Innovative financial tool for compressor station retrofits

Global Methane Initiative

April, 2018
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

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
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 Support System Data
- Power requirements
- Cooling configuration

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

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>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas:</td>
<td>96% Methane</td>
</tr>
<tr>
<td></td>
<td>$3.00 / Mcf</td>
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<tr>
<td>Flow:</td>
<td>50,000 scfm (1416 m³/min)</td>
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<tr>
<td>Pressure:</td>
<td>600 psig (41.3 Barg) Suction</td>
</tr>
<tr>
<td></td>
<td>1,100 psig (75.8 Barg) Discharge</td>
</tr>
<tr>
<td>Shaft Speed:</td>
<td>9,000 RPM</td>
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<tr>
<td>Driver:</td>
<td>Gas Turbine 10,500 hp (7,800 kW)</td>
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<tr>
<td>Shaft Diameter:</td>
<td>5” (127 mm)</td>
</tr>
<tr>
<td>Operational hours:</td>
<td>4,000 hr/year (167 days/year)</td>
</tr>
<tr>
<td>Spared:</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Equipment operator owns the compressed gas
Life Cycle Cost versus Time

- Total Estimated Life-Cycle Cost ($M)
- Time (Years)

- Blue line: Oil Seal Routed to Atmosphere
- Red line: Oil Seal Routed to Capture/Use
- Green line: Gas Seal
- Orange line: 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
Life Cycle Cost versus Time

- **Total Estimated Life-Cycle Cost ($M)**
  - Y-axis range: 0 to 3

- **Time (Years)**
  - X-axis range: 0 to 25

Lines represent different scenarios:
- **Blue** - Oil Seal Routed to Atmosphere
- **Red** - Oil Seal Routed to Capture/Use
- **Green** - Gas Seal
- **Orange** - Oil Seal Routed to Flare

Graph shows the increasing cost over time for each scenario.
Select FSA members are exploring innovative commercial arrangements to reduce initial retrofit costs to optimize the retrofit solution in return for a share in future savings.

... The Lifecycle Cost Calculator provides decision support that is:

- Insightful
- Comprehensive
- Customizable
- Specific
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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