Liquids Unloading Options for Natural Gas Wells

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Annual Implementation Workshop

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Agenda

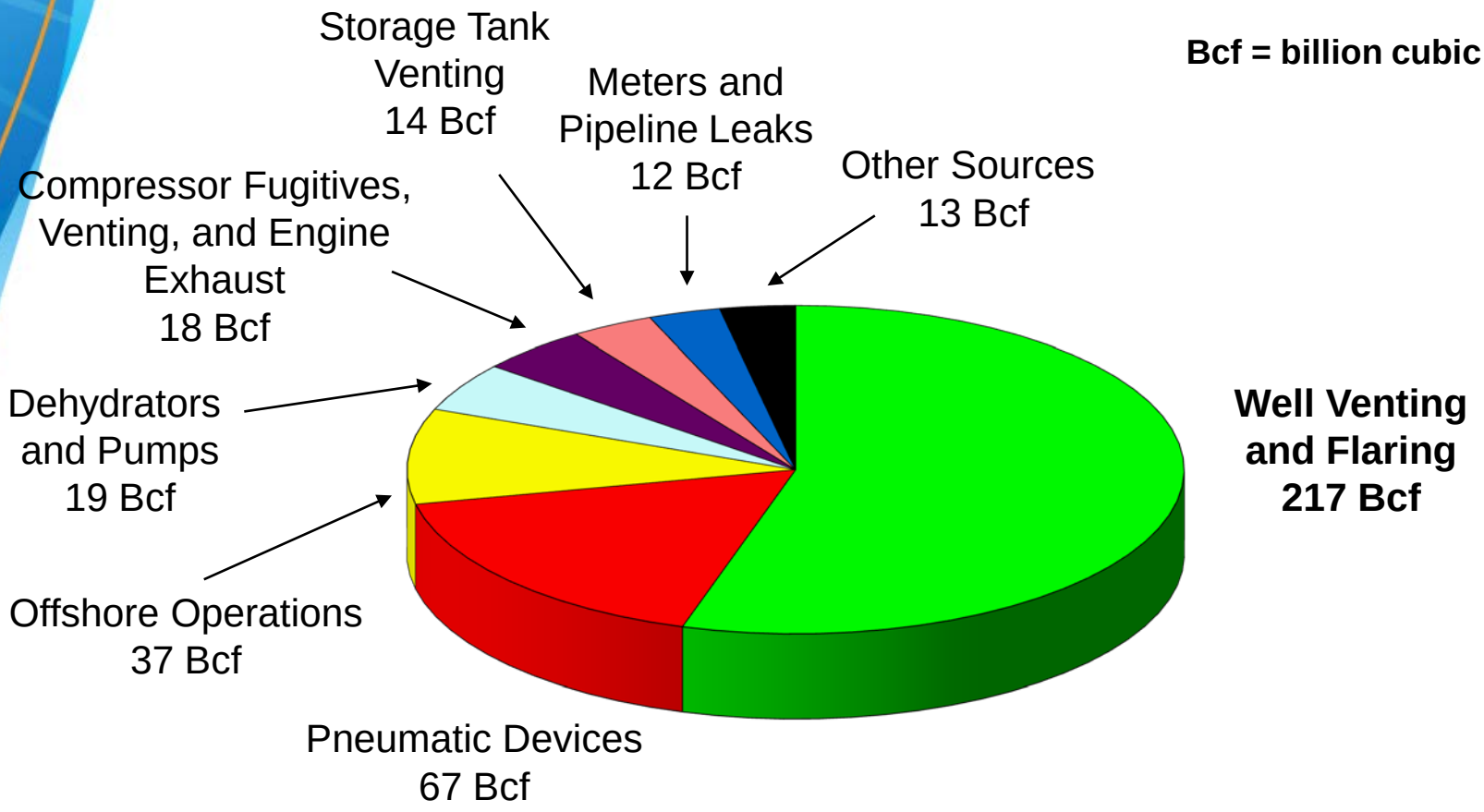
- **U.S. Production Sector Methane Emissions**
  - Methane losses
- **Liquids Unloading**
  - Plunger lifts
  - Methane savings
  - Is recovery profitable?
  - Industry experience
- **Partner experience – Weatherford**

Source: BP

Global Methane Initiative

2009 U.S. Production Sector Methane Emissions (397 Bcf)

Bcf = billion cubic feet



EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2009.* April, 2011. Available on the web at: epa.gov/climatechange/emissions/usinventoryreport.html.

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Methane Losses – U.S. Production

- Over 550,000 producing gas wells in the U.S.
- Unmitigated emissions from gas production facilities are estimated to be 166 Bcf/year
- Common “blow down” practices to temporarily restore production can vent 50 to 600 Mcf/yr to the atmosphere per well
  - Estimated average 353 Mcf emissions per well per year
  - Worth over $1,000/ well-year at $3/Mcf
- The real economic loss is gas production

Source: Newfield

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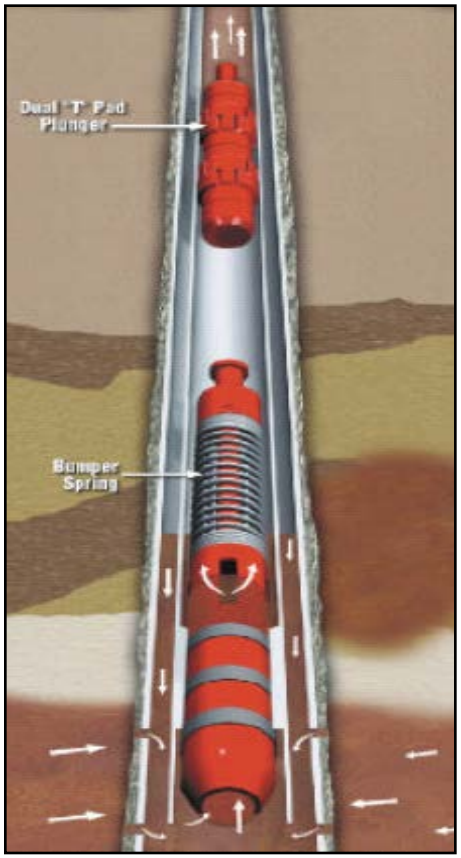
Plunger Lift Liquid Unloading

- Conventional plunger lift systems use well shut-in pressure buildups to efficiently lift columns of fluid out of well without venting
- U.S. gas wells have 150,000 plunger lifts
- Emission reductions using plunger lifts are 163 Bcf/year*
- Gas production is estimated to be as much as 10 percent higher with plunger lifts



Source: Weatherford

*Assumes 40% of plunger lift systems equipped with "smart" automation, 50% reduction from plunger lift and 75% reduction from plunger lift with "smart" automation

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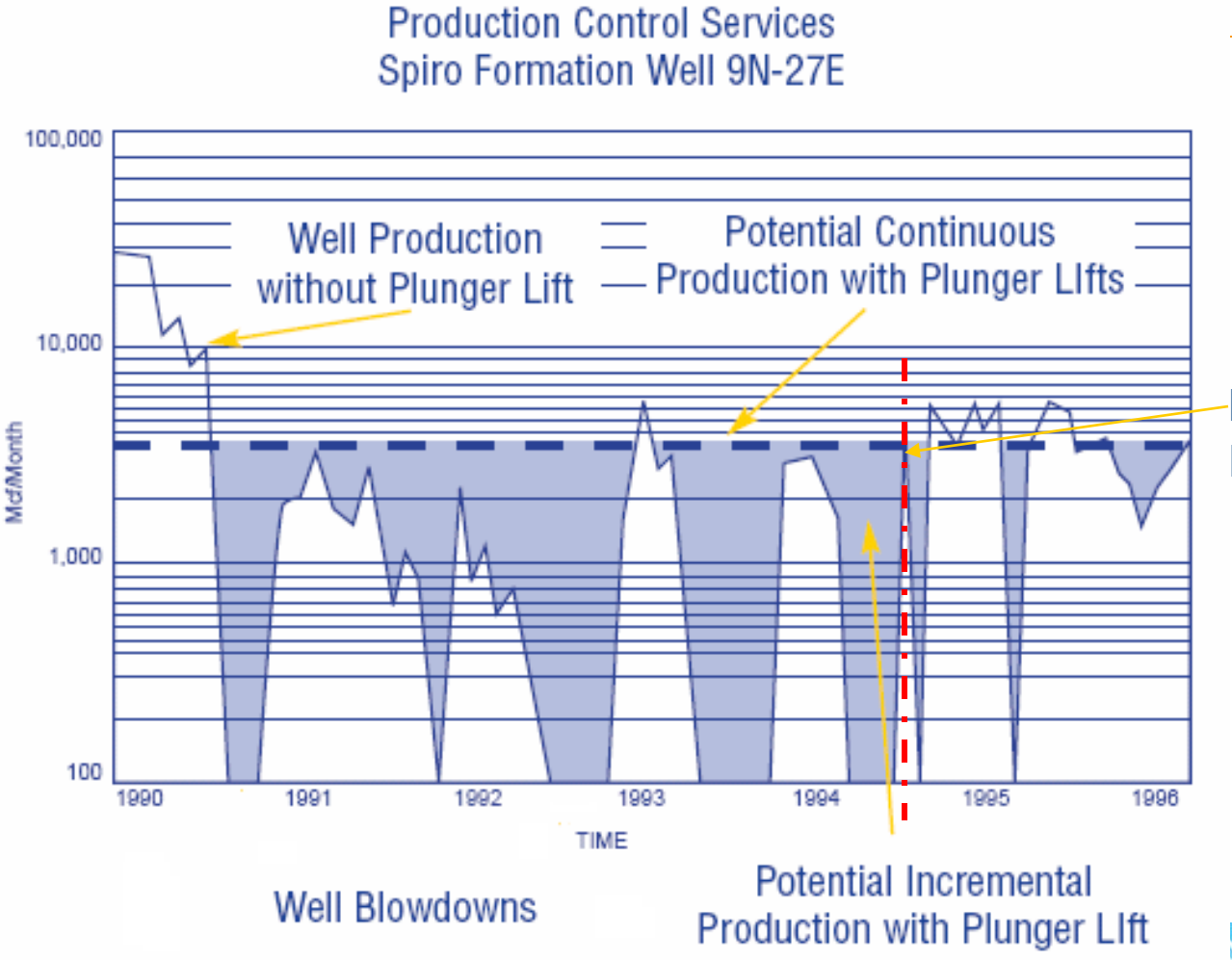
Increased Production is the Main Benefit of Plunger Lifts



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

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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/year of methane emissions savings for average U.S. well requiring unloading

Source: BP

1 - Reported by Weatherford

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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

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

  = $ savings per year

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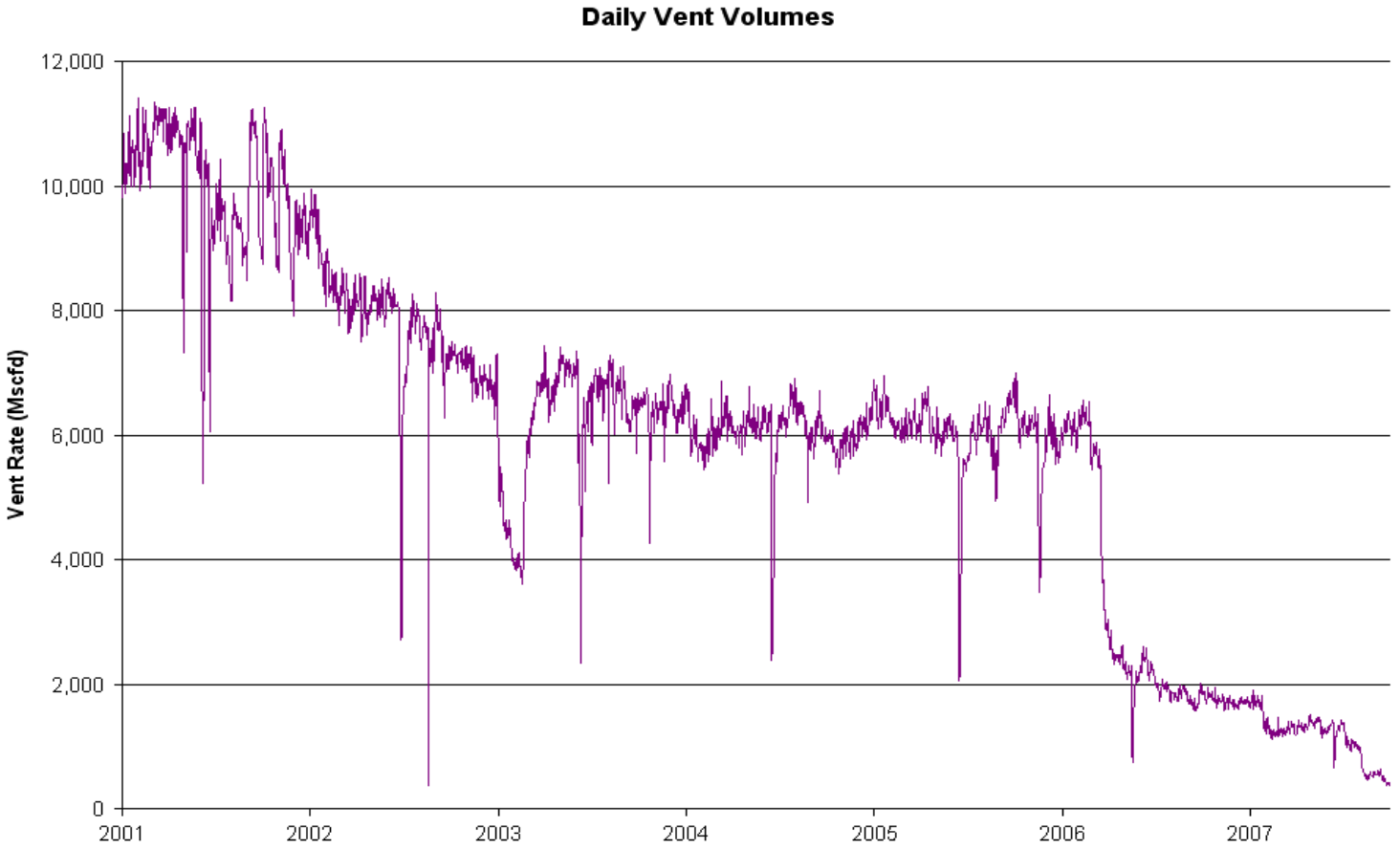
BP Experience



Source: BP

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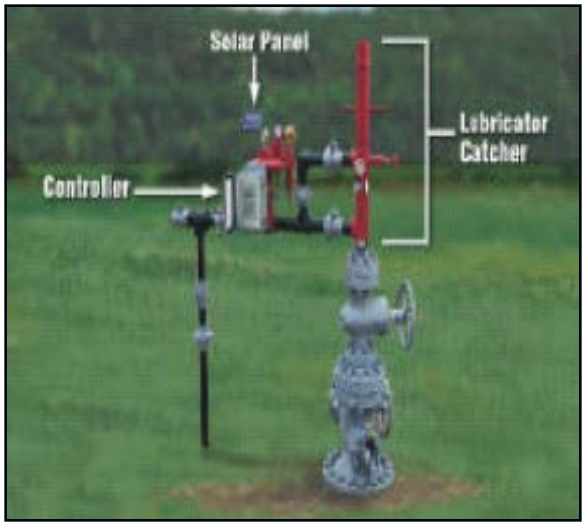
Partner experience

- Weatherford experience in reducing methane emissions from liquids unloading



Source: Weatherford

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Contacts and Further Information

- More detail is available on these practices and over 80 others online at: epa.gov/gasstar/tools/recommended.html
- For further assistance, direct questions to:

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