Replace Bi-Directional Orifice Metering with Ultrasonic Meters

Technology/Practice Overview

Description

Bi-directional flow rate measurement is commonly done with the gas that is injected into and withdrawn from gas storage fields. For accurate flow measurement, the orifice plate (the component inside the pipeline) is removed, inspected, and replaced if the sharp edges on the orifice plate are worn smooth. Removing the orifice plate requires the valves on each side of the orifice meter run to be closed and the pipeline segment vented to the atmosphere. This orifice inspection may be required monthly during winter gas withdrawal. Orifice plates need to be inspected and changed more frequently when measuring "dirty" gas (i.e., direct from a reservoir, such as gas withdrawal from storage during peak demand periods), because the particulates will wear the sharp orifice plate edges smooth, distorting the accuracy of the measurement.

A partner reported replacing orifice meters with ultrasonic meters, reducing methane emissions, operating costs, and maintenance costs, and increasing operating efficiency. Ultrasonic meters use high frequency sound pulses between two sensors across the pipeline, calibrated for the flow rate of the gas. Ultrasonic meters have no pressure drop, no flow blockage, no moving parts, and can be calibrated without venting gas.

Operating Requirements

An electrical power supply and a minimum length of straight pipe, or straightening vanes, are needed to implement this technology.

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

Applicable Sector(s)

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

Other Related Documents:

Reduce Frequency of Replacing Modules in Turbine Metes, PRO No. 906

Economic and Environmental Benefits

Methane Savings

Estimated annual methane emission reductions	*20 Mcf per year*

Economic Evaluation

Estimated Gas Price	Annual Methane Savings	Value of Annual Gas Savings*	Estimated Implementation Cost	Incremental Operating Cost	Payback (months)
$7.00/Mcf	20 Mcf	$149	$50,000	-$25,000	24 Months
$5.00/Mcf	20 Mcf	$106	$50,000	-$25,000	24 Months
$3.00/Mcf	20 Mcf	$64	$50,000	-$25,000	24 Months

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

Additional Benefits

- Reduced labor costs
- Reducing methane emissions was an associated benefit of the project

Replace Bi-Directional Orifice Metering with Ultrasonic Meters (Cont'd)

Applicability

This technology is applicable to all flow measurements, but particularly for bi-directional flow metering.

Methane Emissions

Methane emissions reduction may be estimated using the Pipeline Rules of Thumb handbook, Fourth Edition, p. 270. One partner reported saving 119 Mcf of methane for 14 units, ranging in size from 6-inch to 10-inch.

Economic Analysis

Basis for Costs and Emissions Savings

Methane emissions reductions of 20 Mcf per year are based on engineering calculations for inspecting/ changing five, 8-inch orifice plates on a 900-psig system, 12 times per year. Also, assuming block valves are located 11 pipe diameters up and downstream of the orifice for both bi-directional meters (storage) and, for conservatism, in unidirectional meters (transmission, distribution).

The primary benefit of this technology is labor cost savings, which could approach $25,000 per year. The capital and installation costs are based on retrofitting an ultrasonic meter on existing pipe at a cost of approximately $50,000. The only operating cost is electrical power for meters that use 10 to 20 watts.

Discussion

The primary benefit of this practice is reducing labor costs. The payback is about 2 years based on labor savings, vented gas savings, and fuel gas savings (O&M).

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 %