

# The Latest Development in Oxygen VPSA Technology: Adsorptech EcoGen™

## A Special Equipment Report

In North America, it is unusual for the consumer who uses industrial oxygen on a large scale to buy the oxygen production unit (the cow). Currently most companies elect to buy the oxygen (the milk) on a long-term contract basis from large companies that produce oxygen with air separation units (ASUs). This purchasing pattern has persisted in part because alternatives to ASU oxygen production have not been cost effective. EcoGen™ may change that.

Adsorptech is a business dedicated to adsorption-based gas separation technology and equipment, including standardized oxygen VPSA (Vacuum Pressure Swing Adsorption) equipment. In discussions with consumers in the 1–10 tpd (tons per day) range, the cost of liquid oxygen (LOX) has risen to levels that demand investigation of economic alternatives. In typical LOX contract terms this volume range is normally identified as 734,000 cubic foot (cf) per month to 7.3 million cf per month.

Three years ago, Adsorptech launched a product development program to determine if on-site production technology in this oxygen demand range could be economically and reliably accomplished. The company first built a lab-scale oxygen VPSA production unit, tested it, and favorably proved a new process concept entitled EcoGen technology. With concept proof in hand, a larger scale VPSA then was built and operated at Adsorptech’s Middlesex, New Jersey engineering facility. The larger size was necessary to prove commercial scale process performance and to test component mechanical reliability incorporated in the commercial model design. The testing was very successful and commercial introduction started about a year ago for models ranging from 1–13 tpd (25 to 330 Nm<sup>3</sup>/hr).

In this production range, other sources of oxygen in order of supply (most dominant first) include LOX, PSA (Pressure Swing Adsorption), and VPSA (oftentimes abbreviated as VSA). Apurva Maheshwary, Adsorptech Vice President, claims, “Through the continuous innovation of Adsorptech’s oxygen VPSA process and product tech-



nology, the EcoGen model oxygen VPSA now achieves a global best-in-class power efficiency over any other source of oxygen.” For example, Adsorptech’s EcoGen VPSA requires about 1.0 kW per 100 cubic foot (ccf) of contained oxygen. LOX produced by ASU requires about four times as much power plus the cost of transportation energy to deliver the LOX to the consumption site. Oxygen PSA systems require about 2.1 kW/ccf. The former best-in-class oxygen VPSA systems require about 1.4 kW/ccf. Although not common at this scale, cryogenic generators require about 1.9 kW/ccf.

Jim Flaherty, Adsorptech President and CEO, notes, “This power efficiency improvement represents an important and immediate step-change in lowering the cost of oxygen. Because the cost of power is ever escalating, the power savings will forever compound in savings for the consumer.” For example, if the consuming site has a power rate of 10 cents per kilowatt hour, the operating cost for EcoGen oxygen is \$0.10/ccf, for LOX \$0.40/ccf (+ transport), PSA \$0.21/ccf, previous VPSA \$0.14/ccf, and

Operating Cost At power rate of \$0.10/kw	
EcoGen™ VPSA	\$0.10/ccf
Previous VPSA	\$0.14/ccf
Cryogenic Generators	\$0.19/ccf
PSA	\$0.21/ccf
LOX	\$0.40/ccf

**Table 1**  
cryogenic generation about \$0.19/ccf (see Table 1).

The Adsorptech EcoGen target markets include fish farming, combustion air enrichment, oxy-fuel combustion, waste remediation, ozone, refining, smelting, water purification, and wastewater treatment applications to name a few. The first commercial oxygen VPSAs sold were shop-tested and are in the process of being field installed. They include a 13 tpd EcoGen model E210 (340 Nm<sup>3</sup>/hr) for an Italian oil refinery and a 7 tpd (180 Nm<sup>3</sup>/hr) EcoGen-model E120 for an Israeli fish farm. Every EcoGen is tested in the shop, thereby proving the power improvement before it ships. ■

Adsorptech, [www.adsorptech.com](http://www.adsorptech.com), is a global supplier of standardized oxygen VPSA equipment and other custom adsorption gas separation technologies, beginning with process development and molecular sieve testing, to full process and equipment design packages and fabrication. Adsorptech also provides services for these technologies such as installation, commissioning, upgrades, refurbishment, productivity and energy improvements, and operations and maintenance support. Industries and applications served include water treatment, aquaculture, combustion, gasification, and chemical manufactures on five continents.