Opportunities for Methane Emissions Reductions from Natural Gas Production

Lessons Learned from Natural Gas STAR

Producers and Processors Technology Transfer Workshop

ConocoPhillips and EPA’s Natural Gas STAR Program

Kenai, AK

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Agenda

- Smart Automation Well Venting
  - Methane Losses
  - Methane Recovery
  - Is Recovery Profitable?
  - Industry Experience
  - Discussion Questions
- Reduced Emissions Completions
  - George Jackson, Devon Energy
Smart Automation Well Venting

- Automation can enhance the performance of plunger lifts by monitoring wellhead parameters such as:
  - Tubing and casing pressure
  - Flow rate
  - Plunger travel time
- Using this information, the system is able to optimize plunger operations
  - To minimize well venting to atmosphere
  - Recover more gas
  - Further reduce methane emissions

Methane Losses

- There are 390,000 natural gas and condensate wells (on and offshore) in the US\(^1\)
- Accumulation of liquid hydrocarbons or water in the well bores reduces, and can halt, production
- Common “blow down” practices to temporarily restore production can vent 80 to 1600 Mcf/yr\(^2\) to the atmosphere per well
- Estimate 9 Bcf/yr methane emissions from U.S. onshore well venting\(^1\)

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\(^1\) - Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2004
\(^2\) - Mobil Big Piney Case Study 1997
What is the Problem?

- Conventional plunger lift systems use gas pressure buildups to repeatedly lift columns of fluid out of well
- Fixed timer cycles may not match reservoir performance
  - Cycle too frequently (high plunger velocity)
  - Plunger not fully loaded
  - Cycle too late (low plunger velocity)
  - Shut-in pressure can’t lift fluid to top
  - May have to vent to atmosphere to lift plunger

Conventional Plunger Lift Operations

- Manual, on-site adjustments tune plunger cycle time to well’s parameters
  - Not performed regularly
  - Do not account for gathering line pressure fluctuations, declining well performance, plunger wear
- Results in manual venting to atmosphere when plunger lift is overloaded
Methane Recovery: How Smart Automation Reduces Methane Emissions

- Smart automation continuously varies plunger cycles to match key reservoir performance indicators
  - Well flow rate
  - Measuring pressure
  - Successful plunger cycle
  - Measuring plunger travel time
- Plunger lift automation allows producer to vent well to atmosphere less frequently

Automated Controllers

- Low-voltage; solar recharged battery power
- Monitor well parameters
- Adjust plunger cycling

- Remote well management
  - Continuous data logging
  - Remote data transmission
  - Receive remote instructions
  - Monitor other equipment

Source: Weatherford
Plunger Lift Cycle

Methane Savings

- Methane emissions savings a secondary benefit
  - Optimized plunger cycling to remove liquids increases well production by 10 to 20%\(^1\)
  - Additional 10%\(^1\) production increase from avoided venting
  - 500 Mcf/yr methane emissions savings for average U.S. well

\(^1\) – Reported by Weatherford
Other Benefits

- Reduced manpower cost per well
- Continuously optimized production conditions
- Remotely identify potential unsafe operating conditions
- Monitor and log other well site equipment
  - Glycol dehydrator
  - Compressor
  - Stock Tank
  - VRU

Is Recovery Profitable?

- Smart automation controller installed cost: ~$11,000
  - Conventional plunger lift timer: ~$5,000
- Personnel savings: double productivity
- Production increases: 10% to 20% increased production

Savings =

\[
\text{Savings} = (\text{Mcf/yr}) \times (10\% \text{ increased production}) \times (\text{gas price}) + (\text{Mcf/yr}) \times (1\% \text{ emissions savings}) \times (\text{gas price}) + (\text{personnel hours/yr}) \times (0.5) \times (\text{labor rate})
\]

$ \text{savings per year}$
Economic Analysis

- Non-discounted savings for average U.S. Well =

\[ (50,000 \text{ Mcf/yr}) \times (10\% \text{ increased production}) \times ($7/\text{Mcf}) \]

\[ + (50,000 \text{ Mcf/yr}) \times (1\% \text{ emissions savings}) \times ($7/\text{Mcf}) \]

\[ + (500 \text{ personnel hours/yr}) \times (0.5) \times ($30/hr) \]

\[ - ($11,000) \text{ cost} \]

$35,000 savings in first year

3 month simple payback

Industry Experience

- BP reported installing plunger lifts with automated control systems on ~2,200 wells
  
  - 900 Mcf reported annual savings per well
  
  - $12 million costs including equipment and labor
  
  - $6 million total annual savings

- Another company shut in mountaintop wells inaccessible during winter
  
  - Installed automated controls allowed continuous production throughout the year\(^1\)

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Discussion Questions

- To what extent are you implementing this opportunity?
- Can you suggest other approaches for reducing well venting?
- How could this opportunity be improved upon or altered for use in your operation?
- What are the barriers (technological, economic, lack of information, regulatory, focus, manpower, etc.) that are preventing you from implementing this practice?