

## Introduction to the ZR-iLNG Process for Biogas and Small-scale Pipeline Gas Liquefaction

An increasing interest in small-scale gas liquefaction facilities for transportation fuel and peak shaving has resulted in the development of many different process schemes. Proven but complex technologies, like amine gas treating and mixed refrigerant liquefaction, although economic for larger plants, struggle to be commercially viable at small and medium scale.

Over the past 5 years, Gasconsult Limited and Osomo Projects BV have independently developed proprietary LNG liquefaction schemes with the primary objective of reducing capital cost by minimizing equipment count. The technologies, which exhibit considerable synergy and have limited overlap, are now available to the market as a combined offering following an agreement between the Gasconsult and Osomo companies. The design, in order to achieve economic viability at low plant capacities, is radically different to conventional liquefaction technologies and is made possible by the unique features of Gasconsult's ZR-LNG technology and Osomo's proprietary iLNG Flash-2-Sweep membrane and CO<sub>2</sub> freeze out systems. This combined technology for single train capacities up to 70,000 tonnes/y is termed ZR-iLNG and revolutionizes the overall equipment line-up and capital and operating cost of small to mid-scale liquefaction facilities. The technology is suited to both biogas and pipeline gas feeds.

Osomo successfully piloted a biogas gas treating and liquefaction scheme at the site of Acres in Lelystad, the Netherlands. For CO<sub>2</sub> removal, this pilot plant used standard membranes with a proprietary 'flash gas to sweep gas' line-up and a proprietary 3 phase separator in which solid CO<sub>2</sub> and solid trace components (e.g. BTX and siloxanes) are removed from the system post liquefaction. The patented Osomo process improves membrane performance by over an order of magnitude for CO<sub>2</sub> removal; and also, water concentration at the outlet of the membrane separator by a factor of 20.

Gasconsult's ZR-LNG process eliminates all refrigerant storage and transfer systems and because of the unique temperature profile of the ZR-LNG cryogenic heat exchanger the feed-gas pre-treatment does not need to reduce CO<sub>2</sub> to the 50ppm level required by conventional mixed refrigerant and nitrogen processes. Significantly higher CO<sub>2</sub> levels are permissible with ZR-LNG without risk of CO<sub>2</sub> solidification. Flash-2-Sweep easily achieves these CO<sub>2</sub> levels together with water removal to 1ppm, permitting ZR-iLNG to eliminate the amine and dehydration systems used in conventional liquefaction schemes. Inter-alia ZR-iLNG has:

- No amine unit
- No molecular sieve dehydration unit
- No refrigerant storage or import facilities
- No refrigerant make-up costs
- No amine or other make-up chemical costs
- No heat source equipment and energy requirement for amine regeneration or mole sieves
- No waste aqueous streams
- Continuous processing
- No batch regenerative processes
- Feed gas flexibility
- Operational simplicity relative to mixed refrigerant schemes
- Substantially lower power demand than nitrogen expander schemes

ZR-iLNG CONCEPTUAL FLOWScheme

