PRO Fact Sheet No. 202

Partner Reported Opportunities (PROs)
for Reducing Methane Emissions

Convert Natural Gas-Driven Chemical Pumps

Technology/Practice Overview

Description

Circulation pumps in glycol dehydration units and chemical injection pumps, used to inject methanol and other chemicals into wells and flow lines, are often powered by pressurized natural gas at remote locations. As part of normal operation, these devices vent methane to the atmosphere. Natural Gas STAR partner companies have achieved significant methane emission reductions by replacing gas-driven pneumatic pumps with alternative pumps including instrument air, solar-charged direct current (DC) electric pumps, and standard alternating current (AC) electric pumps.

One Natural Gas STAR Partner replaced natural gas with instrument air to drive large-volume glycol circulation pumps. The use of instrument air increased operational efficiency, decreased maintenance costs, and reduced emissions of methane, volatile organic compounds (VOC), and hazardous air pollutants (HAP).

Other partners have replaced gas-driven chemical pumps with solar-charged DC electric pumps. One partner company replaced more than 2,000 chemical pumps which were used to inhibit corrosion and prevent freezing in pipelines and wells. The solar-charged pumps were installed when older natural gas-driven pneumatic pumps required replacement. Where electricity is already available at the producing site, some replacement pumps use onsite AC electric power.

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

Applicable Sector(s)

■ Production
■ Processing
■ Transmission
□ Distribution

Economic and Environmental Benefits

Methane Savings

Estimated annual methane emission reductions

Convert Gas-Driven Glycol Pumps to Instrument Air: *2,500 Mcf per dehydrator unit*
Replace Pneumatic Chemical Injection Pumps with Solar Electric Pumps: *182.5 Mcf per pump replaced*

Economic Evaluation

Estimated Gas Price	Annual Methane Savings	Value of Annual Gas Savings*	Estimated Implementation Cost	Incremental Operating Cost	Payback (months)
$7.00/Mcf	2,500 Mcf 183 Mcf	$18,600 $1,300	$1,000—$10,000 $2,000	$100—$1,000 -	1 - 8 Months 19 Months
$5.00/Mcf	2,500 Mcf 183 Mcf	$13,300 $900	$1,000—$10,000 $2,000	$100—$1,000 -	1 - 11 Months 27 Months
$3.00/Mcf	2,500 Mcf 183 Mcf	$7,800 $550	$1,000—$10,000 $2,000	$100-$1,000 -	2 - 18 Months 44 Months

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

Additional Benefits

- Operations and maintenance cost savings
- More precise control of injection volumes and reduced chemical use
- Less downtime for wells and pipelines

Other Related Documents:

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

Replace Glycol Dehydration Units with Methanol Injection, PRO No. 205

Solar Charged Chemical Pump

Source: Chesapeake Energy

Convert Natural Gas-Driven Chemical Pumps

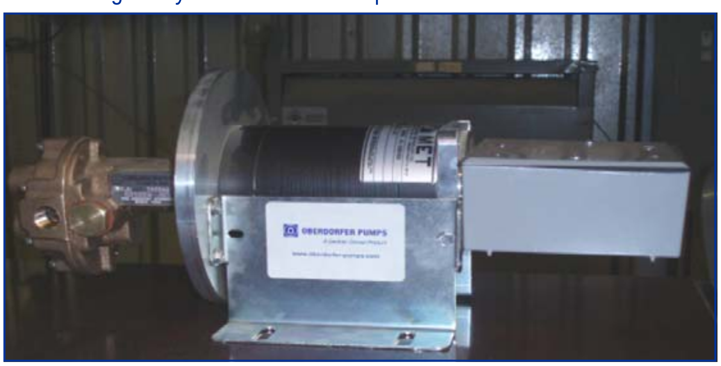
Operating Requirements

A facility may take advantage of the excess capacity of its instrument air system to convert natural gas-driven glycol circulation pumps. In a field setting, low volume natural gas pneumatic pumps can be replaced with electric pumps if the site is electrified, or if sufficient sunlight is available for solar-charged DC pumps. Other operating requirements include installation of solar panels and a storage battery for each solar-charged pump. No special training is required to operate solar electric pumps beyond review of the operating manual.

Applicability

Converting chemical pumps and circulation pumps to instrument air, solar or electric could be applied to gas dehydration operations across all gas industry sectors, including production operations where low volume chemical injection is necessary. For gas production, typical applications include methanol injection into pipelines and injection of corrosion inhibitors into producing wells and other field equipment. These chemical injection pumps are typically sized for 6 to 8 gallons of methanol injection per day.

Solar-Charged Glycol Circulation Pump



Source: BP

Solar injection pumps can handle a range of throughputs and injection pressures. Low volume solar-charged DC pumps are limited to approximately 5 gallons/day discharge at 1,000 psig. Large volume solar pumps are available with maximum output of 38 to 100 gallons per day at maximum injection pressures of 1,200 to 3,000 psig. Solar panels and storage batteries are nearly maintenance free, which saves downtime and service costs. The solar panels have a life span of up to 15 years and the electric motors last approximately 5 years in continuous use.

Methane Emissions

Gas savings and methane emission reductions vary according to the pump size, operating pressure, and the size and configuration of the pump installation. For glycol circulation pumps, partners report typical methane savings of 2,500 Mcf/year for each gas-drive glycol pump converted to instrument air. One partner reported total annual methane savings of 9,125 MMcf for converting gas drive glycol pumps plus other pneumatic services. For chemical injection pumps, one operator reports annual methane savings of approximately 365 MMcf after replacing 2,000 pneumatic chemical injection pumps with solar-charged electric pumps.

Solar Panels at Remote Production Site

Source: BP

Economic Analysis

Basis for Costs and Emissions Savings

Typical methane emissions from gas-driven glycol circulation pumps are estimated based on the following relationship:

Methane Emissions = Pump Gas Use *x* Glycol Ratio *x* Water Removal Ratio *x* Over Circulation Ratio

[Methane Emissions, = scf/ MMcf gas processed; Pump Gas Use = scf/ glycol circulated, gallons; Glycol Ratio = glycol, gal. / water removed, lb; Water Ratio = water removed, lb./ gas processed, MMcf; Over Circulation Ratio *(typical default = 2)]*

Methane emissions savings of 2,500 Mcf per year for each glycol pump conversion to instrument air assume the following conditions:

- One glycol pump sized for a gas dehydrator that processes 10 MMcf per day
- Pump gas use = 2 scf per gallon of glycol circulated

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- Glycol ratio = 3 gallons glycol per pound of water removed
- Water removal ratio = 56 pounds of water per MMcf of gas processed
- Over circulation ratio = 2 (default)

The methane emissions savings are equivalent to natural gas savings because the emissions savings boost the volume of the sales gas stream. At $5.00 per Mcf, estimated annual revenue is $12,500 for each pump conversion. The total cost to convert a gas pneumatic glycol circulation pump to instrument air would include installation of piping and an appropriate control system between the existing instrument air system and the glycol pump if the driver is independent of the circulation pump. If the driver is separated from the pump by o-rings, then the pump would have to be replaced as well. If potential total implementation costs range between $1,000 and $10,000, project payback would occur in less than one year.

Typical methane emissions savings from converting gas pneumatic chemical injection pumps to solar-charged electric pumps are estimated based on Partner experiences. One Partner converted 2,000 chemical pumps to solar-charged electric pumps thus saving 1,000 Mcfd of methane emissions or approximately 0.5 Mcfd per pump conversion. This equates to total annual methane emissions savings of approximately 182.5 Mcf per pump conversion.

The reporting Partner replaces failed pneumatic pumps, on an ongoing basis, with solar-charged electric pumps at a cost of approximately $2,000 per pump. Installation of the pump is typically included at no additional charge. No training costs are required. On-going operating and maintenance costs have not been quantified, but appear to be lower for the solar-charged electric pumps compared to the natural gas-driven pumps. The methane content of natural gas in the reporting partner's operating area is approximately 90 percent, so annual natural gas savings are approximately 203 Mcf per pump conversion. At $5.00 per Mcf, the value of the natural gas saved equals $1,015 per year, thus paying back the cost of the pump replacement in approximately two years.

Discussion

Replacing high volume natural gas-driven glycol circulation pumps with instrument air may provide a relatively quick payback. The installation of piping between an existing air compressor and the glycol circulation pump accounts for the major capital costs in high volume systems. These capital costs are assumed to be incremental to the cost of the existing instrument air system. The electric power required to compress the air is the primary operating cost.

In field applications discussed above, operators report that solar-charged electric pumps are more accurate and allow more precise control of chemical injection. Electric driven pumps are more reliable and require less maintenance than pneumatic pumps because they eliminate the use of wet lease gas and the downtime associated with freezing and corrosion. The benefits associated with reduced chemical use and reduced maintenance have not been quantified, but partners estimate these additional cost savings can be significant for daily operations.

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 %

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.

Solar Chemical Pump with SCADA Interface

Source: Encana