH4 recovery, and steady power consumption. This proprietary new cycle results in CH4 recovery >99.8%, while maintaining methane purity and minimizing increases in power consumption.



Above: The permeate of the feed membrane stage is re-compressed in a second interstage compressor, which runs just above the pressure of the feed compressor and is fed to the 1st enriching membrane stage which allows the retentate of the 1st enriching membrane stage to be recycled directly back to the feed stage (downstream of the feed compressor). The permeate of the 1st enriching stage is then fed to a 2nd enriching membrane stage which further reduces the methane slip. By distributing compression work to the parts of the system where it's needed the most for high efficiency, the total compressor power is reduced.

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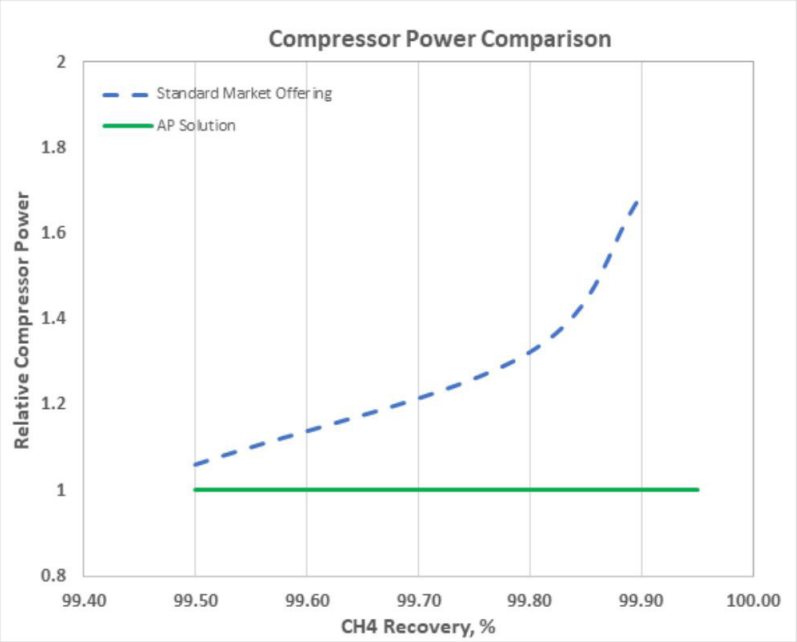
Comparison

The performance of Air Products' novel interstage compressor design is compared to that of a one-compressor, three-stage membrane system, the standard market offering. The graph shows relative compressor power as a function of methane recovery for the two membrane configurations (at a fixed product purity). As recovery increases, the standard market configuration requires significantly more compressor power than Air Products' novel interstage design. This clear advantage in power consumption easily justifies the additional CAPEX investment for the interstage compressor.



Conclusion

The novel, interstage compressor design offered by Air Products Membrane Solutions helps meet strict GHG emission laws while keeping operating costs in control and maintaining a simple system design. There are many additional benefits to working with Air Products Membrane Solutions for your biogas upgrading projects. Contact us to learn how Air Products can help you get the most out of your system.

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