FLIR | The World's Sixth Sense®

Optical Gas Imaging History, Innovations and Industry Results

Natural Gas STAR Methane Challenge Program

Leak Detection Technologies Panel

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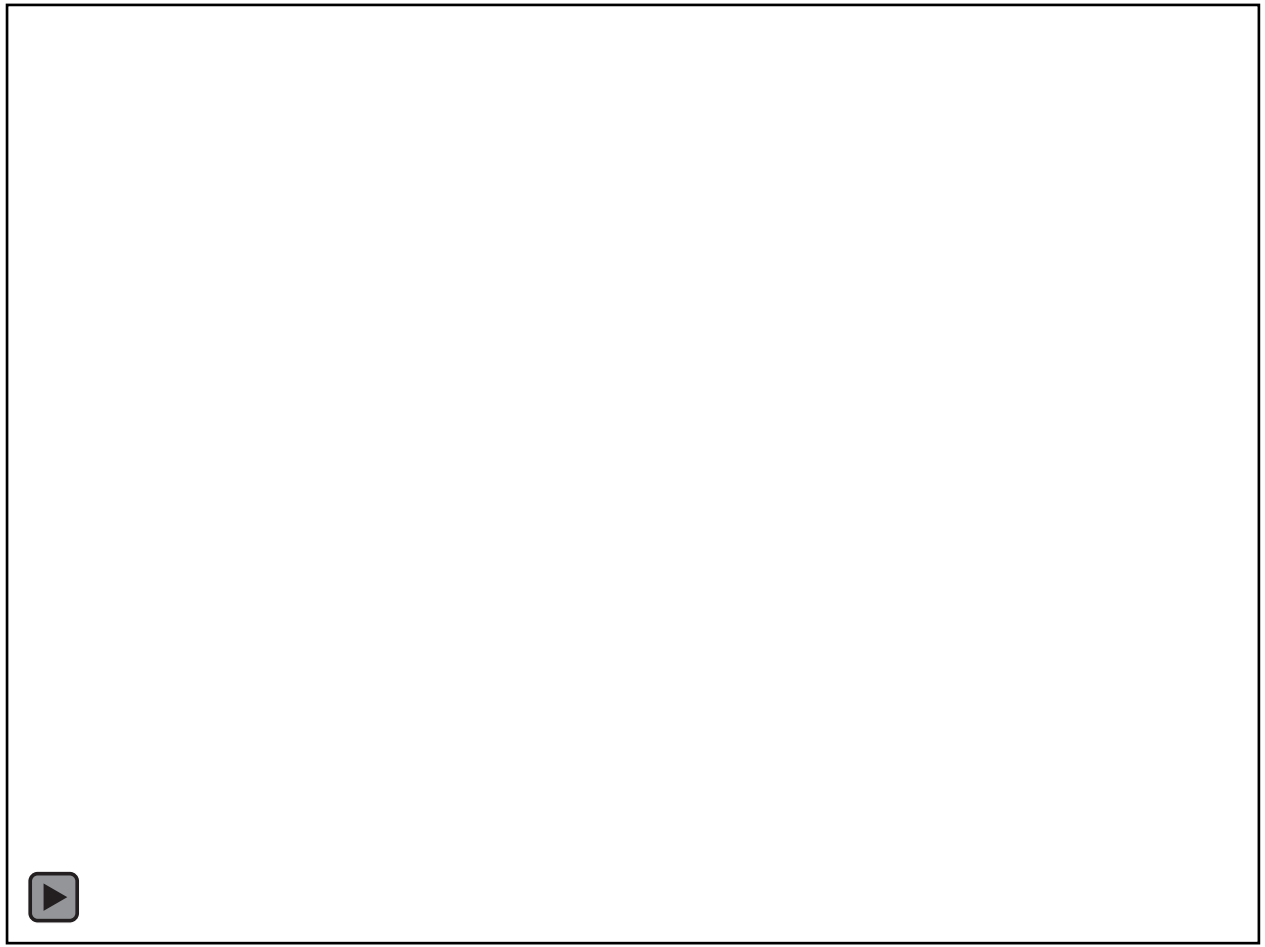
Solutions for Military & Defense

Solutions for Work

FLIR®

Solutions for the Outdoors

Solutions for First Responders



History of Optical Gas Imaging

1980s | 1990 | 2006 | 2009 | TODAY

Latest Innovation from FLIR

FLIR GFx320™

Designed and certified as intrinsically safe for use in hazardous areas by methods of controlling energy (electrical and thermal) to non-incendive levels

Quantitative Optical Gas Imaging

Providence Photonics QL320 paired with FLIR's GF320 or GFx320 unit

- Measures mass leak rates (lb/h or g/h) or volumetric leak rates (cc/min or L/min) for most hydrocarbons
- Portable, easy to use, and provides results in the field within seconds
- Independently field tested against other leak quantification methods (Method 21 and High Flow Sampler)

Who is utilizing OGI?

FLIR

OGI Return On Investment

The cumulative gas savings realized by the program has exceeded $5 million in the past 6 years, which has more than covered the overall program costs. This includes the Optical Gas Imaging equipment and associated operators, along with all repairs and maintenance, including labor and parts.

EDI&M Results

12 Month Total	1st Year	2011	2012	2013	2014	2015
# of Inspections	3303	3473	4187	3847	2964	885
Leaks identified	2959	2159	2086	1947	1330	460
Repair Time (hr)	704.9	401.8	357.4	246.5	190	106
Labor Cost ($)	$58,369	$37,125	$31,109	$18,249	$15,984	$7,586
Material Cost ($)	$266,963	$186,884	$142,884	$100,381	$70,246	$17,077
Gas Savings ($/yr)*	$347,491	$234,964	$264,570	$159,886	$114,921	$20,526
VOC Emissions (tons)**	351	163	97	70	95	31.3

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JONAH ENERGY LLC

Application Note: http://www.flirmedia.com/MMC/THG/Brochures/OGI_014/OGI_014_US.pdf

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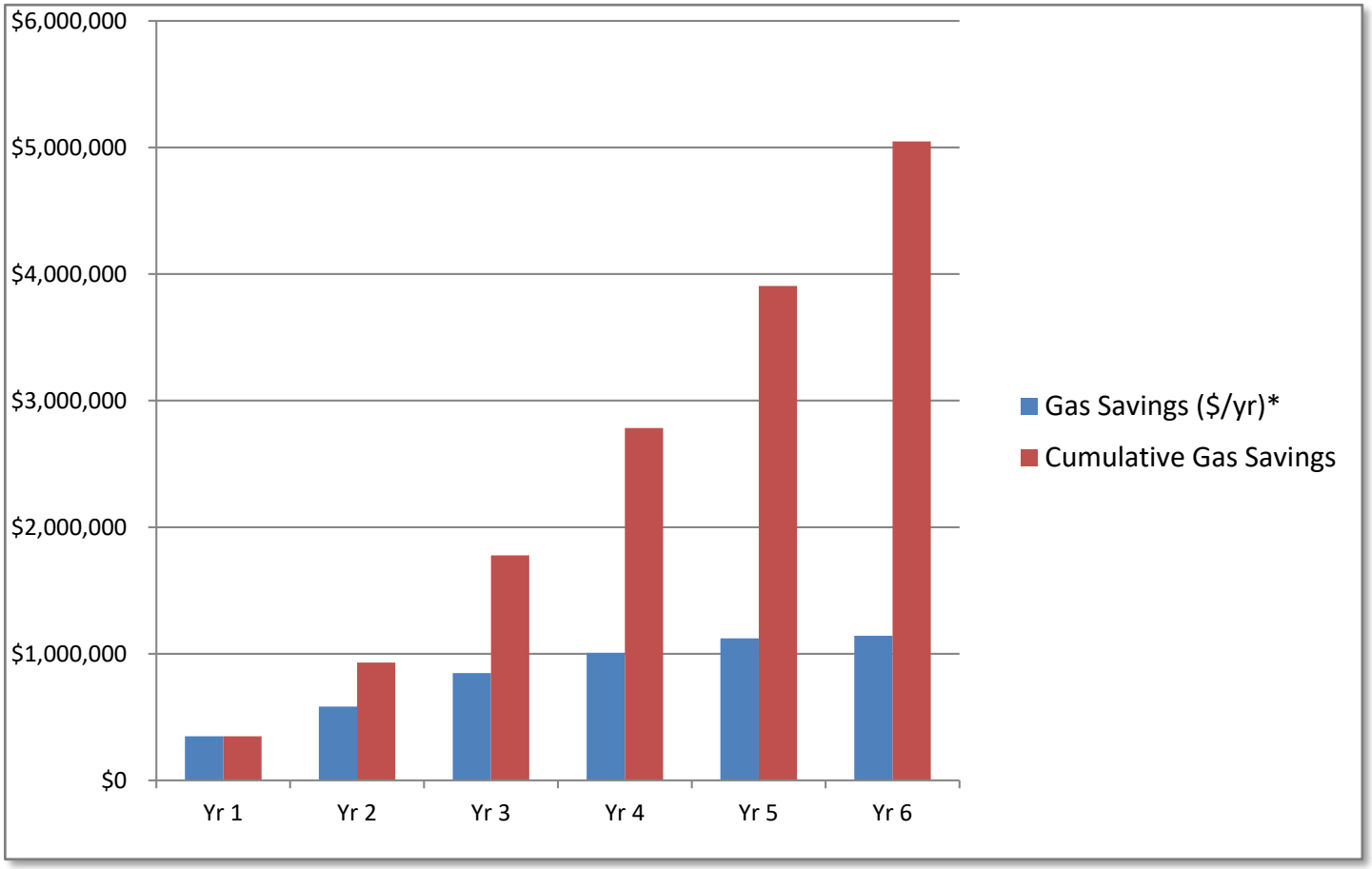

Application Note: http://www.flirmedia.com/MMC/THG/Brochures/OGI_014/OGI_014_US.pdf

OGI PILOT STUDY: Leak Detection & Measurement

ConocoPhillips

*"The study identified 144 leaking components. Collectively, these leaks account 58.26 mmcf/y and $358,012.10 USD/year in lost product. The methane leak sources contribute 21,420.7 tonnes/year CO2e to GHG emissions. It is **estimated that 92%** of the 144 fugitive sources are **economical to repair**. Implementing all economical repairs would result in a **net present savings of $2,002,602.72 USD**."*

2006, T. Trefiak, ConocoPhillips http://www.flir.com/uploadedFiles/Thermography_USA/Industries/OGI/7_Pilot_Study.pdf

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