SNI Energy Forum on Implications of Natural Gas in Israel
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Natural Gas Star International

Best Management Practices for Methane Emission Reductions

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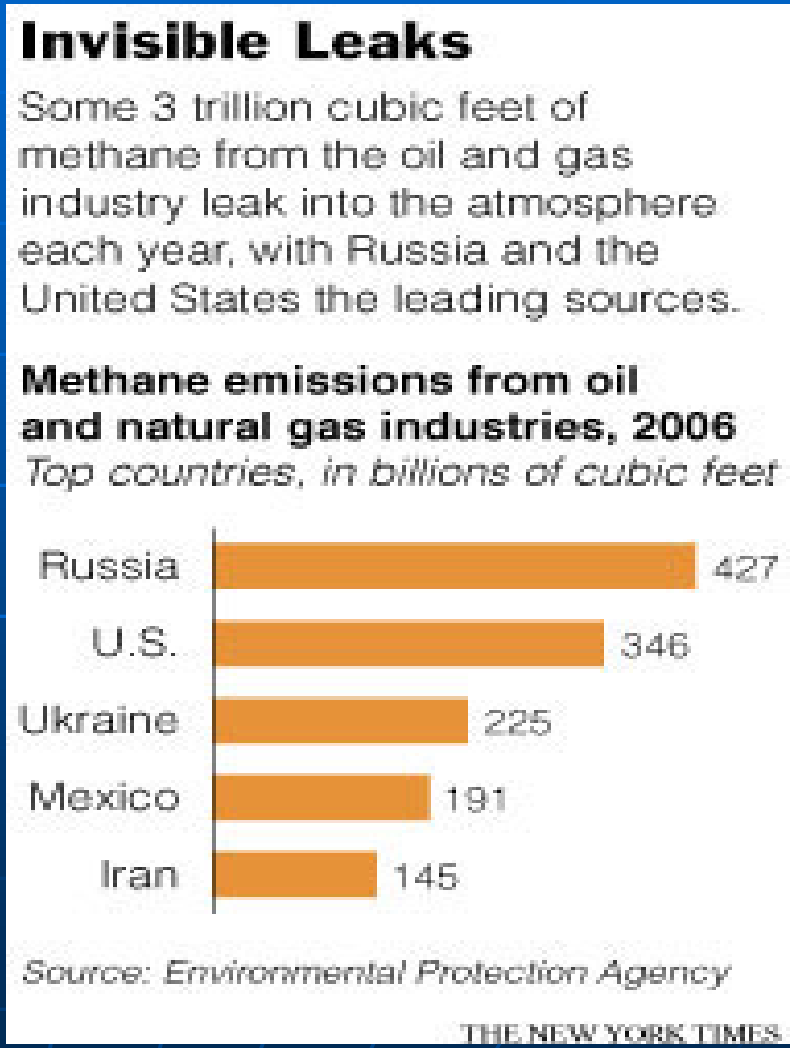
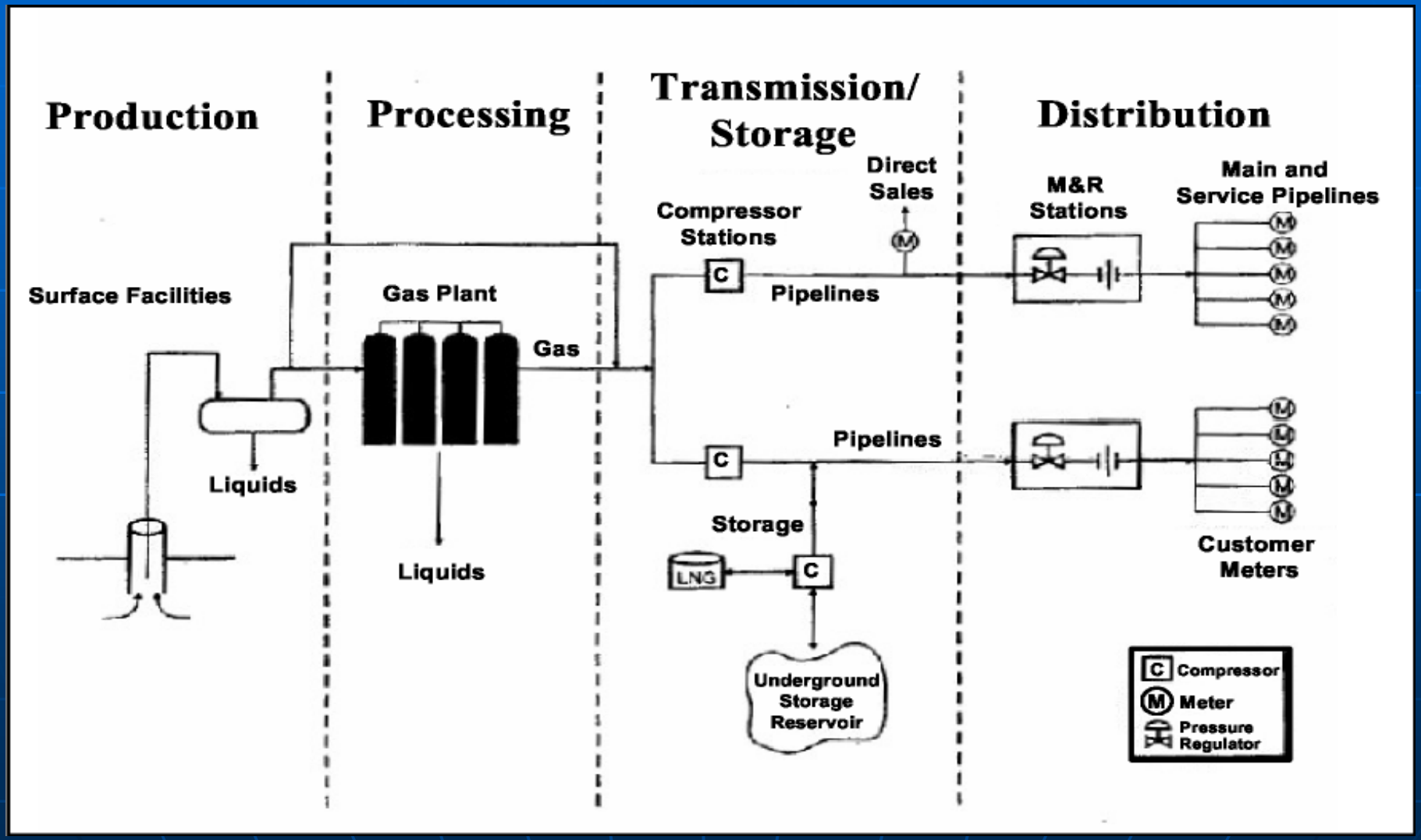
Natural Gas Sector Impact

- Switching to gaseous fuels, such as Natural Gas, is a strategy adopted by many countries
- Increased distances of transmission and distribution pipelines raises the risk of leakages
- Leaks contributes to increased emissions of methane - a potent GHG



Natural Gas Industry Segments



Key Natural Gas Emission Sources

- Pneumatic Controllers
  - ✓ Instrumentation
  - ✓ Chemical, Methanol, and Glycol Pumps
- Direct Well Venting/Flaring
- Process Vents
  - ✓ Acid Gas Removal Vents
  - ✓ Storage Tank Flashing
  - ✓ Glycol Dehydrator Diverts
- Components Leaks
  - ✓ Compressor Seals; rod packing
  - ✓ Valves, Connections, etc.

Source: Norriseal Pneumatic Liquid Level Controller

Methane Losses by Source Category

Methane Source	U.S. Natural Gas Sector
Pneumatic devices	46%
Dehydrators and pumps	15%
Gas engine exhaust	10%
Compressors fugitives and venting	8%
Well venting and flaring	7%
Meters and pipeline leaks	7%
Storage tanks flashing	5%
Other sources	2%

Source: EPA, 2007

Methane Reductions Approaches

- Collaborative effort between governments, technical experts and industry
- Review of new operating technologies and their expected pay back
- Country specific economic analysis to prioritize direct inspection and maintenance (I&M) and replacements
- Network to share lessons learned and best management practices

Emissions Reductions = Direct Increase in Gas Available for Sale $$

Global Partnership Scope

- Methane emissions: 14% of global GHG
- Projected 23% increase by 2020
  - to ~ 8 billion tons CO_2E
- Key sources: fugitive (leaked) and vented methane emissions from oil and gas systems
  - in 2005 ~ 1.2 billion tons CO_2E

Example: Mexico Methane Reduction

- Collaboration with PEMEX
  - ✓ Country-specific methane emission reduction with economic analyses
- Started in 2006
  - ✓ Measurements in gas plants, compressor stations, and pipelines
- Achievements to date
  - ✓ Directed I & M
  - ✓ Replacement of wet compressor seals
- Savings of 100,000 tons CO_2E
  - ✓ Potential for another 400,000 tons CO_2E in four more facilities

Utilizing infrared cameras to detect leaks at a natural gas facility in Mexico.

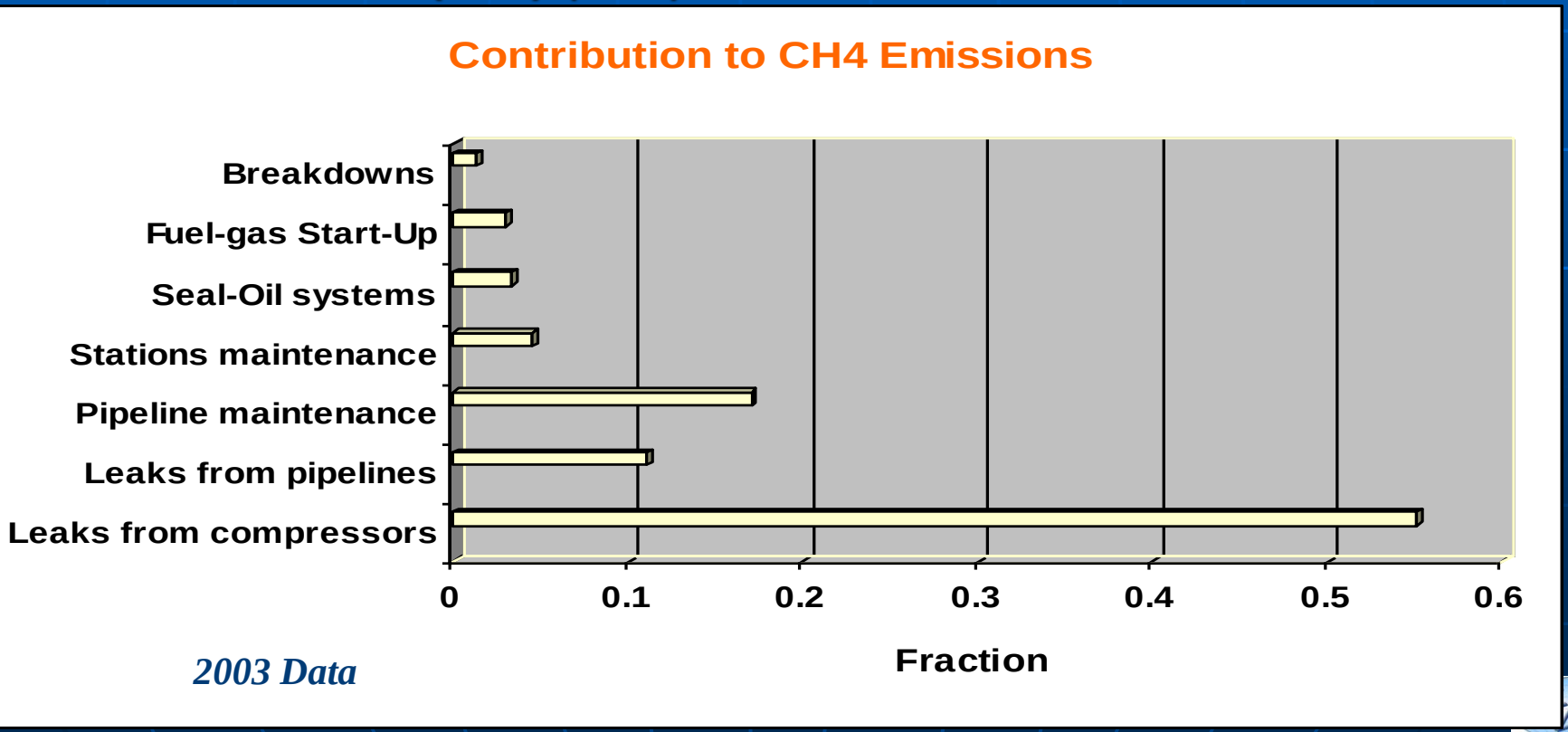
Example: Ukraine Approach

- Analysis of methane reductions potential in the gas transmission systems
- Pre-feasibility studies on methane monitoring and mitigation in the natural gas system
- National regulations and incentives programs to reduce methane emissions from the gas transmission system

Cherkasytransgaz:
• Reduced methane leaks by 1 million m^3 by 2009,
• Reduction goal of a total of 3.7 million m^3 by 2010-2012

Example: Russian Gas Transmission

- Russian supply to Western Europe:
  115 Billion m^3 of Natural Gas per year
- Transmission distance > 5,000 km, with over 150,000 km of Gas Mains
- Estimated losses from leaks and venting:
  ~3.4 Billion m^3 (3%) per year



Methane Emissions Reduction Options

- **Cost-effective technologies**
  - ✓Replace continuous/high bleed pneumatic controllers with low/no bleed controllers
  - ✓Optimize glycol dehydrator systems
  - ✓Replace glycol dehydrators with desiccants
- **Implement best management practices**
  - ✓Conduct frequent Leak Detection and Repair surveys and fly-overs
  - ✓Practice enhanced directed maintenance
  - ✓Document and reduce venting and flaring

http://www.epa.gov/gasstar/

In Summary

- Minimizing methane venting benefits:
  - ✓Reduced product losses
  - ✓Diminished operational risks
  - ✓Lower greenhouse gas emissions
- A wealth of technical and cost data is available
- Israel should learn from global experience and prevent the need for costly future retrofits

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Specific Details on Key Sources

Back-up slides

What is the Problem with Dehydrators?

- Water in produced gas must be removed for gas transmission
  - Commonly use glycol dehydrators for this removal
- Glycol dehydrators generate emissions
  - Methane, VOCs, Toxic Air Pollutants from reboiler vent
  - Methane from pneumatic controllers

Source: GasTech

Best control techniques

1. Optimization of glycol circulation rates
2. Installation of flash tank separator (FTS)
3. Using electric or solar pumps
4. Replacement of glycol unit with desiccant dehydrator

What is the problem with pneumatic devices?

- Pneumatic devices release natural gas to the atmosphere
- Used for level controllers, pressure controllers, temperature controllers
  - High-bleed devices bleed over 6 CF/hour (Equates to >50,000 CF/year)
  - Low or no bleed devices are pilot operated and minimize venting
- Actual bleed rate is largely dependent on device's design

Fisher Electro-Pneumatic Transducer

Reducing Methane Venting from Pneumatic Devices

Option 1

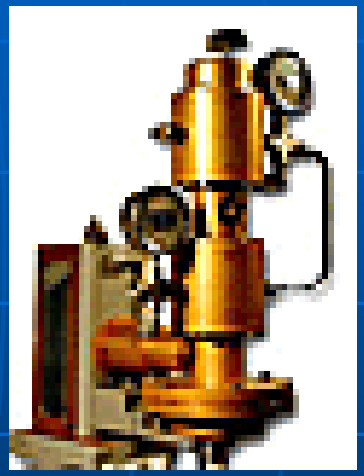
- Replace high-bleed devices with low-bleed devices

Option 2

- Retrofit controller with bleed reduction kits
- Experience shows that up to 80% of all high-bleed devices can be replaced or retrofitted with low-bleed equipment

Option 3

- Maintenance aimed at reducing losses



Typical gas savings payback for replacement 2-8 months

What is the problem with Compressors?

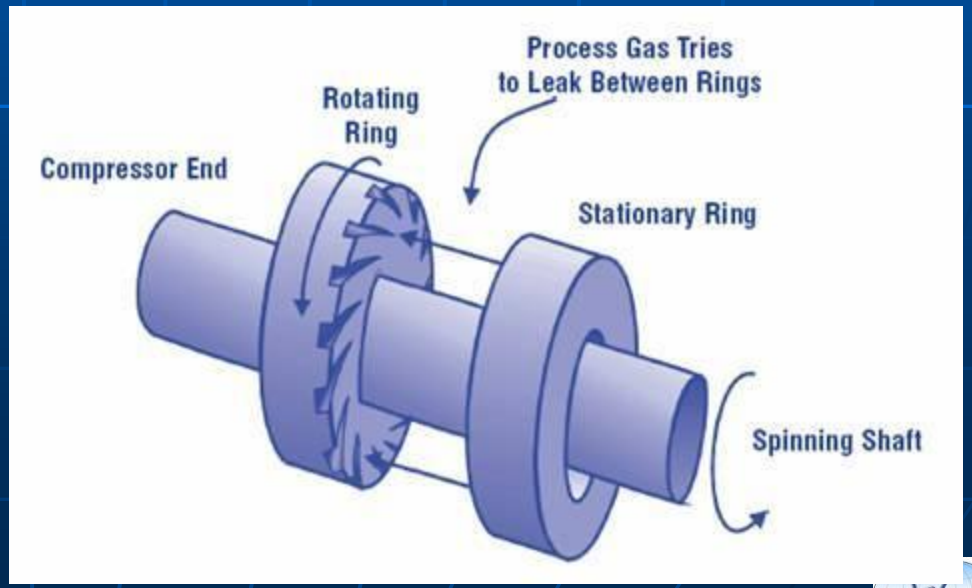
Reciprocating compressor

- Rod packing leaks some gas by design
- Newly installed packing may leak 60 CF/hr
- Worn packing has been reported to leak up to 900 CF/hr

Centrifugal compressor

- Wet seals leak little gas at the seal face
- Seal oil degassing may vent 40 to 200 CF/minute
- Dry seals typically leak at a rate of only 0.5 to 3 CF/minute

U.S. Experience
• Rod and packing replacement cost recovery 1-3 years
• Replacing wet seals with dry seals, typical recovery < 2 years



Benefits of Dry Compressor Seals

Lower operating cost

- Dry seals do not require oil make-up

Reduced power consumption

- Wet seals require 50 to 100 kW/hr for ancillary equipment
- Dry seals need only 5 kW/hr

Improved reliability

- Wet seals have more compressor downtime
- Dry seals eliminate oil leakage into the pipelines
- Dry seals lower drag in pipelines (and horsepower to overcome)