Install Electric Motor Starters

Technology/Practice Overview

Description

In the natural gas industry, internal combustion engines for compressors, generators, and pumps are often started using small gas expansion turbine motor starters. High-pressure natural gas is stored in a volume tank while a compressor is running. The pressurized gas is expanded across the starter turbine, initiating startup of the engine, and then vented to the atmosphere. In addition to the vented emissions, natural gas leakage from the volume tank also leads to significant losses.

Partners have found that replacing the starter expansion turbine with an electric motor starter, similar to an automobile engine motor starter, can avoid methane emissions.

Operating Requirements

Electric motor starters require a power supply. Power can be provided from electrical utility, portable and solar-recharged batteries, or generated onsite.

Applicability

This technology is applicable in all sectors of the gas industry.

Methane Emissions

The methane emissions savings are based on 10 compressor startup attempts using factors from Perry's Chemical Engineers' Handbook, Sixth Edition, (p. 24-15) of 0.5 scf of gas per HP at 250 psig stored to operate the starting motor. The EPA/GRI Study, "Methane Emissions from The Natural Gas Industry" Volume 8, reported 1,341 Mcf per year leakage from compressor starter open-ended lines. Blowdown

- [x] Compressors/Engines
- [ ] Dehydrators
- [ ] Directed Inspection & Maintenance
- [ ] Pipelines
- [ ] Pneumatics/Controls
- [ ] Tanks
- [ ] Valves
- [ ] Wells
- [ ] Other

Applicable Sector(s)

- [x] Production
- [x] Processing
- [x] Transmission
- [ ] Distribution

Other Related Documents:

Replace Gas Starters with Air or Nitrogen, PRO No. 101

Reduce Gas Venting with Fewer Compressor Engine Startups & Improved Engine Ignition, PRO No. 102

Install Electric Compressors, PRO No. 103

Economic and Environmental Benefits

Methane Savings

Estimated annual methane emission reductions *(Assumes 10 engine startups per year)*	*1,356 Mcf per engine motor starter*

Economic Evaluation

Estimated Gas Price	Annual Methane Savings	Value of Annual Gas Savings*	Estimated Implementation Cost	Incremental Operating Cost	Payback (months)
$7.00/Mcf	1,356 Mcf	$10,100	$1,000—$10,000	$100	2—12 Months
$5.00/Mcf	1,356 Mcf	$7,200	$1,000—$10,000	$100	2—17 Months
$3.00/Mcf	1,356 Mcf	$4,300	$1,000—$10,000	$100	3—29 Months

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

Additional Benefits

- Reduced methane emissions is a primary justification for this project

Install Electric Motor Starters (Cont'd)

valves of a size and pressure differential similar to the gas shutoff valve on the volume tank leak up to 150 scf per hour or 1.3 MMcf per year.

Conversion to electric motor starters completely eliminates the venting of methane to the atmosphere and the leakage of methane through the gas shutoff valve.

Partners have reported savings of 23 Mcf to 600 Mcf per year, a range that is dependent on how many times compressors are restarted in a year and how readily the engine starts up and stays running. A single startup of a properly tuned engine may require 1 Mcf to 5 Mcf of gas at 200 psig average volume tank pressure, depending on engine size (horsepower).

Economic Analysis

Basis for Costs and Emissions Savings

Methane emissions savings of 1,356 Mcf per year apply to one electric motor starter for a compressor engine, assuming ten startups per year and methane leakage through the gas shutoff valve.

The cost of an electric motor starter can vary significantly depending on the size and operating parameters of the individual compressor. The range of costs is estimated to be $1,000 to $10,000.

The electrical energy required for the new electric motor starter will be equivalent to the energy imparted by the gas expansion. Using an electrical power cost of 7.5¢ per kWh, the gas expansion turbine above is equivalent to $1 to $5 per engine start attempt, depending on engine size (horsepower).

Discussion

This technology can provide a payback in less than three years. Important economic considerations include the capital cost of installing an electric motor starter, the revenue gained from salvaging the gas expansion turbine starter, and the cost of the electric power needed to drive the motor.

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 %