

# Reduced Emission Completions (Green Completions)

Lessons Learned  
from Natural Gas STAR



Producers Technology Transfer Workshop

Devon Energy and  
EPA's Natural Gas STAR Program  
Casper, Wyoming  
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# Green Completions: Agenda

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



# Methane Losses During Well Completions

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- ★ It is necessary to clean out the well bore and formation surrounding perforations
  - ◆ After new well completion
  - ◆ After well workovers
- ★ Operators produce the well to an open pit or tankage to collect sand, cuttings and reservoir fluids for disposal
- ★ Vent or flare the natural gas produced
  - ◆ Venting may lead to dangerous gas buildup
  - ◆ Flaring is preferred where there is no fire hazard or nuisance



# Methane Losses: Well Completions and Workovers

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- ☆ An estimated 45.5 Bcf of natural gas lost annually due to well completions and workovers<sup>1</sup>
  - ◆ 45,000 MMcf in losses from high pressure wells
  - ◆ 319 MMcf in losses from low pressure wells
  - ◆ 48 MMcf in losses from workovers
- ☆ An estimated total of 480,000 Bbl condensate lost annually due to venting and flaring
- ☆ This amounts to over \$145 million lost due to well completions and workovers

Note:

- <sup>1</sup>Percentage that is flared and vented unknown
- Value of natural gas at \$3/Mcf
- Value of condensate at \$22/bbl



# Methane Recovery by Green Completions

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- ☆ Green completions recover natural gas and condensate produced during well completions or workovers
- ☆ Use portable equipment to process gas and condensate suitable for sales
- ☆ Direct recovered gas through permanent dehydrator and meter to sales line, reducing venting and flaring
- ☆ An estimated 25.2 Bcf of natural gas can be recovered annually using Green Completions
  - ◆ 25,000 MMcf from high pressure wells
  - ◆ 181 MMcf from low pressure wells
  - ◆ 27 MMcf from workovers



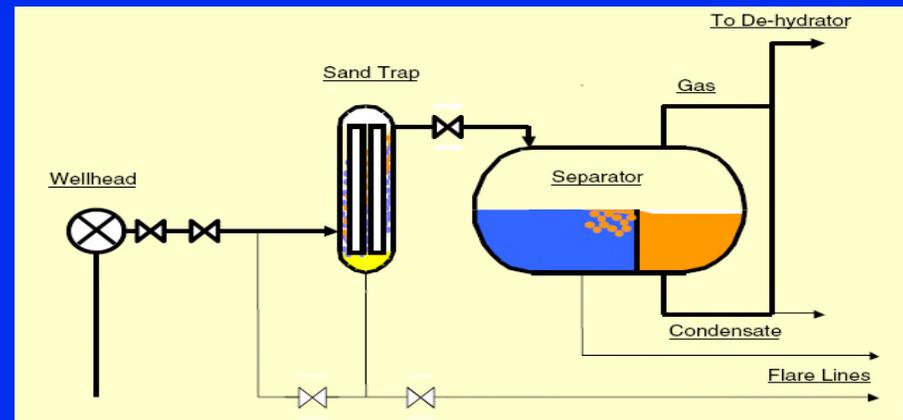
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# Green Completions: Equipment

- ☆ Truck or trailer mounted equipment to capture produced gas during cleanup
  - ◆ Sand trap
  - ◆ Three-phase separator
- ☆ Use portable desiccant dehydrator for workovers requiring glycol dehydrator maintenance



Temporary, Mobile Surface Facilities,  
Source: BP



# Green Completions: Preconditions

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- ★ Must have permanent equipment on site before cleanup
  - ◆ Piping from well-head to sales line
  - ◆ Dehydrator
  - ◆ Lease meter
  - ◆ Stock tank
- ★ Sales line gas can be used for fuel and/ or gas lift in low pressure wells



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# Green Completions: Low Pressure Wells

- ★ Can use portable compressors to start-up the well when reservoir pressure is low
  - ◆ Artificial gas lift to clear fluids
  - ◆ Boost gas to sales line
- ★ Higher cost to amortize investment in portable equipment



Portable Compressors, Separator and Other Equipment on a trailer

Source: Herald



# Is Recovery Profitable?

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- ★ Partners report recovering 2% - 89% (average of 53%) of total gas produced during well completions and workovers
- ★ Estimate 7- 12,500 Mcf (average of 3,000 Mcf) of natural gas can be recovered from each cleanup
- ★ Estimate 1- 580 Bbl of condensate can be recovered from each cleanup



Note: Values for high pressure wells

# Green Completions: Benefits

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- ★ Reduced methane emissions during completions and workovers
- ★ Sales revenue from recovered gas and condensate
- ★ Improved relations with state agencies and public neighbors
- ★ Improved safety
- ★ Reduced disposal costs



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# BP Experience

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- ★ Capital investment ~ \$1.4 million on portable three-phase separators, sand traps and tanks
- ★ Used Green Completions on 106 wells
- ★ Total natural gas recovered ~ 350 MMcf/year
- ★ Total condensate recovered ~ 6,700 Bbl/year



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# BP Experience

- ★ Total value of natural gas and condensate recovered  
~ \$840,000 per year
- ★ Investment recovered in 2+ years



Portable Three Phase Separator, Source: BP

Note:

- Value of natural gas at \$1.99/Mcf
- Value of condensate at \$22/bbl



# Weatherford Durango Experience

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- ★ Successfully completed pilot project in the Fruitland coal formations in Durango, Colorado
  - ◆ Well depth: 2,700 to 3,200 feet
  - ◆ Pore pressure: estimated at 80 pounds per square inch gauge (psig)
  - ◆ Well type: coal bed methane
  - ◆ Hole size: 5 ½ inches
  - ◆ No. of wells: 3 well pilots
- ★ Captured 2 MMcf of gas and sold by client



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# Weatherford Portable Equipment

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# Weatherford Green Completions

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- ★ Use pipeline gas with proprietary foaming agent as compressible fluid to initiate cleanout
- ★ System includes
  - ◆ Wet screw compressor when well pressure is less than 80 psig
  - ◆ Booster compressor, three phase separator and sand trap
- ★ Estimate cleanup pressure of 300 to 400 psig at a well depth of 8000 feet
- ★ Suggest use in all kinds of completion and workover cleanup operations



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# Discussion Questions

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- ★ **To what extent are you implementing this opportunity?**
- ★ **Can you suggest other approaches for reducing well venting?**
- ★ **How could these opportunities 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?**



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