Innovative financial tool for compressor station retrofits

US EPA Natural Gas STAR Technology Transfer Workshop

Glen Allen, VA

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Executive Summary

- Centrifugal compressors equipped with wet seal technology are generally acknowledged as a leading source of methane emissions in the natural gas value chain.

- There are 3 approaches to reduce methane emissions from such equipment.

- This presentation showcases a decision support tool that evaluates the three options from an economic perspective.

- The Life Cycle Cost Calculator is a web-based decision support tool that builds on previous work and takes it to the next level. This tool provides economic comparisons of methane reduction options to assist customers in decision making and ensures all factors are considered for individual compressor units, including initial costs, operational savings and emissions reductions.
Who is FSA?

- An association of North American companies who manufacture fluid sealing devices and suppliers to process industries.
- Represents over 80% of the manufacturing capacity for fluid sealing devices in North America.
- Member companies and distributors have manufacturing and service centers in all 50 States, Canada and Mexico.
- FSA partners closely with the European Sealing Association (ESA).
- Industry represents engineers, machinists, technicians, laborers...
Our mutual objective

Source: US EPA Natural Gas STAR
Economic Payback

Cumulative Financial Return vs. Time (Yrs)

- Oil Seal routed to capture / use
  - (Range dependent upon application specifics)

- Oil Seal to Gas Seal Retrofit
  - (Range dependent upon application specifics)

- Oil Seal routed to flare

The role of Lifecycle Cost Calculator

Fluid Sealing Association (FSA)
Life Cycle Cost Calculator

Compressor Data
- Driver
- Power
- Efficiency
- Number of seals
- Shaft Size

Process Data
- Methane content
- Flow rate
- Pressure
- Operational hours
- Process gas value

Reliability Data
- Planned maintenance costs
- Unplanned maintenance costs
- Spare parts cost
- Lost production time
- MTBR

Seal Data
- Frictional power
- Leakage rate
- Gas injection source
- Leakage destination

Seal Support System Data
- Power requirements
- Cooling configuration

Utilities Data
- Driver fuel value
- Electricity value
- Purge gas value

Retrofit / Upgrade Data
- New seals and spares costs
- System upgrade/replacement costs
- Equipment modification costs
- Electrical and instrumentation costs
- Site materials and installation costs
- Decommissioning and disposal costs
- Lost production time
## Life Cycle Cost Calculator Outputs

### Costs Calculated

**Annual Operating Costs**
- Maintenance cost
- Value of leaked gas
- Consumables
- Energy consumed by seal
- Energy consumed by seal system

**One-Time Costs**
- Total retrofit costs
- Payback

**Present Value**
- Present value of annual operating costs over lifespan remaining

**Total Life Cycle Cost**
<table>
<thead>
<tr>
<th><strong>Pipeline compressor</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Natural Gas:</strong></td>
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<tr>
<td><strong>Flow:</strong></td>
</tr>
<tr>
<td><strong>Pressure:</strong></td>
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<tr>
<td><strong>Shaft Speed:</strong></td>
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<tr>
<td><strong>Driver:</strong></td>
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<tr>
<td><strong>Shaft Diameter:</strong></td>
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<tr>
<td><strong>Operational hours:</strong></td>
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<tr>
<td><strong>Spared:</strong></td>
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</tbody>
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Equipment operator owns the compressed gas
Life Cycle Cost versus Time

- Oil Seal Routed to Atmosphere
- Oil Seal Routed to Capture/Use
- Gas Seal
- Oil Seal Routed to Flare
< ~4 months – Lowest cost solution is to do nothing
4 months to 5 years – Lowest cost solution is oil seal with leakage routed to capture/use
Life Cycle Cost versus Time

> 5 years – Lowest cost solution is gas seal
Illustration

Outputs

Life Cycle Cost versus Time

- **Oil Seal Routed to Atmosphere**
- **Oil Seal Routed to Capture/Use**
- **Gas Seal**
- **Oil Seal Routed to Flare**

Total Estimated Life-Cycle Cost ($M)

Time (Years)

0  5  10  15  20  25

0  0.5  1  1.5  2  2.5  3
The Lifecycle Cost Calculator provides decision support that is:

- Insightful
- Comprehensive
- Customizable
- Specific
Further Information

Accessing the Gas Compressor Lifecycle Cost Calculator is free

www.fsaknowledgebase.org
(Requires free user account to access)
Fluid Sealing Association

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