Cost-Effective Methane Emissions Reductions for Small and Midsize Natural Gas Producers

NaturalGas

EPA POLLUTION PREVENTER

Annual Implementation Workshop

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Houston, Texas

Agenda

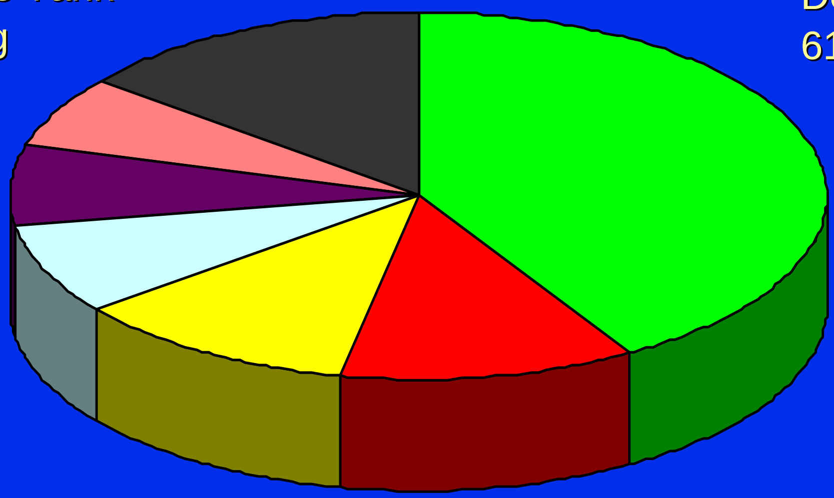
- U.S. Natural Gas Production Sector
- Cost-Effective Methane Emissions Reduction Options
- Calculating Economics
- Conclusions

U.S. Natural Gas Production Sector

- Independent producers drill 85% of new gas wells
- 80% of these companies have fewer than 20 employees
- Natural gas prices have hit record highs
- Gas losses are becoming more attractive to recover considering potential benefits
- While most small and midsize producers are not Gas STAR Partners, they regularly attend workshops and report applying Best Management Practices (BMPs)

U.S. Production Sector Emissions

- Emissions from production sector are ~150 Bcf/year.



Bcf = Billion cubic feet

Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2003

Cost-Effective Methane Emissions Reduction Options

Technologies & Practices	Equipment Cost	O&M Cost	Saleable Gas Savings	Operating requirements	Basis for Cost & Savings
	$	$/yr	Mcf/d		
Installing Vapor Recovery Unit on Crude Oil Storage Tanks	$26,500	$5,000	12	Electrical power supply for VRU compressor	Installing one 25 Mcfd VRU on crude oil or condensate storage tank(s)
Connect Casing to VRU	$1,000	$3,400	27	Pressure Regulators may be required	Connecting one casing to an existing stock tank with VRU, O&M cost is incremental electricity
Pipe Glycol Dehydrator Vapor to VRU	$1,000	$3,000	9	Existing VRU with excess capacity	Dehydrator throughput = 20 MMcfd Operating cost is incremental electricity
Aerial Optical Leak Imaging	N/A	$450/hr travel plus $65/mile	2,000	Operating location ≤5 hours helicopter travel time from service provider base	Surveillance of 500 miles of flowlines, identifying leaks totalling 2% of 100 Mcf/d production
Begin DI&M at remote facilities	N/A	$1 per component screened	1	Soap solution and/or Gas Detector	Screening 200 components, repair leaks in one open-ended blowdown valve and one control valve stem seal

Excerpt from the Journal of Petroleum Technology, June 2005, page 38.

Cost-Effective Methane Emissions Reduction Options

- Options for small to midsize producers range from fixing fugitives to installation of new technologies
- With high gas prices, more options are becoming economically attractive for producers
- Two examples of technologies that have great potential to increase profits:
  - **Vapor recovery units**
  - **Aerial optical leak imaging**

Vapor Recovery Units (VRUs)

- Capture up to 95% of hydrocarbon vapors vented from oil storage tanks
- Recovered vapors have higher Btu content than pipeline quality natural gas
- Recovered vapors are more valuable than natural gas and have multiple uses:
  - **Re-inject into sales pipeline**
  - **Use as on-site fuel**
  - **Send to processing plants for recovering NGLs**

Characteristics of VRUs

- Conventional vapor recovery units
  - **Use rotary compressor to suck vapors out of atmospheric pressure storage tanks**
  - **Require electrical power or engine**
- Gas savings can range up to 12 Mcf/d for a 25 Mcf/d size unit
- Other methane reduction options can be implemented as a result of installing a VRU:
  - **Connecting a casinghead vent to a VRU instead of venting to the atmosphere can further reduce emissions**
  - **Piping a glycol dehydrator regenerator vent stack and pneumatic devices to an oil tank equipped with a VRU can further reduce emissions**

Vapor Recovery Unit Calculation

- Goal: Install 50 Mcf/d VRU unit on crude oil tanks
- Basis for cost and savings:
  - **Basis size: 25 Mcfd VRU**
  - **Equipment cost = $26,500**
  - **O&M cost = $5,000**
  - **Gas savings = 12.0 Mcf/d**
- Scaleable calculation:
  - **Calculation 1**
    - **Equipment cost = square root (your size ÷ basis size) * basis cost**
    - **$= \sqrt{(50 \text{ Mcf/d} \div 25 \text{ Mcf/d})} * (\$26{,}500)$**
    - **≈ $37,100**
  - **Calculation 2**
    - **Your O&M cost = (your size ÷ basis size) * basis O&M cost**
    - **= (50 Mcf/d ÷ 25 Mcf/d) * ($5,000)**
    - **= $10,000**

Vapor Recovery Unit Calculation

- Scaleable calculation continued:
  - **Calculation 3**
    - **Your gas savings = (your size ÷ basis size) * basis gas savings**
    - **= (50 Mcf/d ÷ 25 Mcf/d) * 12.0 Mcf/d * 365 days**
    - **= 2 * 12 * 365**
    - **= 8,760 Mcf/yr**
  - **Calculation 4**
    - **Payback = Equipment cost ÷ ((Annual gas savings * Price of gas) - 1 year O&M)**
    - **= $37,100 ÷ ((8,760 Mcf/yr * $5/Mcf) - $10,000)**
    - **≈ 1.1 years (13 months)**

Aerial Optical Leak Imaging

- Real-time visual image of gas leaks
  - **Quicker identification & repair of leaks**
  - **Screen hundreds of components an hour**
  - **Screen inaccessible areas simply by viewing them**
- Gas savings can range up to 2,000 Mcf/d depending on the size of the area surveyed
- Other methane reduction practices can be used in conjunction with Aerial Optical Leak Imaging:
  - **Directed Inspection & Maintenance (DI&M) at remote facilities**
  - **DI&M at compressor stations**

Aerial Optical Leak Imaging Calculation

- Goal: Inspect ~200 miles of gas flowlines for leaks
- Basis for cost and savings
  - **Basis size: inspect 500 miles of flowlines**
  - **Equipment cost = N/A (leased service)**
  - **O&M cost = $450/hr travel to/from helicopter base plus $65/mile**
  - **Gas savings = 2,000 Mcf/d**
- Directly proportional calculation:
  - **Calculation 1**
    - **Equipment cost = N/A**
  - **Calculation 2**
    - **Assume ~5 hours helicopter travel to/from pipeline and surveillance of ~200 miles of flowlines**
    - **Your O&M cost = (Helicopter cost * hours to/from base) + (Surveillance cost * miles traveled)**
    - **= ($450/hr * 5 hr) + ($65/mile * 200 miles)**
    - **= $15,250**

Aerial Optical Leak Imaging Calculation

- Directly proportional calculation continued:
  - **Calculation 3**
    - **Your gas savings = (your size ÷ basis size) *basis gas savings**
    - **= (200 miles ÷ 500 miles) * 2,000 Mcf/d * 365 days/year**
    - **= ~290,000 Mcf/yr**
  - **Calculation 4**
    - **Revenue = Your gas savings * cost of gas**
    - **= 290,000 Mcf/yr * $5/Mcf**
    - **= $1,450,000 per year**
  - **Revenue up to $1,450,000 per year provides an ample payback of the $15,250 cost to find leaks and cost to repair those leaks**
    - **Partners have reported finding flow line leaks over 10% of the product flow using aerial optical leak imaging**

Conclusions

- Each volume of gas not vented or leaked to the atmosphere is a volume of gas sold
- With increasing natural gas demand and high prices, emissions reductions will result in increased sales and greater revenue
- New technologies can also lower operating costs
- VRUs and Aerial Optical Leak Imaging are only two of twenty-five technologies identified for small and midsize producers

Discussion Questions

- To what extent are you implementing these technologies?
- How can the Gas STAR technical documents 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?