

A photograph of two male workers in an industrial setting. They are both wearing yellow hard hats and high-visibility yellow safety vests over light-colored work shirts. The worker on the left is pointing upwards with his right hand, while the worker on the right holds a black clipboard. They are both looking upwards with expressions of interest or concentration. The background shows industrial structures, including pipes and a metal framework, under a bright sky. The image is partially obscured by a blue geometric overlay on the right side of the slide.

# THE ROLE OF GAS SEAL TECHNOLOGY IN REDUCING METHANE EMISSIONS

United Nations  
Economic Commission for Europe  
Group of Experts on Gas

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March 27 2017, Geneva

# Executive Summary

In regard to the natural gas industry, centrifugal compressors equipped with oil seal technology are generally acknowledged as a leading source of methane emissions in offshore and onshore operations.

This equipment is an area of focus in such programs as Global Methane Initiative, US Natural Gas STAR and the United Nations Environment Programme, Climate and Clean Air Coalition, Oil and Gas Methane Partnership

There are three technologies available to reduce methane emissions from existing oil seal equipped centrifugal compressors. **Gas Seal Technology** is proven and available and proposed as the **Best Available Technology** for reducing methane emissions from centrifugal compressors equipped with oil seals

A number of operators have had success over the past 15 years in upgrading from oil seal technology to gas seal technology

This presentation also showcases the Lifecycle Cost Calculator (LCC) decision support tool that evaluates the three options from an economic perspective

# Presentation outline

Background

The options for methane emissions reduction

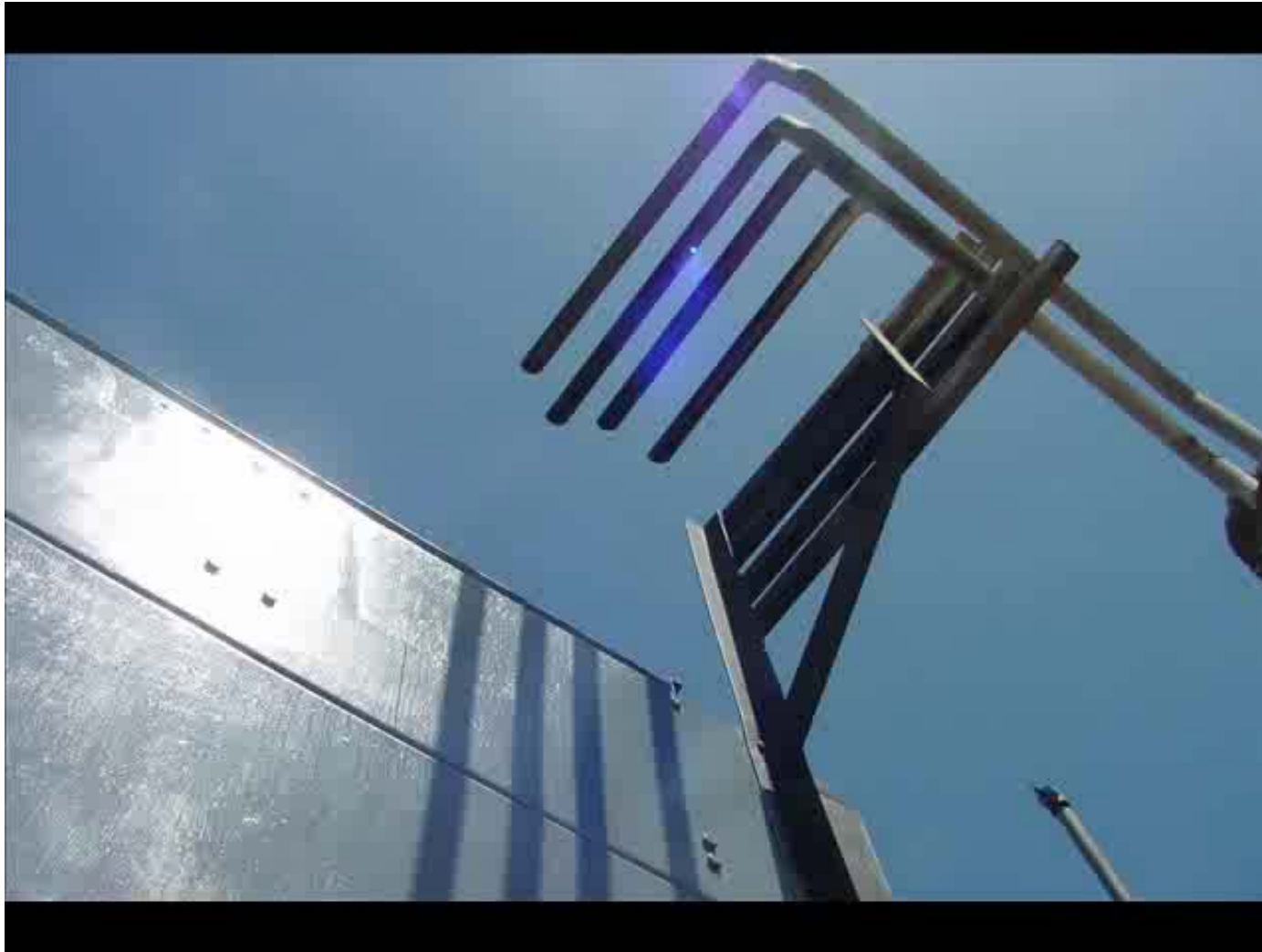
Introducing gas seal technology

The role of the Lifecycle Cost Calculator (LCC)

Illustration

Summary

# The Challenge

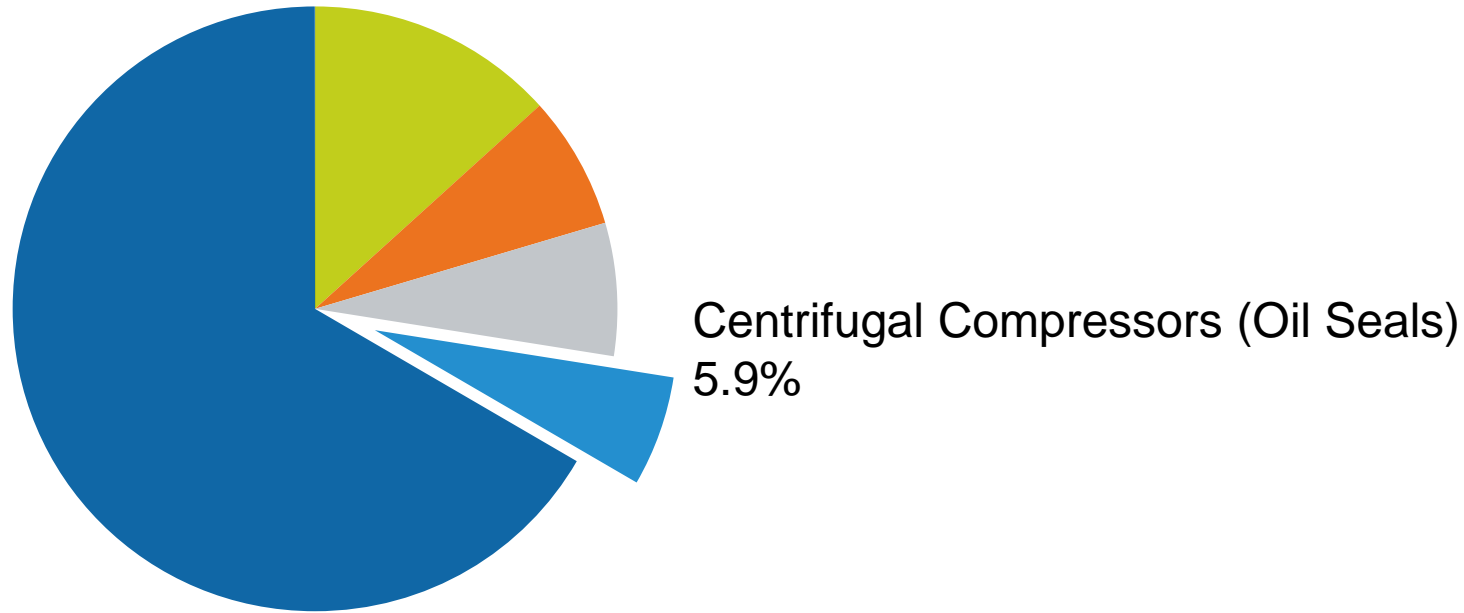


Source: US EPA Natural Gas STAR



# Why is this relevant?

## 2018 Projected Onshore Methane Emissions from US Natural Gas Industry (Source: ICF/EDF March 2014)



**I am not here to convince you why we need to focus on emissions from oil seal equipped centrifugal compressors**

**I am are here to discuss the best available technology to reduce methane emissions from this equipment**

# Where is this equipment?

Natural Gas Processing

Natural Gas Transmission

Natural Gas Storage



# Compressor shaft sealing solutions - options

Oil seal with captured emissions vented to flare

Oil seal with enhance gas separation and rerouting to alternative use

Dry gas seal



# Compressor shaft seal technology - overview

Oil seals are a **contacting** seal technology

Gas seals are a **non contacting** seal technology

- Significantly reduced emissions by design
- Lower operating costs
- No liquid required for lubrication
- No liquid required for cooling
- No liquid supply system required
- No wear – long life and reliability
- Safer – no gas entrapment
- Very little power consumed
- Reduced space and weight



**Gas seals are fundamentally a superior seal**



# Gas seals

A technology that is proven and widely deployed\*

## Centrifugal Compressor Original Equipment Manufacturers



SIEMENS

Solar Turbines  
A Dresser Industries Company

mitsubishi

沈鼓集团



DRESSER-RAND

ELLIOTT  
EBARA GROUP

## Operating Facilities



ExxonMobil



BASF



ConocoPhillips



VALERO ENERGY  
CORPORATION

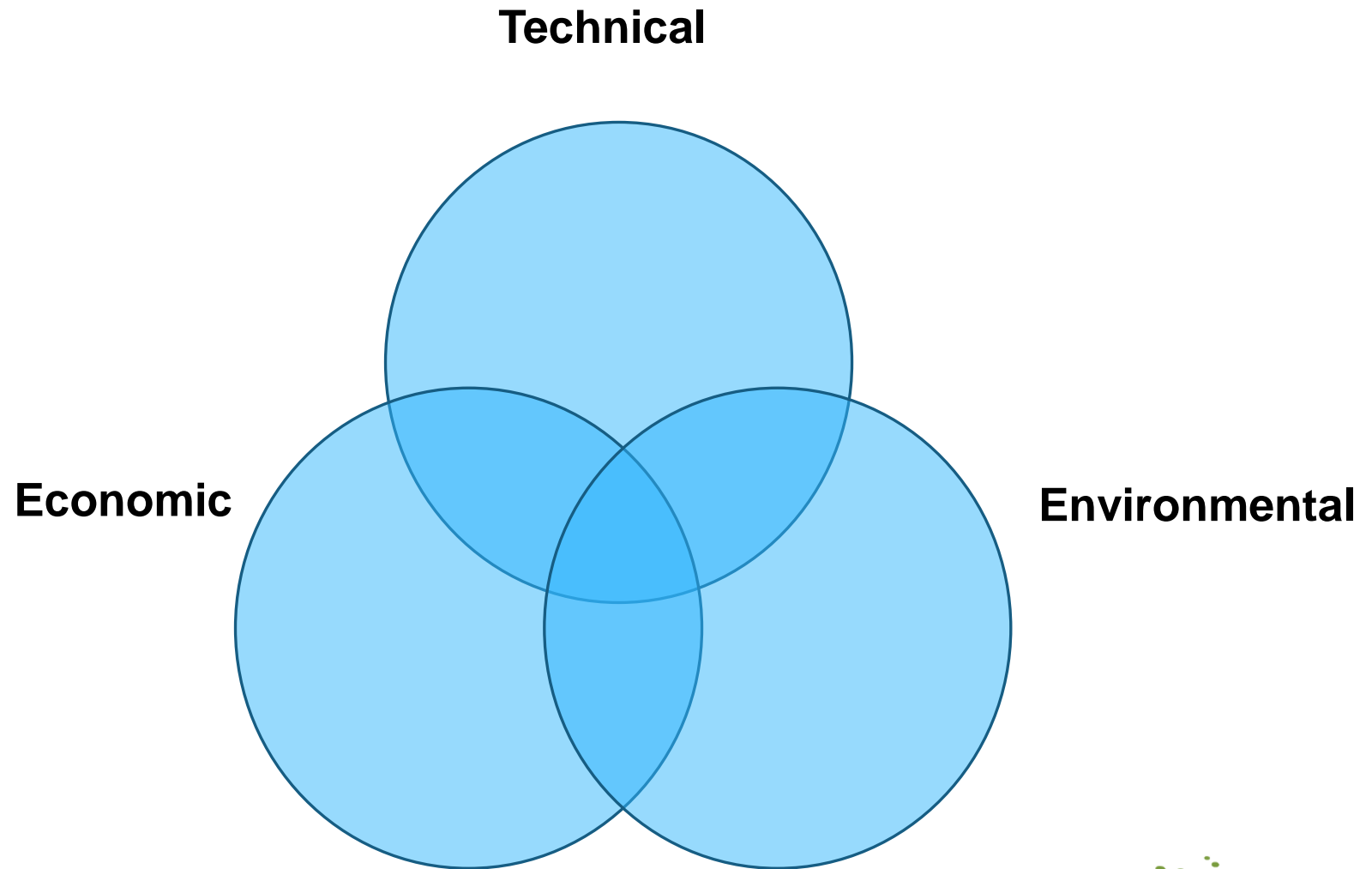


## Gas Seals – The choice of Blue Chips globally

\*John Crane's use of the above marks is for informational purposes only and should not be construed as sponsorship or endorsement of John Crane or any of its products or services by the respective trademark owners.

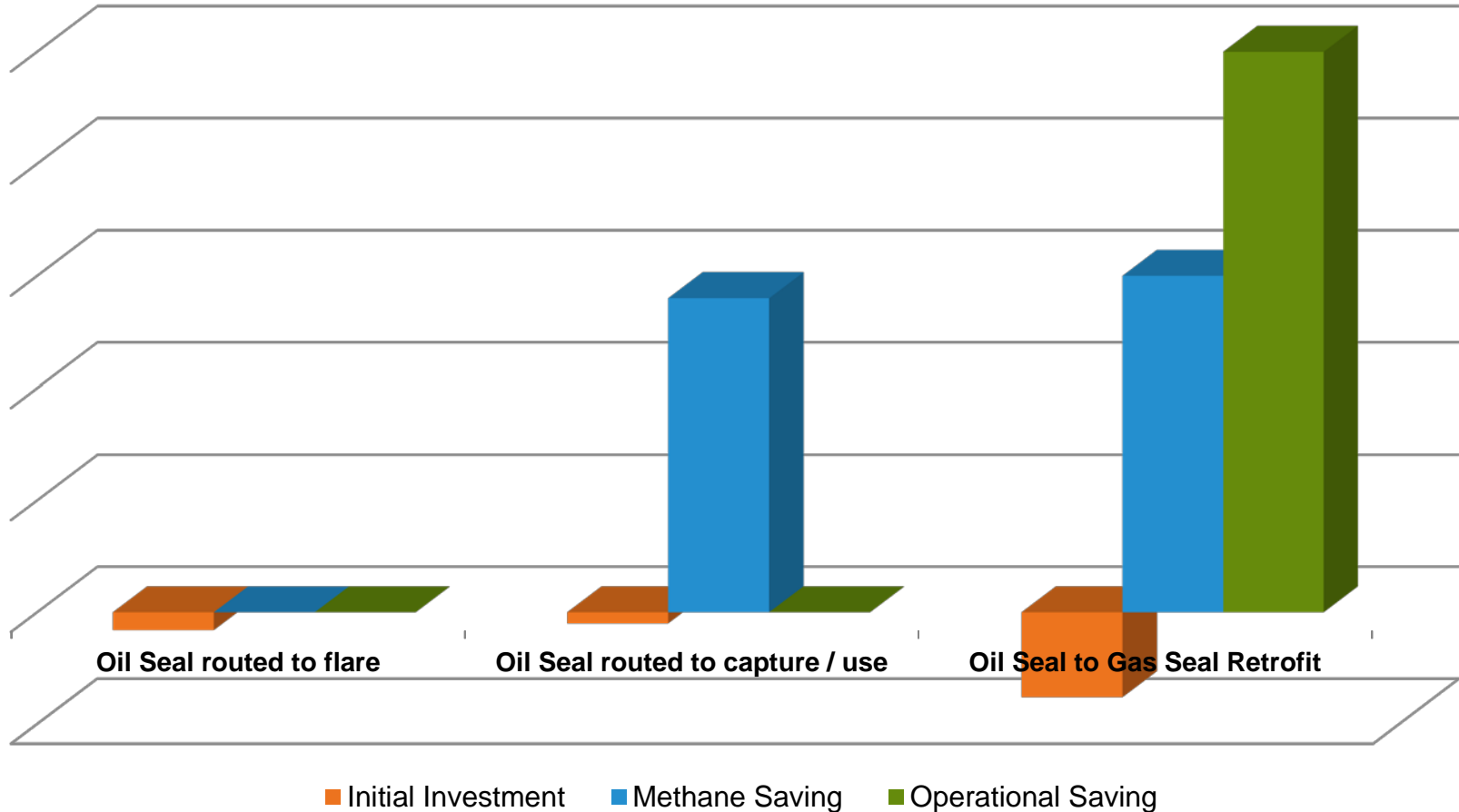


# The determining factors

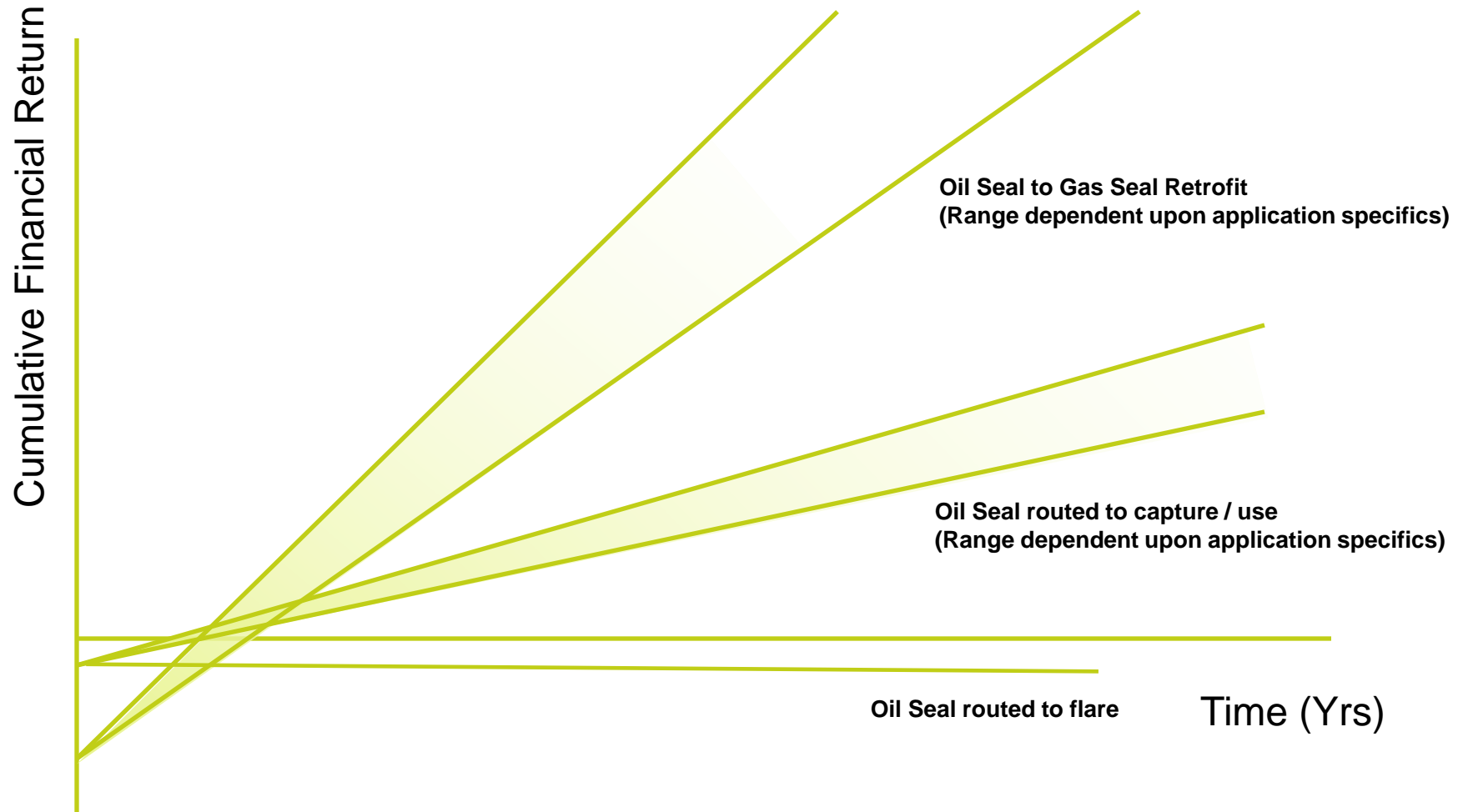


# Qualitative Economic Comparison

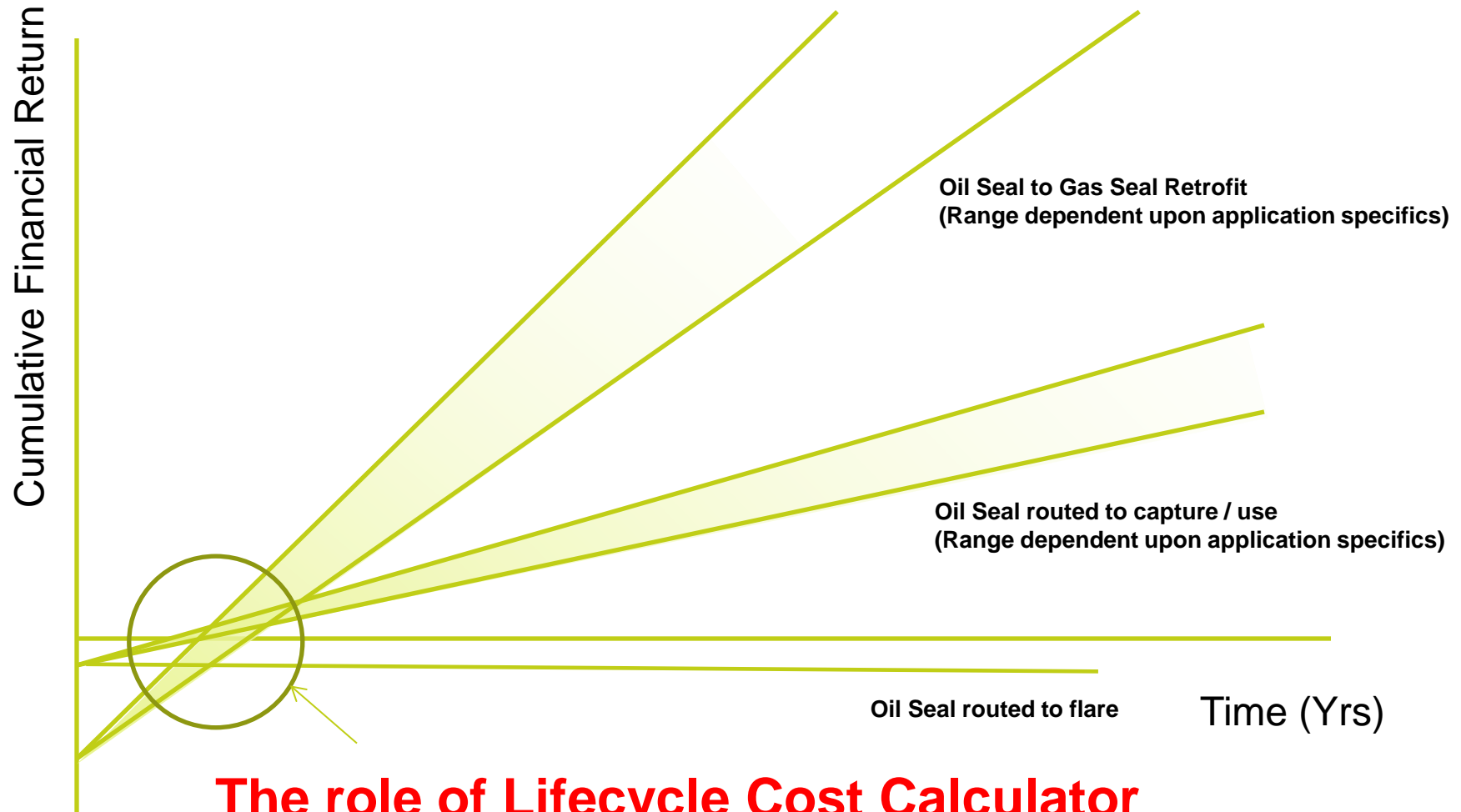
Oil Seal routed to flare vs oil seal routed to capture/use vs gas seal retrofit



# Economic payback

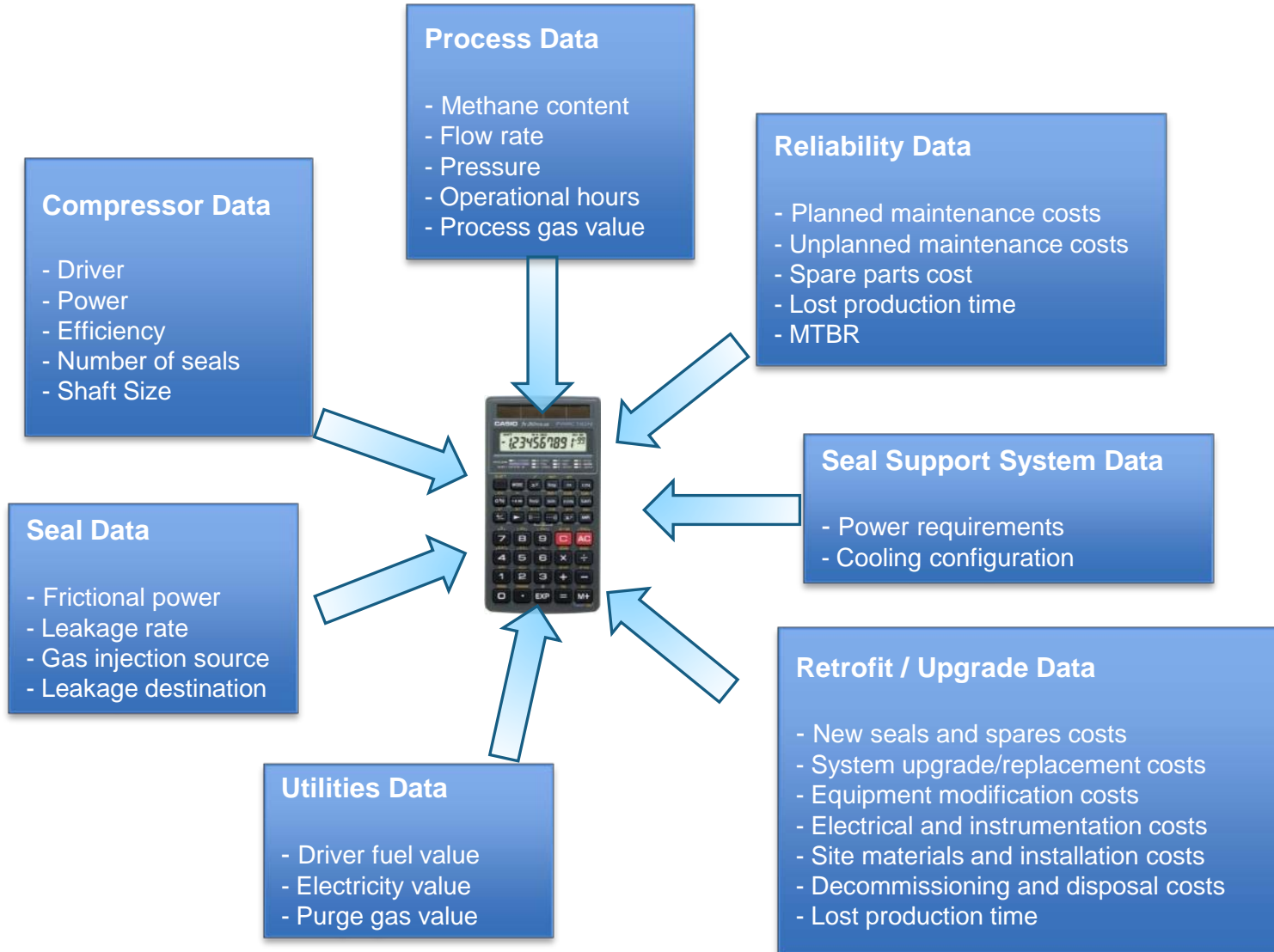


# Economic payback



**The role of Lifecycle Cost Calculator**

# Lifecycle Cost Calculator



# Lifecycle Cost Calculator outputs

## Costs Calculated

### Annual Operating Costs

- Maintenance cost
- Value of leaked gas
- Consumables
- Energy consumed by seal
- Energy consumed by seal system

### Total Life Cycle Cost

### One-Time Costs

- Total retrofit costs
- Payback

### Present Value

- Present value of annual operating costs over lifespan remaining



# Illustration

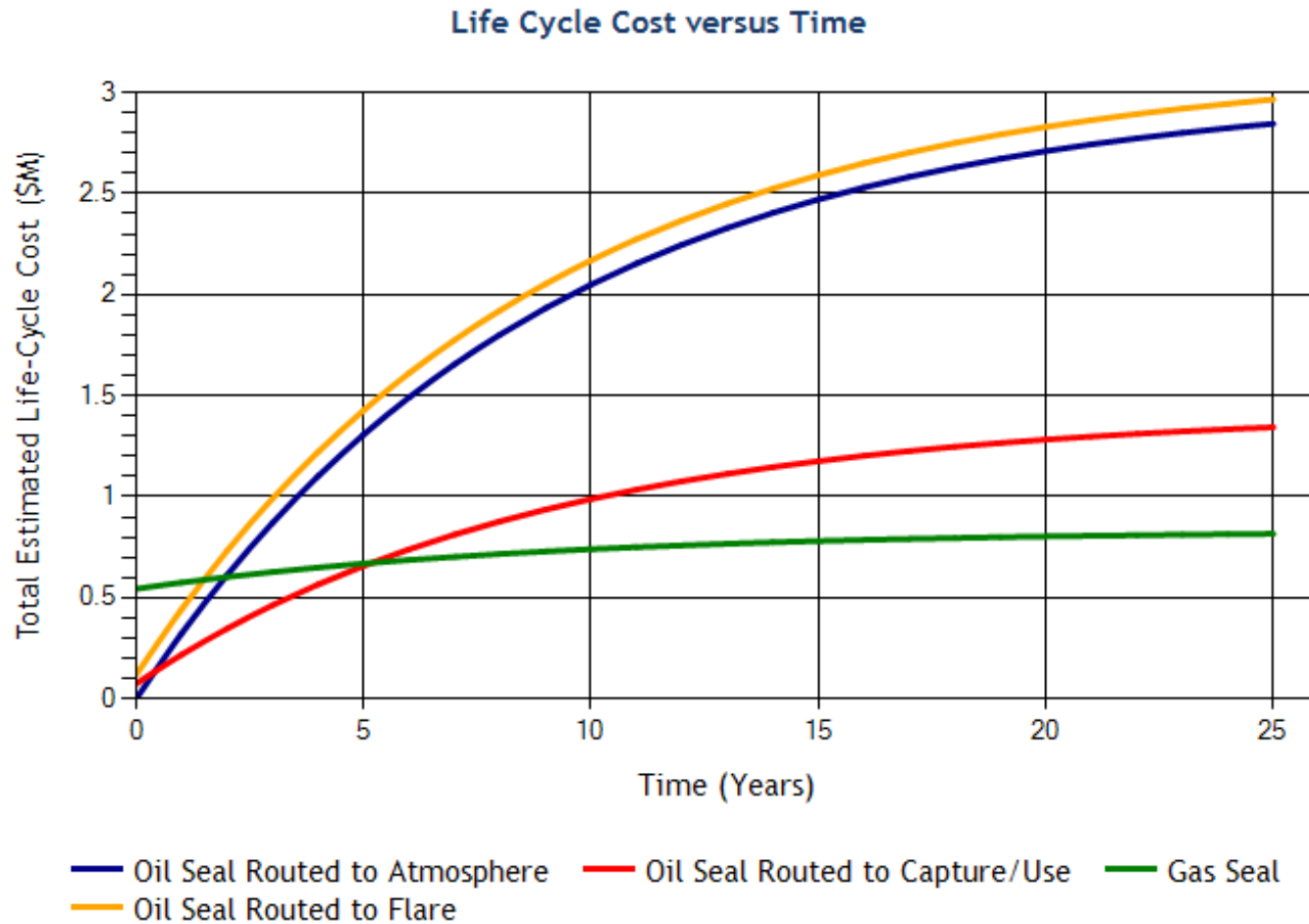
## Pipeline compressor

Natural Gas:	96% Methane \$3.00 / Mcf
Flow:	50,000 scfm (1416 m <sup>3</sup> /min)
Pressure:	600 psig (41.3 Barg) Suction 1,100 psig (75.8 Barg) Discharge
Shaft Speed:	9,000 RPM
Driver:	Gas Turbine 10,500 hp (7,800 kW)
Shaft Diameter:	5" (127 mm)
Operational hours:	4,000 hr/year (167 days/year)
Spared:	Yes

**Equipment operator owns the compressed gas**

# Lifecycle Cost Calculator

## Summary output



# Experience



# Summary

Why is **gas seal technology** the **Best Available Technology** for reducing methane emissions from centrifugal compressors equipped with oil seals?

- Gas seal technology is **proven** and the **current industry standard** for all new equipment including natural gas applications
- Oil seal to gas seal retrofits are **not new** and are applicable in the majority of cases
- While the actual benefit is specific to a given compressor
- Retrofit with gas seal technology offers the **maximum environmental benefit**
- Retrofit with gas seal technology offers the industry **safety benefit**
- Retrofit with gas seal technology offers the **maximum reliability benefit**
- Retrofit with Gas Seal Technology offers the **maximum operational savings**

**Gas Seal Technology**

**Best Available Technology, Applicable, Executable**