Natural Gas Dehydration

Lessons Learned from the
Natural Gas STAR Program

Producers Technology Transfer Workshop

ConocoPhillips Petroleum Company,
New Mexico Environment Department,
New Mexico Oil & Gas Association

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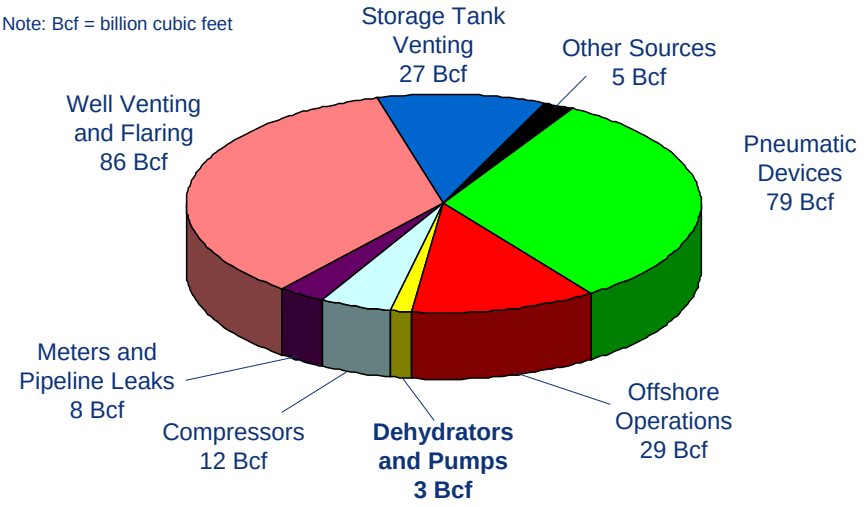
epa.gov/gasstar

Natural Gas Dehydration: Agenda

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

U.S. Production Sector Methane Emissions (2007)

Note: Bcf = billion cubic feet



EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2007.* April, 2009. Available on the web at: epa.gov/climatechange/emissions/usinventoryreport.html. Updated with revised emissions estimates for glycol dehydrators, well venting, pneumatic devices, and storage tanks.

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What is the Problem?

- Produced gas is saturated with water, which must be removed for gas transmission
- Glycol dehydrators are the most common equipment to remove water from gas
  - 41,800 dehydration units in natural gas production, gathering, and boosting
  - Most use triethylene glycol (TEG)
- Glycol dehydrators create emissions
  - Methane, Volatile Organic Compounds (VOCs), Hazardous Air Pollutants (HAPs) from reboiler vent
  - Methane from pneumatic pump and valves

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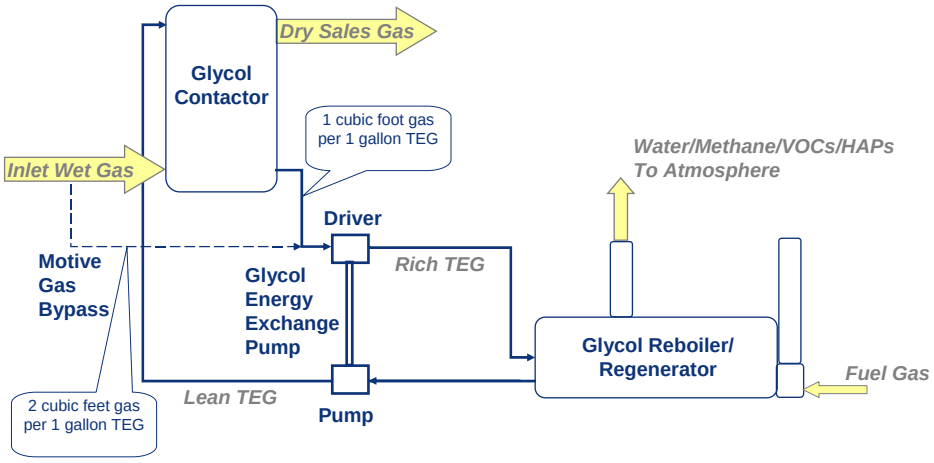
Basic Glycol Dehydrator System Process Diagram



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Methane Recovery

- Optimize glycol circulation rates
- Flash tank separator (FTS) installation
- Electric pump installation
- Other opportunities

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Optimizing Glycol Circulation Rate

- Gas pressure and flow at wellhead dehydrators generally declines over time
  - Glycol circulation rates are often set at a maximum circulation rate
- Glycol overcirculation results in more methane emissions without significant reduction in gas moisture content
  - Partners found circulation rates two to three times higher than necessary
  - Methane emissions are directly proportional to circulation
- Lessons Learned study: optimize circulation rates

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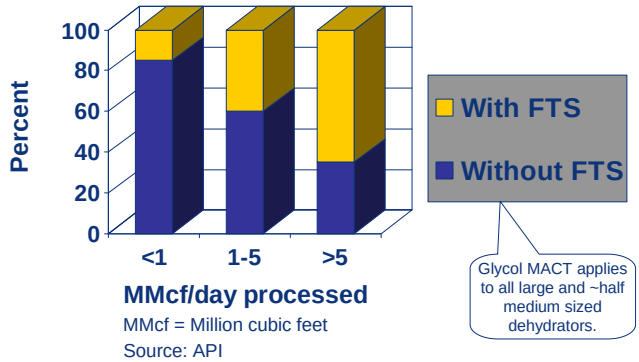
Installing Flash Tank Separator (FTS)

- Methane that flashes from rich glycol in an energy-exchange pump can be captured using an FTS
- Many small units are not using an FTS



MMcf = Million cubic feet

Source: API

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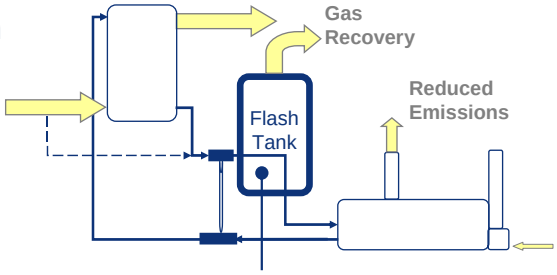
Methane Recovery

- Recovers about 90% of methane emissions
- Reduces VOCs by 10 to 40%
- Must have an outlet for low pressure gas
  - Fuel
  - Compressor suction
  - Vapor recovery unit



Low Capital Cost/Quick Payback

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Flash Tank Costs

- Lessons Learned study provides guidelines for scoping costs, savings and economics
- Capital and installation costs:
  - Capital costs range from ~$3,375 to $6,750 per flash tank
  - Installation costs range from ~$1,650 to $3,050 per flash tank
- Negligible operating and maintenance (O&M) costs

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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 often 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

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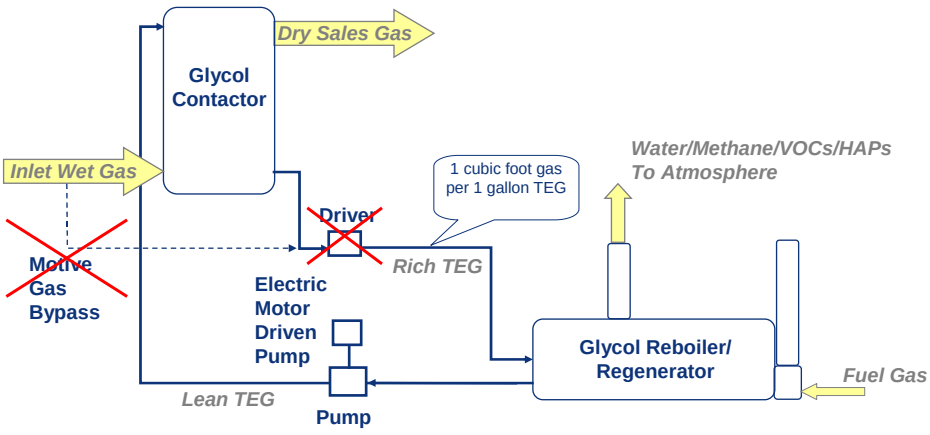
Electric Pump Eliminates Motive Gas



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Overall Benefits

- Financial return on investment through gas savings
- Increased operational efficiency
- Reduced O&M costs
- Reduced compliance costs (HAPs, BTEX[1])
- Limitation: must have electric power source

1 – Benzene, toluene, ethylbenzene, xylene

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Is Recovery Profitable?

Three Options for Minimizing Glycol Dehydrator Emissions

Option	Capital Costs	Annual O&M Costs	Emissions Savings	Payback Period[1]
Optimize Circulation Rate	Negligible	Negligible	394 to 39,420 Mcf/year	Immediate
Install Flash Tank	$6,500 to $18,800	Negligible	1,191 to 10,717 Mcf/year	4 to 11 months
Install Electric Pump	$1,400 to $13,000	$165 to $6,500	360 to 36,000 Mcf/year	< 1 month to several years

1 – Gas price of $7/Mcf

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Additional Dehydration Opportunities

- Desiccant dehydrators
  - Use packed column of desiccant salts to remove water instead of using glycol
- Zero emission dehydrators
  - Combine several dehydration technologies (flash tanks, electric pumps, reroute skimmer gas, electric control valves) to virtually eliminate methane emissions
- JATCO venturi system
  - Use high pressure motive gas to capture still gas and reroute to facility suction to create a closed loop system
- Re-route glycol skimmer gas
  - Non-condensable skimmer gas from the condensate separators in glycol dehydrators can be re-routed to:
    - Reboiler for fuel use
    - Low pressure fuel systems for fuel use

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Other Partner Reported Opportunities

- Pipe glycol dehydrator to vapor recovery unit (VRU)
- Replace glycol dehydration units with methanol injection
- Flare regenerator off-gas (no economics)
- Replace glycol dehydrator with desiccant dehydrator (see Lessons Learned study)
- With a vent condenser,
  - Route skimmer gas to firebox
  - Route skimmer gas to tank with VRU
- Instrument air for controllers and glycol pump

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Lessons Learned

- Optimizing glycol circulation rates increase gas savings, reduce emissions
  - Negligible cost and effort
- FTS reduces methane emissions by about 90 percent
  - Require a low pressure gas outlet
- Electric pumps reduce O&M costs, reduce emissions, increase efficiency
  - Require electrical power source
- Additional methane emissions reduction technologies and practices available on the Natural Gas STAR website

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Discussion

- Industry experience applying these technologies and practices
- Limitations on application of these technologies and practices
- Actual costs and benefits

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