Zero Emissions Dehydrators

Technology/Practice Overview

Description

Produced natural gas is saturated with water, which must be removed in preparation for transmission. The oil and gas industry relies heavily upon glycol dehydrators using triethylene glycol (TEG) to remove water from gas. Dehydrators can produce significant methane emissions from the venting of still column vapors, as well as leaks from gas-driven glycol circulation pumps and pneumatic controls. Some of these emissions include methane, volatile organic compounds (VOCs) and hazardous air pollutants (HAPs).

Zero emissions dehydrators combine several technologies to virtually eliminate methane emissions. This equipment includes flash tanks, electric pumps and electric control valves, which reduce emissions by avoiding use of pneumatic gas. Zero emissions dehydrators are also designed to collect all condensable components from the still column vapor and use the remaining non-condensable still vapor (methane and ethane) as fuel for the glycol re-boiler.

A water exhauster removes water from the wet glycol stream and yields high glycol concentrations without the use of a gas stripper. Electric circulation equipment are used instead of gas driven pumps to eliminate gas emissions from natural gas-driven diaphragm pumps. Another option is to replace methane with compressed air as the operating gas for pneumatic controls. This eliminates significant methane emissions from valves and controllers.

Economic and Environmental Benefits

Natural Gas and Methane Savings

Estimated annual methane emission reductions	*31,400 Mcf per average application*

Economic Evaluation

Estimated Gas Price	Annual Methane Savings	Value of Annual Gas Savings*	Estimated Implementation Cost	Incremental Operating Cost	Payback (months)
$7.00/Mcf	33,900 — 37,300 Mcf	$253,000 —$278,000	$22,065—$63,300	$165—$6,500	<1 — 4 Months
$5.00/Mcf	33,900 — 37,300 Mcf	$180,500 —$199,000	$22,065—$63,300	$165—$6,500	1 — 5 Months
$3.00/Mcf	33,900 — 37,300 Mcf	$108,300 —$119,200	$22,065—$63,300	$165—$6,500	2 — 8 Months

* *Whole gas savings are calculated using a conversion factor of 94% methane in pipeline quality natural gas.*

Additional Benefits:

- Reduced maintenance costs
- Reduced fuel cost for the re-boiler

- ☐ Compressors/Engines
- ■ Dehydrators
- ☐ Directed Inspection & Maintenance
- ☐ Pipelines
- ☐ Pneumatics/Controls
- ☐ Tanks
- ☐ Valves
- ☐ Wells
- ☐ Other

Applicable Sector(s)

- ■ Production
- ■ Processing
- ■ Transmission
- ■ Distribution

Other Related Documents:

Reroute Glycol Skimmer Gas, PRO No. 201

Convert Natural Gas-Driven Chemical Pumps, PRO No. 202

Pipe Glycol Dehydrator to Vapor Recovery Unit, PRO No. 203

Portable Desiccant Dehydrators, PRO No. 207

Convert Pneumatics to Mechanical Controls, PRO No. 301

Zero Emissions Dehydrators (Cont'd)

Operating Requirements

Glycol dehydrators require electric utilities or an engine-generator set to achieve zero emissions. A five kW generator set for electrical power will allow the conversion of all gas fueled pumps to electric as well as the use of electric controllers. An electric compressed air system with storage vessels for fuel air can also be used to actuate various controls throughout the system.

Flash tank separators capture methane that flashes or evaporates from rich glycol (water wet glycol) in an energy-exchange pump. Flash tank separators recover about 90 percent of methane emissions and reduce VOCs by 10 to 40 percent. These installations require an outlet for low pressure gas such as a vapor recovery unit, compressor suction or fuel line.

Some partner companies install glycol still column condensers to comply with current regulation of HAP emissions. Still column condensers require routing of the non-condensable methane and ethane to a low pressure fuel line, VRU or flare. Desiccant dehydrators can be used in place of glycol dehydrators. Desiccant dehydrators eliminate the use of glycol in the process which also eliminates most of the methane emissions associated with dehydrators. Refer to the Lessons Learned paper, *Replacing Glycol Dehydrators with Desiccant Dehydrators.* The water content of produced gas that can be removed by desiccant dehydrators depends upon the temperature and pressure of the gas and the type of desiccant. Desiccant dehydrators are most effective for higher pressure, lower temperature conditions and comparatively low flow rates.

Applicability

New dehydrators can be designed to eliminate methane, VOC, and HAP emissions. In addition, existing glycol dehydrators can be retrofitted with zero emissions technology through modifications of the gas stream piping, valves, pumps, and controllers, as well as modification of the fuel used, and/or the dehydrating media. Partners can apply zero emission dehydrator technologies to various onshore and offshore production, processing and gas transportation settings.

Methane Content of Natural Gas

The average methane content of natural gas varies by natural gas industry sector. The Natural Gas STAR Program assumes the following methane content of natural gas when estimating methane savings for Partner Reported Opportunities.

Production	79 %
Processing	87 %
Transmission and Distribution	94 %

Methane Emissions

The reductions in natural gas losses are calculated assuming a conventional dehydrator processing 28 MMcf/day (million cubic feet per day) with a glycol circulation rate of 4 gpm (gallons per minute). The zero emissions dehydrator eliminates emissions from glycol circulation pumps, gas strippers, and most of the still column effluent.

Economic Analysis

Basis for Costs and Savings

A conventional dehydrator of similar size (processing 28 MMcf/day) shows losses of 5.95 scf (standard cubic feet)

Table 1. Zero Emission Dehydrator Technology Examples; Partner-Reported Costs and Savings

Option	Capital Costs	Annual O&M Cost	Annual Methane Emission Savings
Install Flash Tank	$6,500 - $18,800	Negligible	1,191 – 10,717 Mcf
Install Electric Pump	$1,400 - $13,000	$165 - $6,500	360 – 36,000 Mcf
Glycol Still Column Condenser	$14,000 - $25,000	not reported	400 – 5,033
TOTAL	**$21,900 - $56,800**	**$165 - $6,500**	**1,951 – 51,750**

Zero Emissions Dehydrators (Cont'd)

per gallon of glycol that is circulated with a Kimray pump at 4 gpm. The conventional dehydrator also has gas losses of 4 scf per gallon of glycol that is circulated through the gas stripper. A zero emissions dehydrator avoids these gas losses by eliminating Kimray pumps and gas strippers. Condensate is also recovered from the still column vapor at 2.88 gal/hr (gallons per hour) while the non-condensable vapor is used to fuel the glycol re-boiler in the zero emissions dehydrator. Two to four cubic feet per minute of gas venting is eliminated by replacing gas pneumatic controllers with electric controls. Examples of Natural Gas STAR Partner reported emissions savings and corresponding implementation costs for different zero emission dehydrator technologies are provided in Table 1.

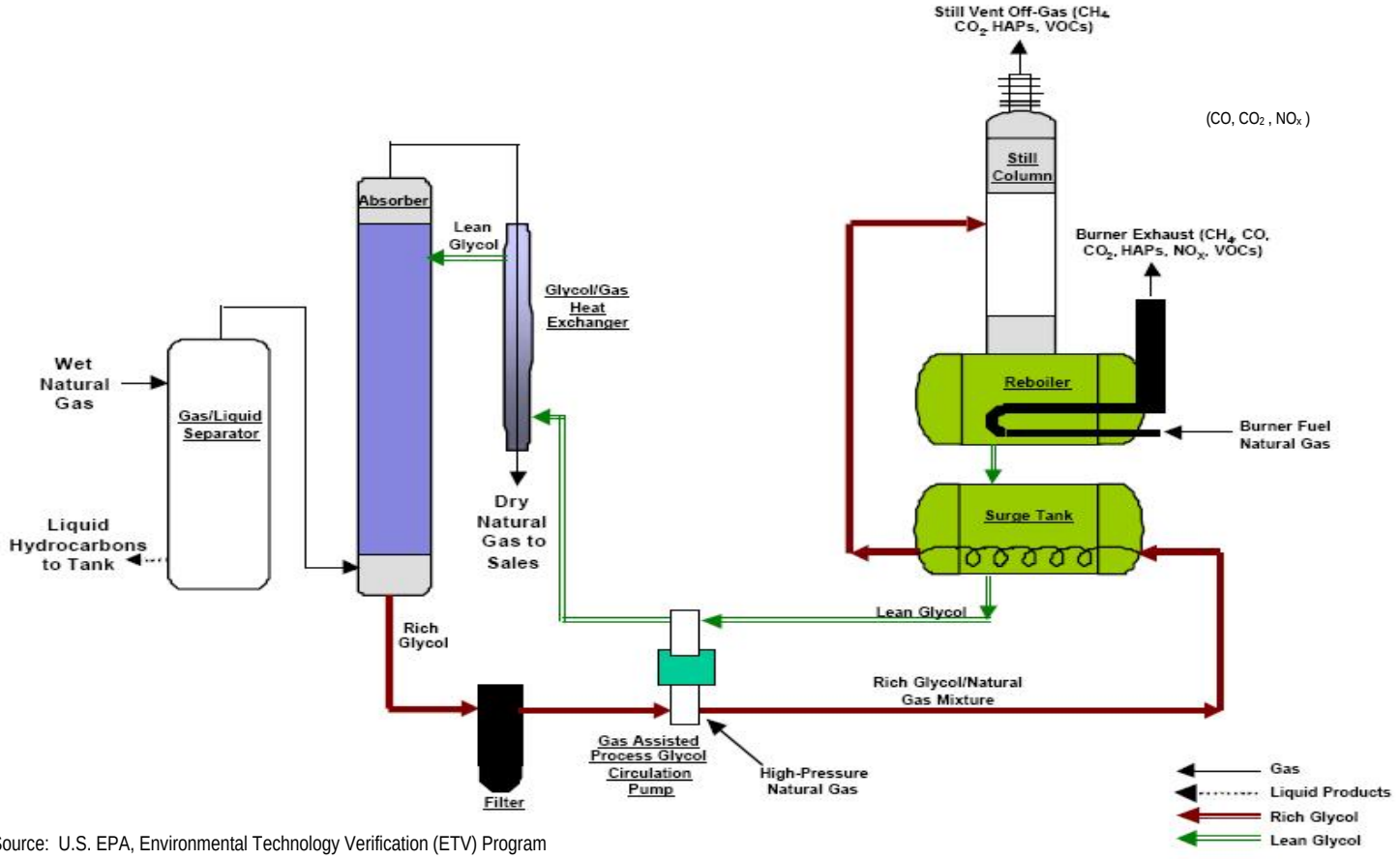
Discussion

Installation costs for a zero emissions dehydrator are similar to those for a conventional dehydrator with a thermal oxidizer. Electric motors and controllers offer several benefits as compared to gas-powered devices; they are more reliable and efficient and provide lower operating and maintenance costs. The cost of electric power is generally offset by increased methane and condensate production sales. Overall benefits of zero emission dehydrators include:

- ★ Rapid return on investment through gas savings,
- ★ Increased operational efficiency
- ★ Reduced O&M costs
- ★ Reduced Compliance Cost for HAPs and BTEX

EPA provides the suggested methane emissions estimating methods contained in this document as a tool to develop basic methane emissions estimates only. As regulatory reporting demands a higher-level of accuracy, the methane emission estimating methods and terminology contained in this document may not conform to the Greenhouse Gas Reporting Rule, 40 CFR Part 98, Subpart W methods or those in other EPA regulations.

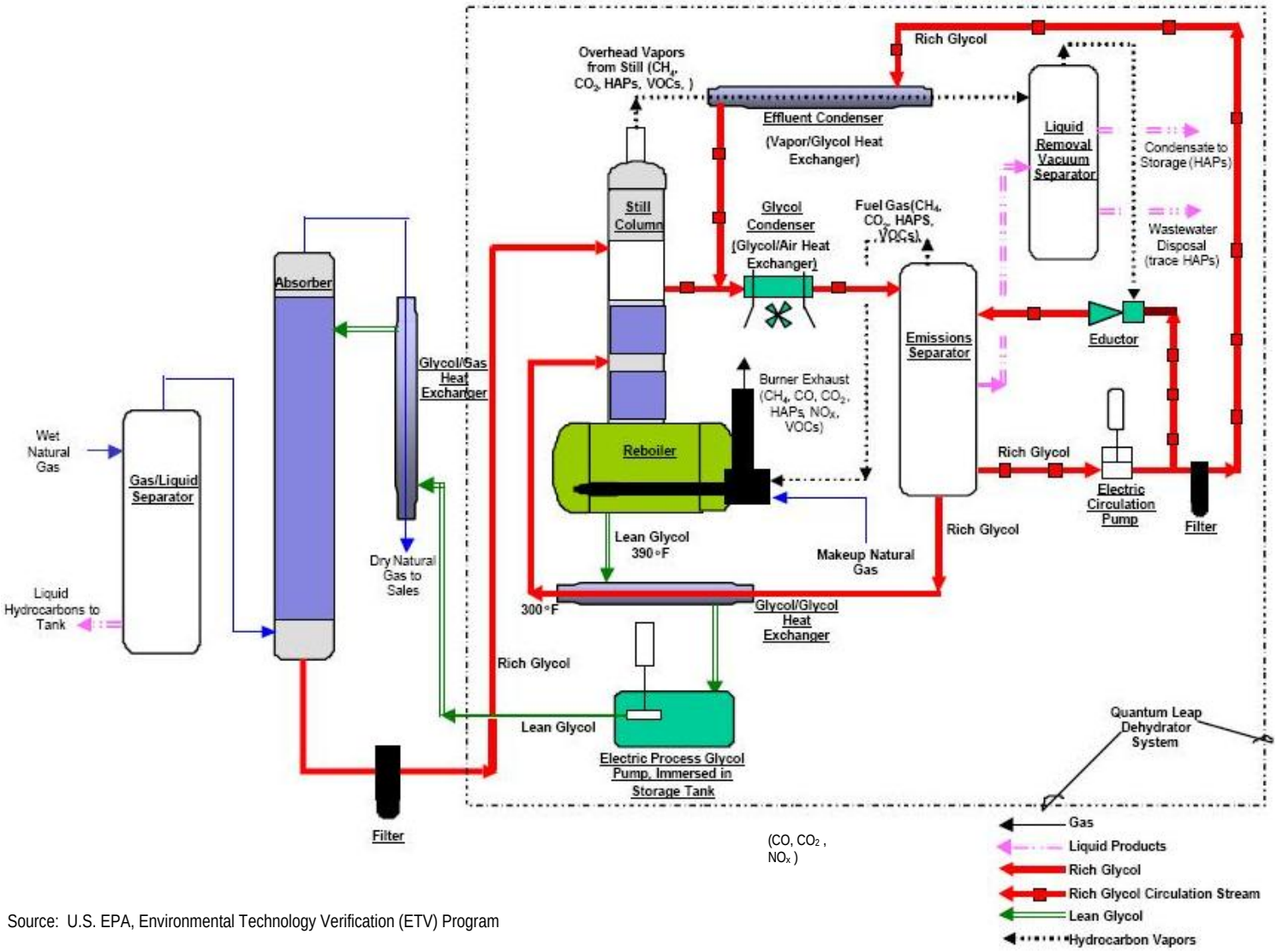
Conventional Glycol Dehydrator System



Source: U.S. EPA, Environmental Technology Verification (ETV) Program

Zero Emissions Dehydrators (Cont'd)

Quantum Leap Dehydrator System (A Zero Emissions Dehydrator)



Source: U.S. EPA, Environmental Technology Verification (ETV) Program