Smart Automation Well Venting

Lessons Learned from Natural Gas STAR

Producers Technology Transfer Workshop

ExxonMobil Production Company, American Petroleum Institute and EPA’s Natural Gas STAR Program

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Smart Automation Well Venting: Agenda

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

★ 360,000 condensate and natural gas wells (on and offshore) in the U.S.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 50 to 600 Mcf/yr to the atmosphere per well

★ Estimate 7 Bcf/yr methane emissions from U.S. onshore well venting¹

¹Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2002
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
    - Gas slippage around plunger and fluid (waste of motive energy)

Source: Weatherford
Conventional Plunger Lift Operations

★ Manual, on-site adjustments tuned plunger cycle time to well’s parameters

◆ Not performed regularly

◆ Do not account for gathering line pressure fluctuations, declining wells, plunger wear

★ Manual vent to atmosphere when plunger lift is overloaded
How Can Smart Automation Reduce Methane Emissions?

★ Smart automation continuously varies plunger cycling 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 and battery powered
- Monitor well parameters
- Adjust plunger cycling

Remote well management
- Continuous data logging
- Remote data transmission
- Receive remote instructions

Source: Weatherford
Plunger Lift Cycle

Production Control Services
Spiro Formation Well 9N-27E

Well Production without Plunger Lift
Potential Continuous Production with Plunger Lifts

Well Blowdowns
Potential Incremental Production with Plunger Lift

Reducing Emissions, Increasing Efficiency, Maximizing Profits
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 emissions savings for average U.S. well

\(^1\) 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 =

(Mcf/yr) x (10% increased production) x (gas price)
+ (Mcf/yr) x (1% emissions savings) x (gas price)
+ (personnel hours/yr) x (0.5) x (labor rate)

$ savings per year
Economic Analysis

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

  \[(50,000 \text{ Mcf/yr}) \times (10\% \text{ increased production}) \times ($3/\text{Mcf}) + (50,000 \text{ Mcf/yr}) \times (1\% \text{ emissions savings}) \times ($3/\text{Mcf}) + (500 \text{ personnel hours/yr}) \times (0.5) \times ($30/\text{hr}) - ($11,000) \text{ cost} \]

$13,000 savings in first year

- 10 month simple payback
Industry Experience

★ BP reported installing plunger lifts with automated control systems in ~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\(^1\)

Discussion Questions

- To what extent are you implementing these technologies?
- What are the barriers (technological, economic, lack of information, regulatory, focus, manpower, etc.) that are preventing you from implementing this technology?