Minimizing Methane Emissions from Glycol Dehydrators

Lessons Learned

from Natural Gas STAR

Offshore Technology Transfer Workshop

Shell, GCEAG, API, Rice University and

EPA's Natural Gas STAR Program

June 8, 2004

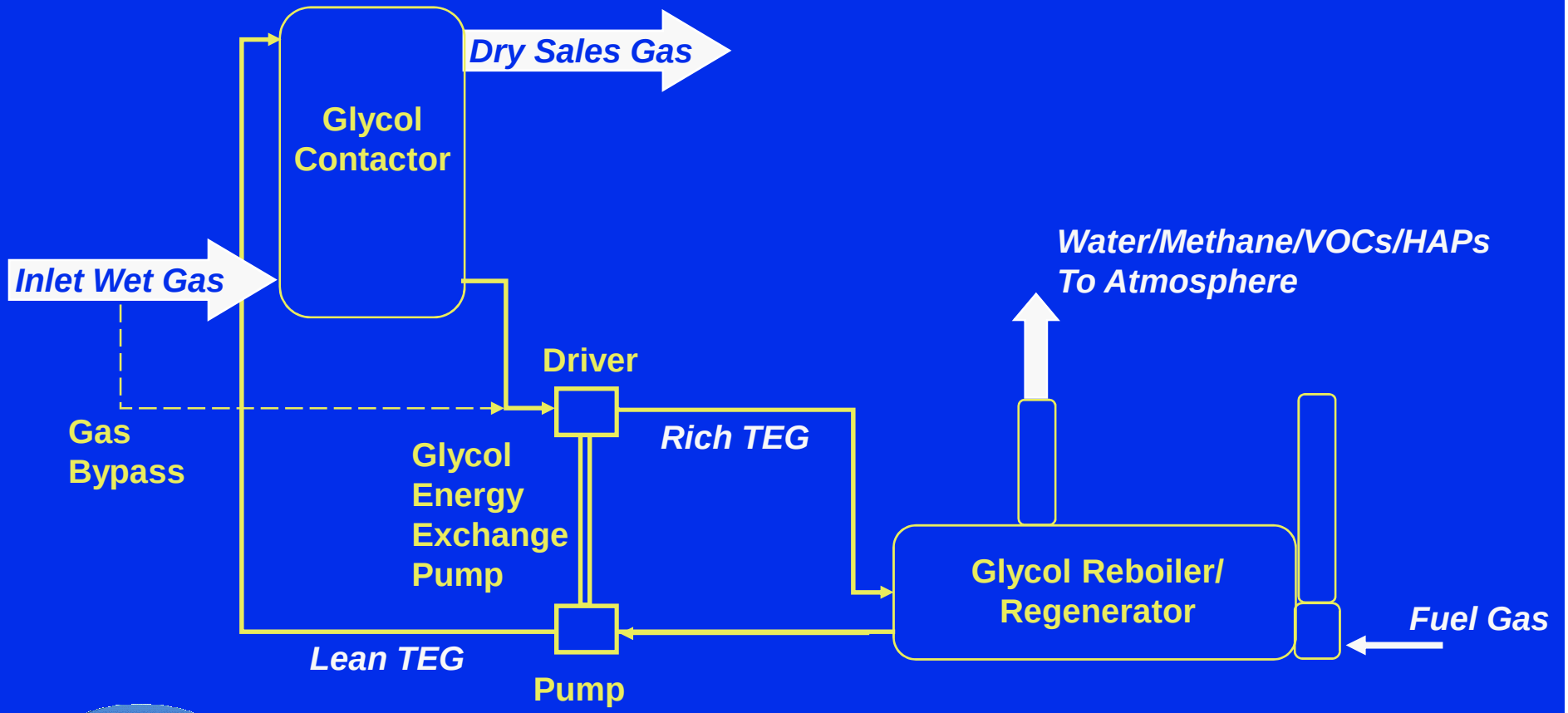
Minimizing Emissions from Glycol Dehydrators: Agenda

- Methane Losses
- Methane Recovery
- Is Recovery Profitable?
- Industry Experience
- Discussion Questions

What is the Problem?

- There are ~ 38,000 glycol dehydration systems in U.S. production sector
  - **Estimate 350 glycol dehydrators in GoM**
- Glycol removes moisture from produced gas
  - **Also absorbs methane, VOCs and HAPs**
- Glycol reboilers vent absorbed water, methane, VOCs, HAPs to the atmosphere
  - **Wastes gas, costs money, reduces air quality**

Basic Glycol Dehydrator System Process Diagram



NaturalGas
EPA POLLUTION PREVENTER

Reducing Emissions, Increasing Efficiency, Maximizing Profits

Glycol Dehydrator Methane Emissions

- Absorbed plus bypassed methane is vented by reboiler
- On average, 600 Mcf methane per glycol dehydrator emitted each year
- To date, ~ 13.5 Bcf methane has been saved in U.S. operations with optimized glycol circulation, flash tanks and electric pumps

How Can Glycol Dehydrator Emissions Be Minimized?

- Optimized glycol circulation rates
  - **Methane emissions are directly proportional to glycol circulation rate**
- Flash tank separator (FTS) installation
  - **Recovers all methane bypassed and most methane absorbed by glycol**
- Electric pump installation
  - **Eliminates need to bypass gas for motive force; eliminates lean glycol lean contamination by rich glycol**

Optimizing Glycol Circulation Rate

- Gas well's initial production rate decreases over its lifespan
  - **Glycol circulation rates designed for initial, highest production rate**
- Glycol overcirculation results in more methane emissions without significant reduction in gas moisture content
  - **Natural Gas STAR partners found circulation rates two to three times higher than necessary**

Overall Benefits

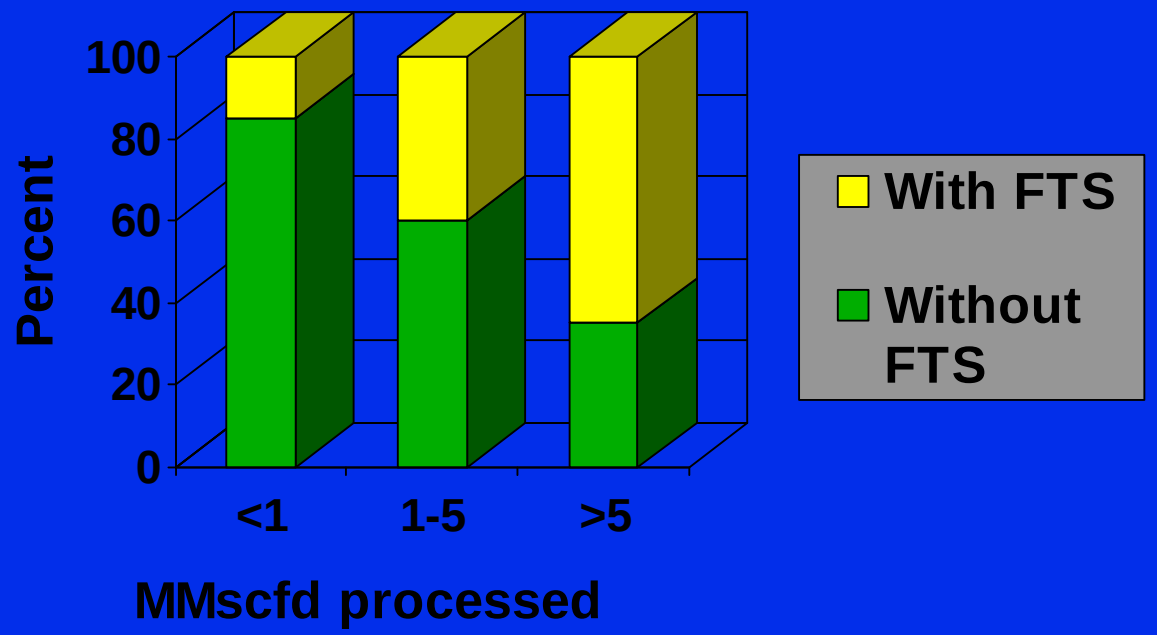
- Methane savings
- Reduced emissions of methane, VOCs, HAPs
- Lower operating costs
  - **Reduced glycol replacement costs**
  - **Reduced fuel costs**
- Immediate payback
- No footprint changes

Installing Flash Tank Separator

- Most dehydrators send glycol/gas mixture from the pump driver to regenerator
- Flash tank separator operating at fuel gas system or compressor suction pressure recovers ~ 90% of methane
  - **Recovers 10 to 40% of VOCs**

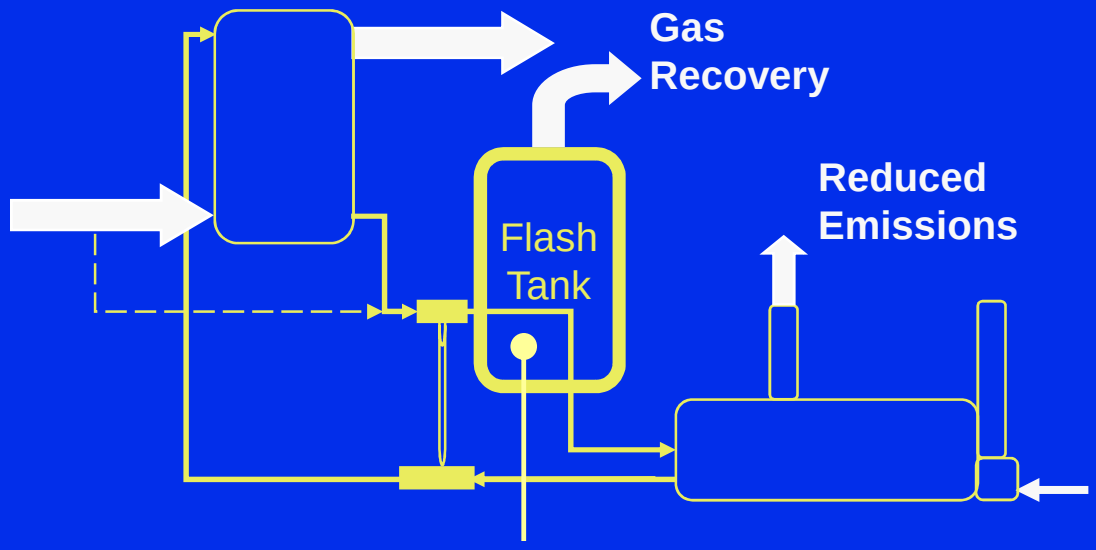
Installing Flash Tank Separator

- Flashed methane can be captured using an FTS
- Many units are not using an FTS

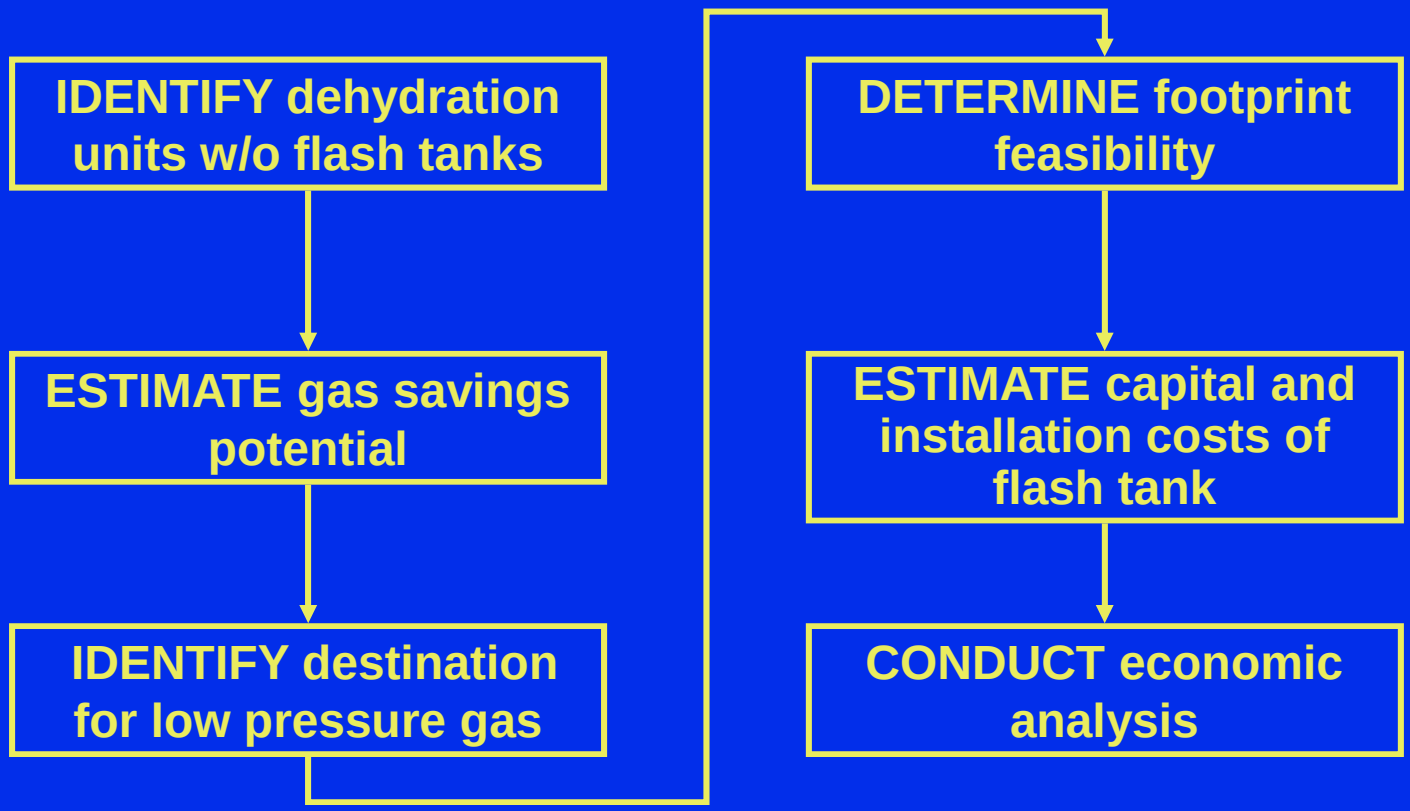


Overall Benefits

- Gas recovery
- Reduced methane emissions
- Low capital cost; short payback period



Decision Process for Installing Flash Tank



Flash Tank Applications

- Flash tanks are a long-term solution
- Flash tanks require a low pressure gas sink
  - **Fuel gas line**
  - **Compressor suction**
- Standard footprints
  -

Settling Volume (gallons)'	Diameter (feet)	Height (feet)
8.2	1.08	4
13.5	1.33	4
22.3	1.66	4
33.6	2	4

Flash Tank Costs

- Two elements: capital and installation costs
  - **Capital costs range from $5,000 to $10,000 per flash tank**
  - **Installation costs range from $2,400 to $4,300 per flash tank**
- Negligible O&M costs

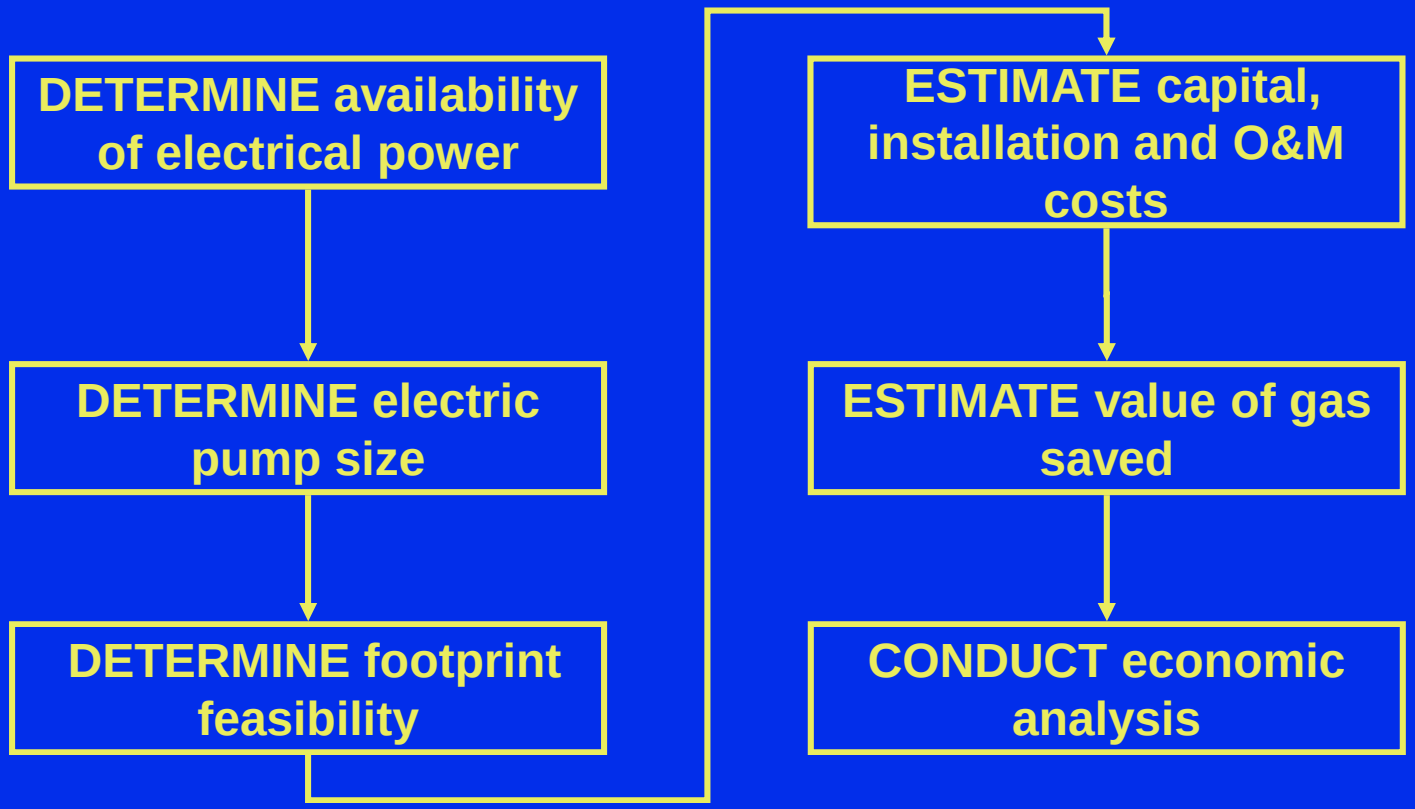
Installing Electric Pump

- Gas-assist pumps require additional wet production gas for mechanical advantage
  - **Removes gas from the production stream**
  - **Largest contributor to emissions**
- Gas-assist pumps contaminate lean glycol with rich glycol
- Electric pump installation eliminates motive gas and lean glycol contamination
  - **Economic alternative to flash tank separator**
  - **Requires electrical power**

Overall Benefits

- Financial return on investment through gas savings
- Increased operational efficiency
- Reduced O&M costs
- Reduced compliance costs (HAPs, BTEX)
- Similar footprint as gas assist pump

Decision Process for Installing Electric Pump



Economic Analysis

Three Options for Minimizing Glycol Dehydrator Emissions

Option	Capital Costs	Annual O&M Costs	Emissions Savings	Payback Period
Optimize Circulation Rate	Negligible	Negligible	130 – 13,133 Mcf/year	Immediate
Install Flash Tank	$5,000 - $10,000	Negligible	236 – 7,098 Mcf/year	5 months – 17 months
Install Electric Pump	$4,200 – $23,400	$3,600	360 – 36,000 Mcf/year	< 2 months – several years

Partner Reported Experience

- Partners report cumulative methane reduction of 13.5 Bcf since 1990
- Past emission reduction estimates for U.S offshore is 500 MMcf/yr or $1.5 million/yr

Case Study

- One partner routes glycol gas from FTS to fuel gas system, saving 24 Mcf/d (8,760 Mcf/yr) at each dehydrator unit
- Texaco has installed FTS
  - **Recovers 98% of methane from the glycol**
  - **Reduced emissions from 1,232 - 1,706 Mcf/yr to <47 Mcf/yr**

Lessons Learned

- Optimizing glycol circulation rates increase gas savings, reduce emissions
  - **Negligible cost and effort**
- Flash tank separators reduce methane emissions by about 90 percent
  - **Require a gas sink and platform space**
- Electric pumps reduce O&M costs, reduce emissions, increase efficiency
  - **Require power source**

Discussion Questions

- To what extent are you implementing these technologies?
- How can the Lessons Learned study be improved upon or altered for use in your operation(s)?
- What are the barriers (technological, economic, lack of information, regulatory, focus, manpower, etc.) that are preventing you from implementing this technology?