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Reduced Emissions Completions Jonah Case Study

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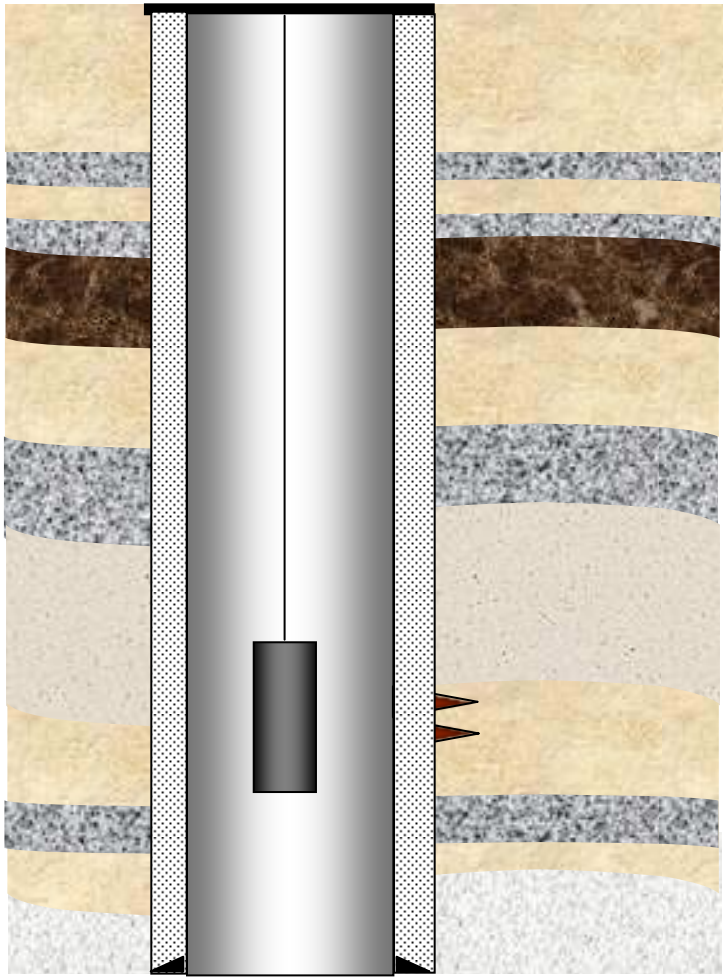
EnCana Oil & Gas (USA) Inc. | Denver, CO | October 20, 2009

Outline

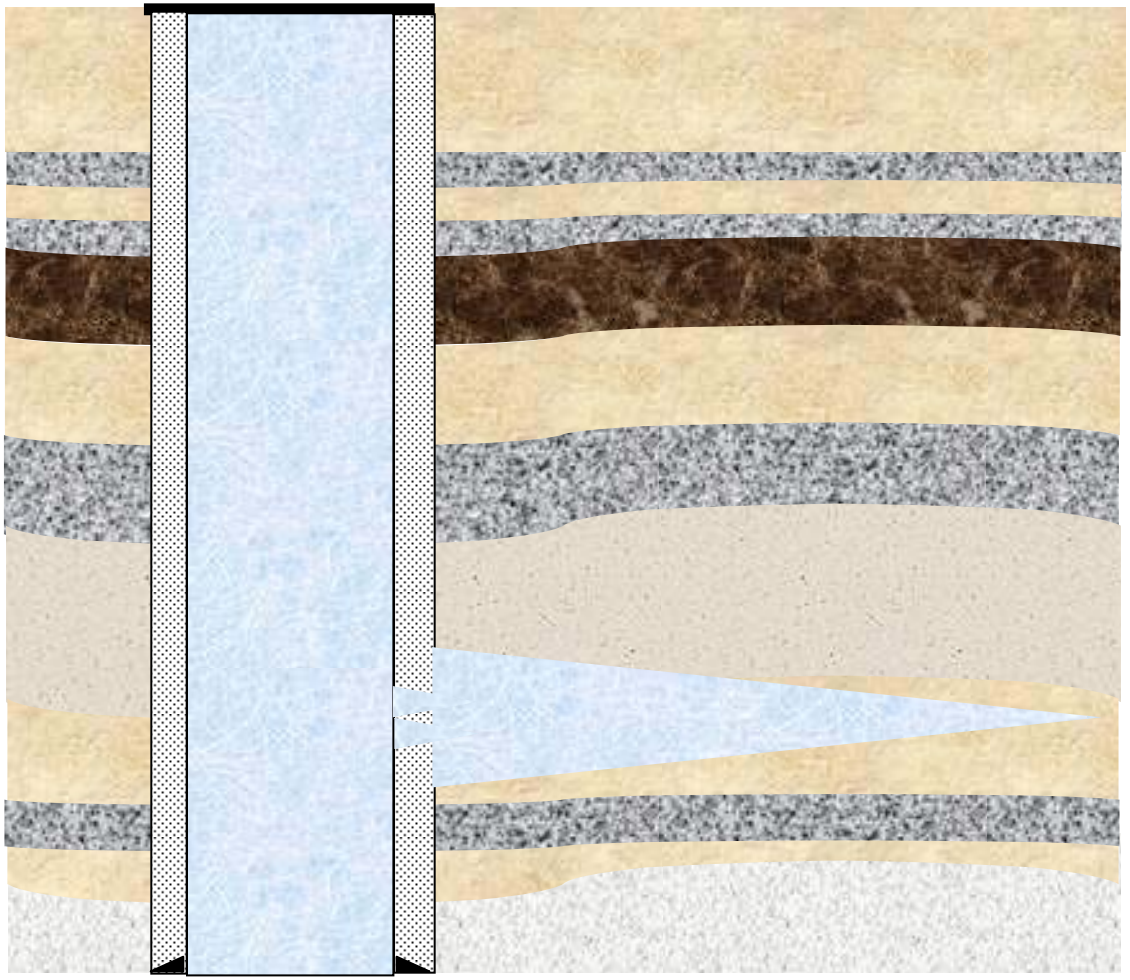
- **Hydraulic fracturing review**
- **Traditional surface setup**
- **Reduced Emission Completions (REC) surface setup**
- **Applicability**
- **Case study**

Completion Operations



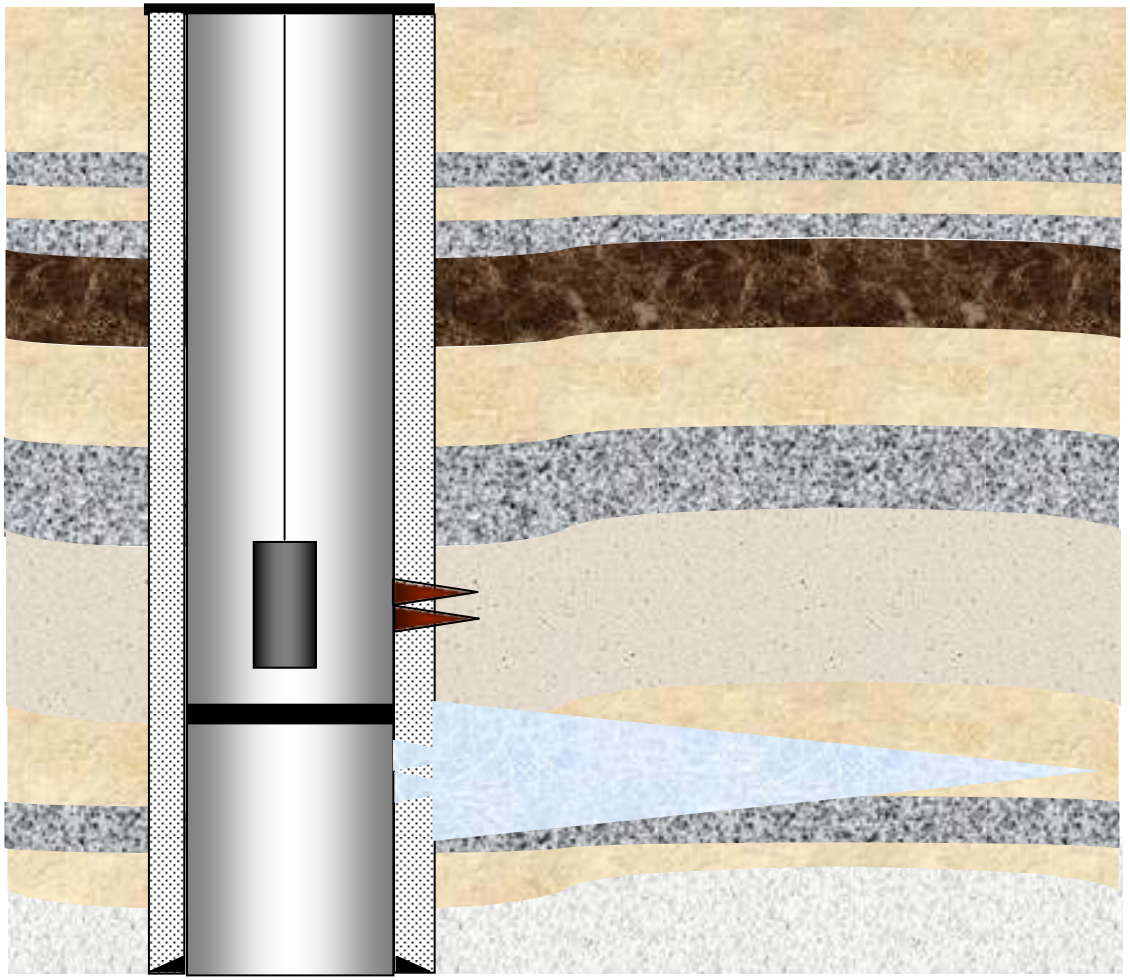
- **Casing perforated with jet charge based on geologic correlation**
- **Penetrates casing and cement**
- **Connects the reservoir to the wellbore**

Fracturing Operations



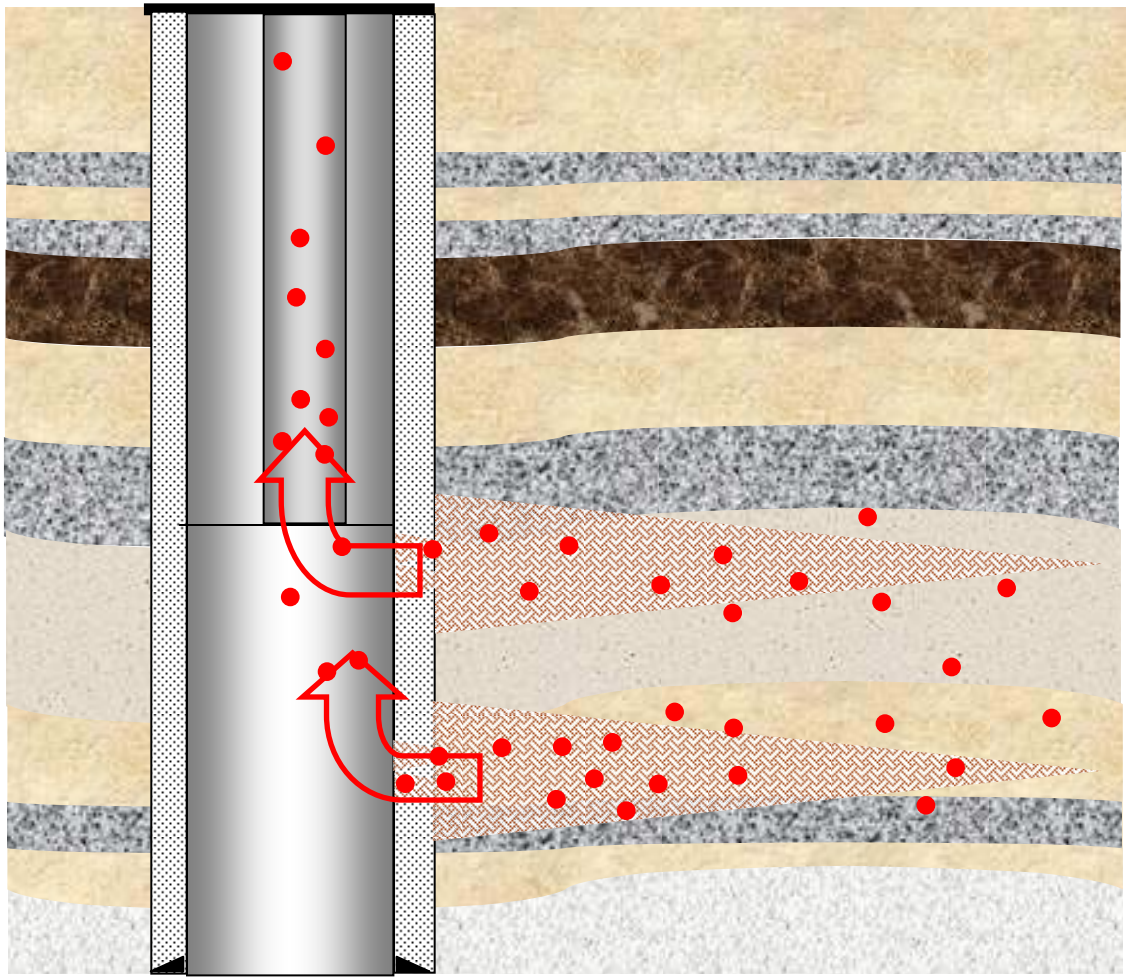
- Sand in gel (guar) and water
- Pressure initiates fracture
- Sand pumped into fracture
- Fluid flowed back
- Sand stays in formation
- Some fluid recovered during completion
- Remainder produced over time or stays in the reservoir
- Fracture creates conductive path
- Very controlled system during fracturing

Fracturing Operations



- **After flow back a composite plug set**
- **Isolates previous stage**
- **Next Stages is perforated**
- **Another fracture treatment is performed**
- **Repeated every 200’ to 250’ as needed**

Fracturing Operations



- **Composite plugs drilled out**
- **Tubing string run in hole**
- **Well put on production through tubing**
- **Gas will follow path of least resistance into wellbore and to surface through tubing**
- **Pressure gradient allows gas to move only up tubing**

Down Hole Frac Fluids

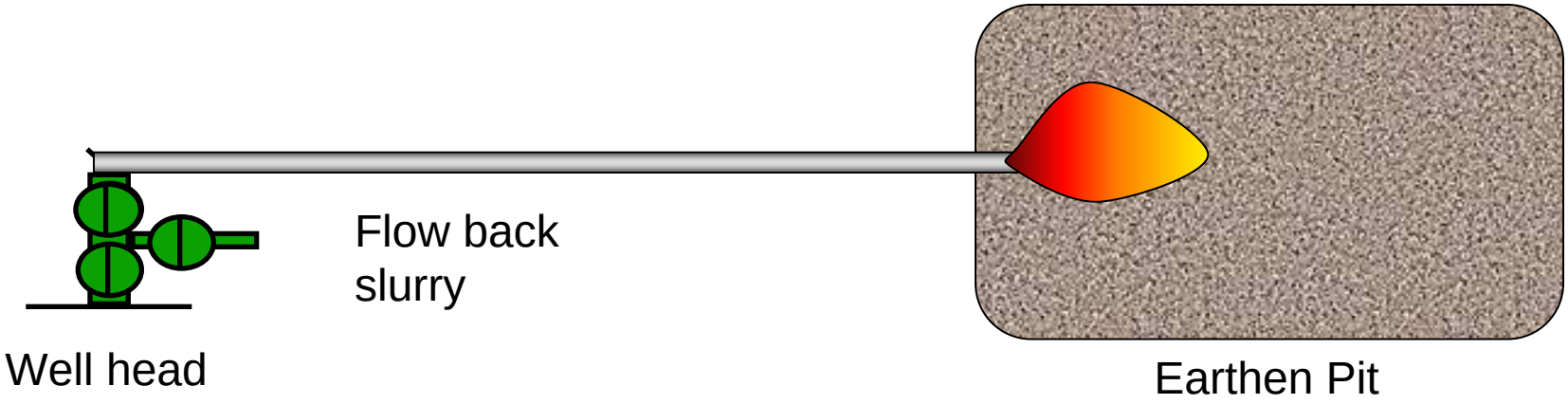
- **Water Fracs**
  - Cross Linked Gel – increases viscosity
  - Breaker – breaks viscosity
- **Energized Systems**
  - N_2, CO_2
  - Foams or assist

Proppant Types

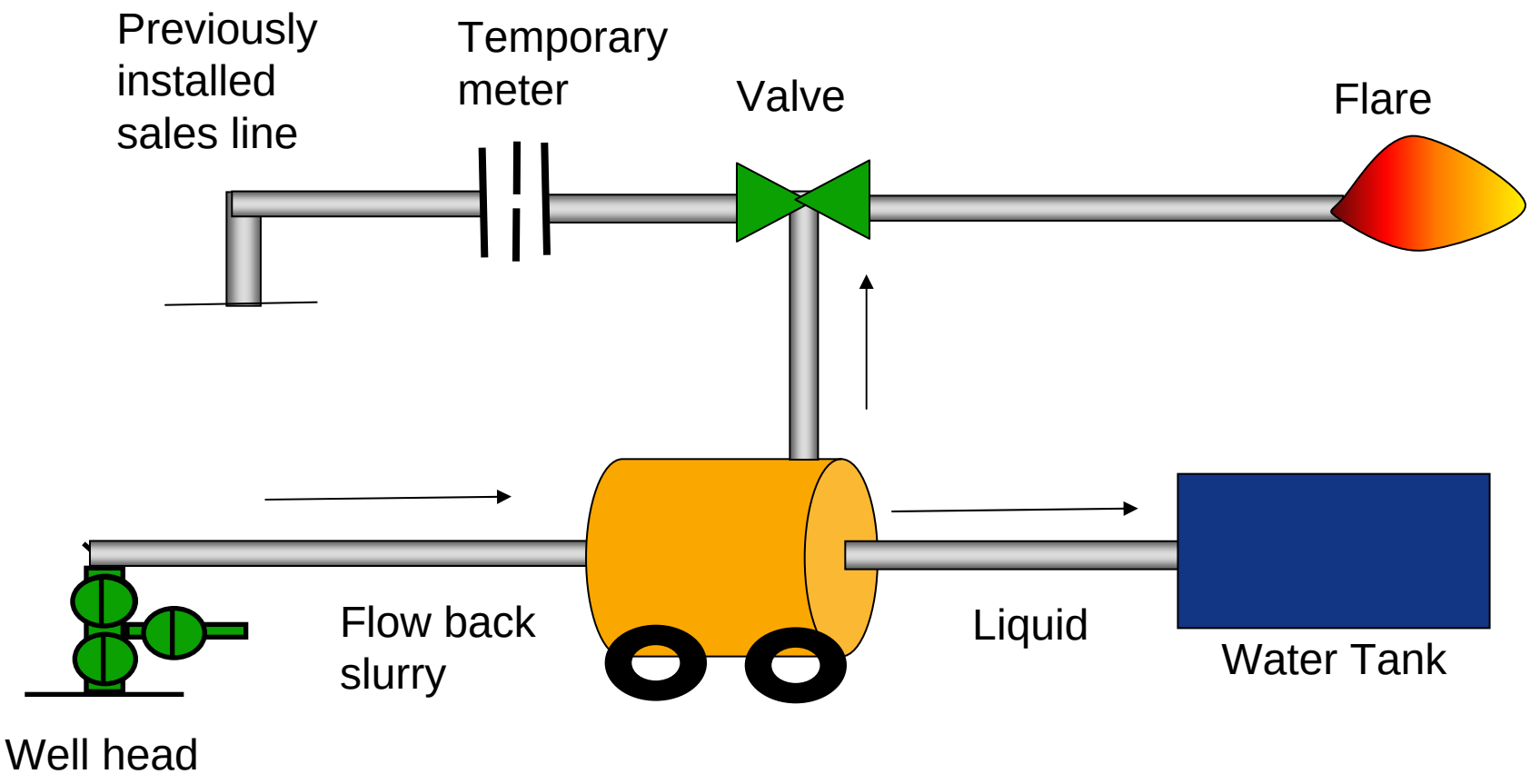
- **Low Strength**
  - Sand
- **Resin Coated**
  - Use various substrate
- **Intermediate Strength**
  - Man-made proppants
  - Aluminum silicate
- **High Strength**
  - Bauxite

Historical set up

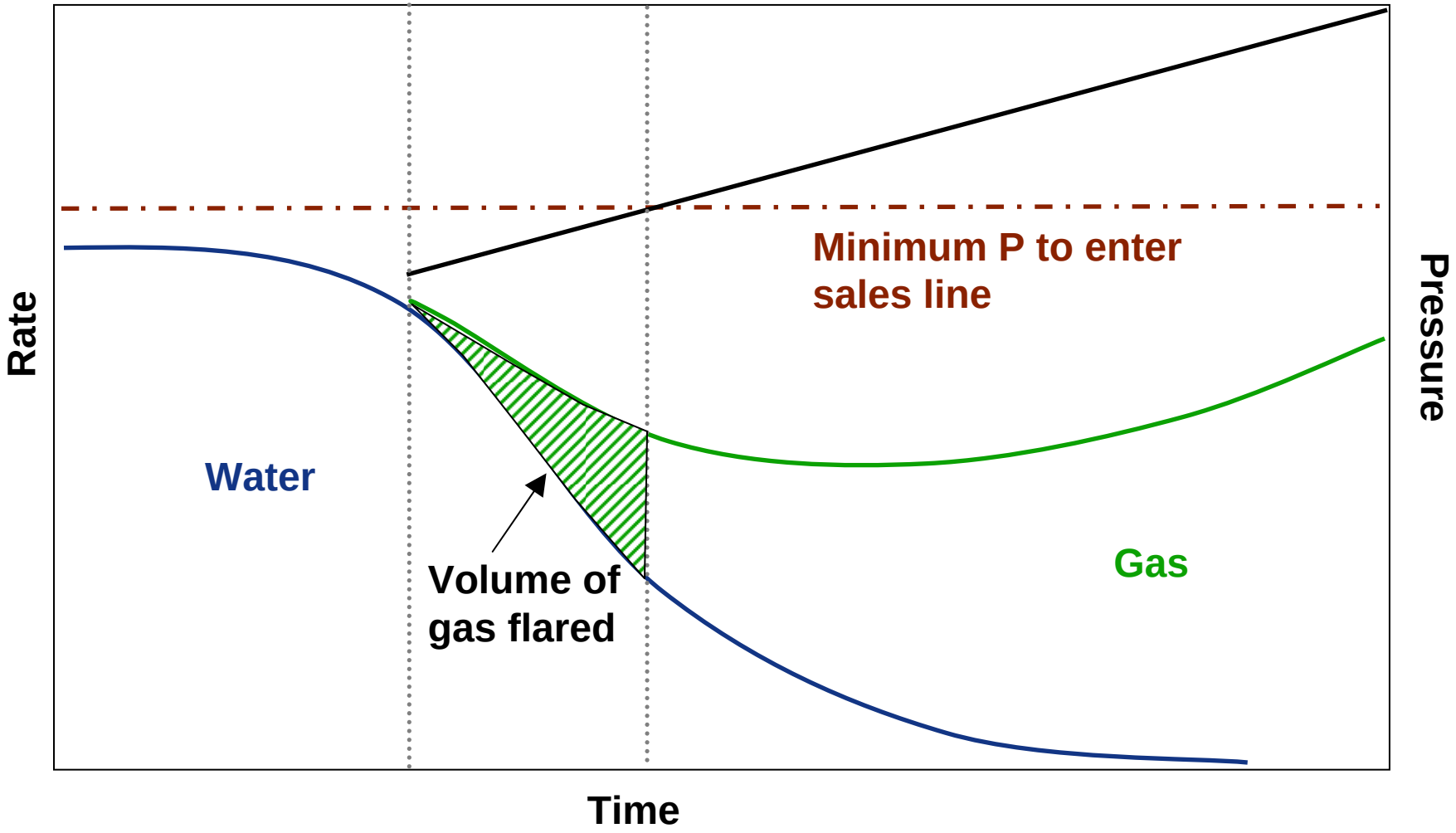
Usually not hooked up to permanent sales line until well is completed and tubing landed



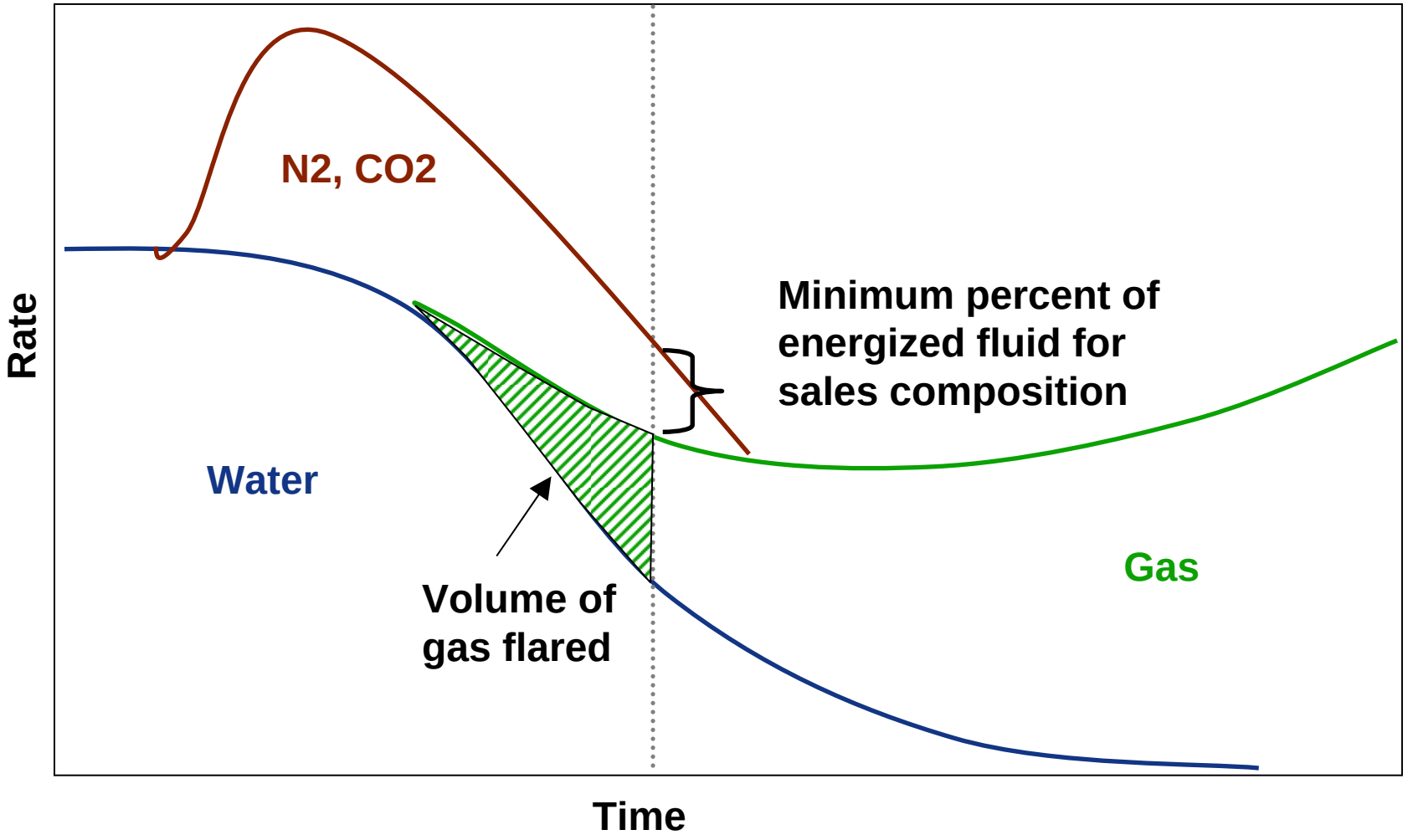
REC Set Up


Previously installed sales line
Temporary meter
Valve
Flare
Flow back slurry
Liquid
Water Tank
Well head

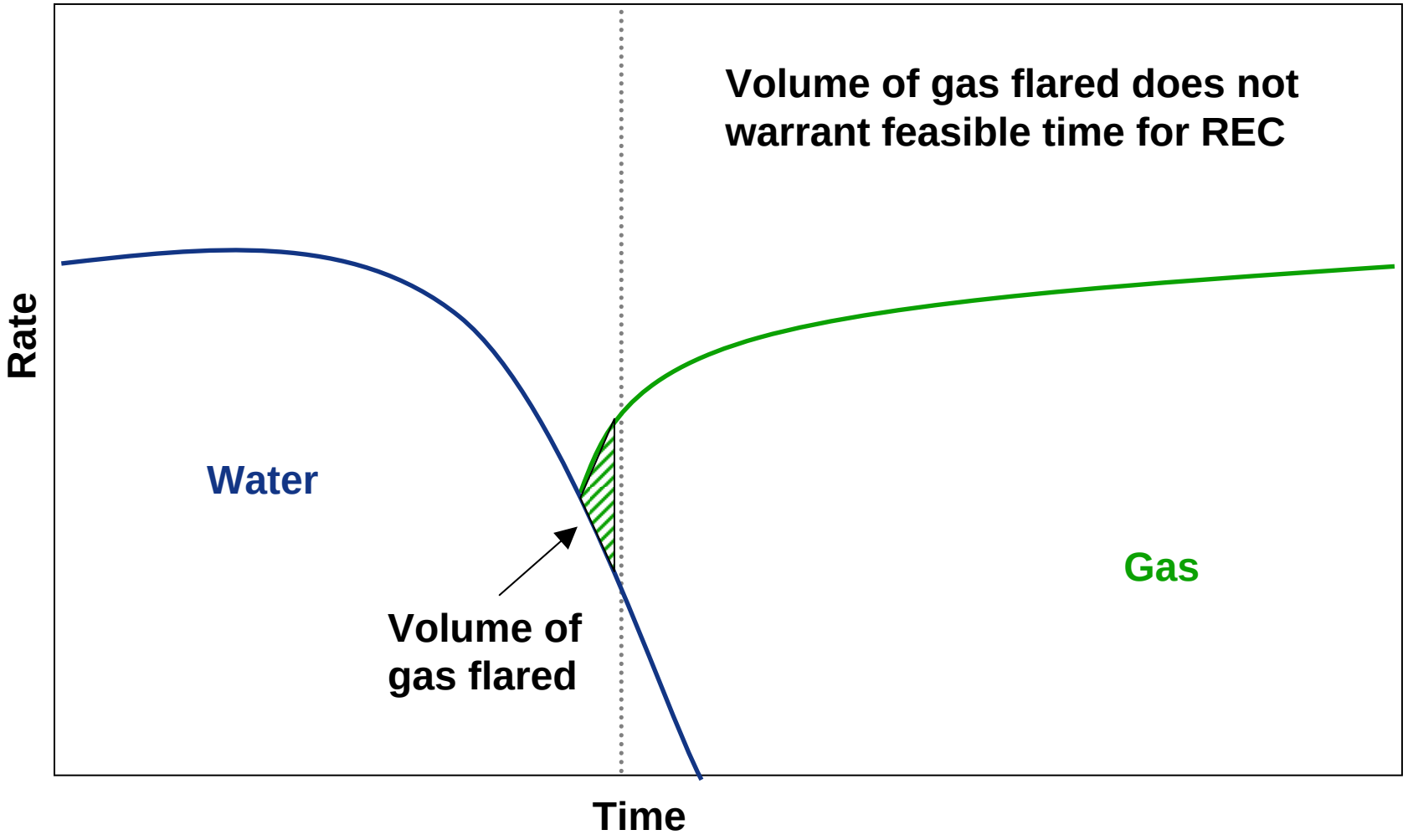
Less Than 100% Captured



Energized Fluids



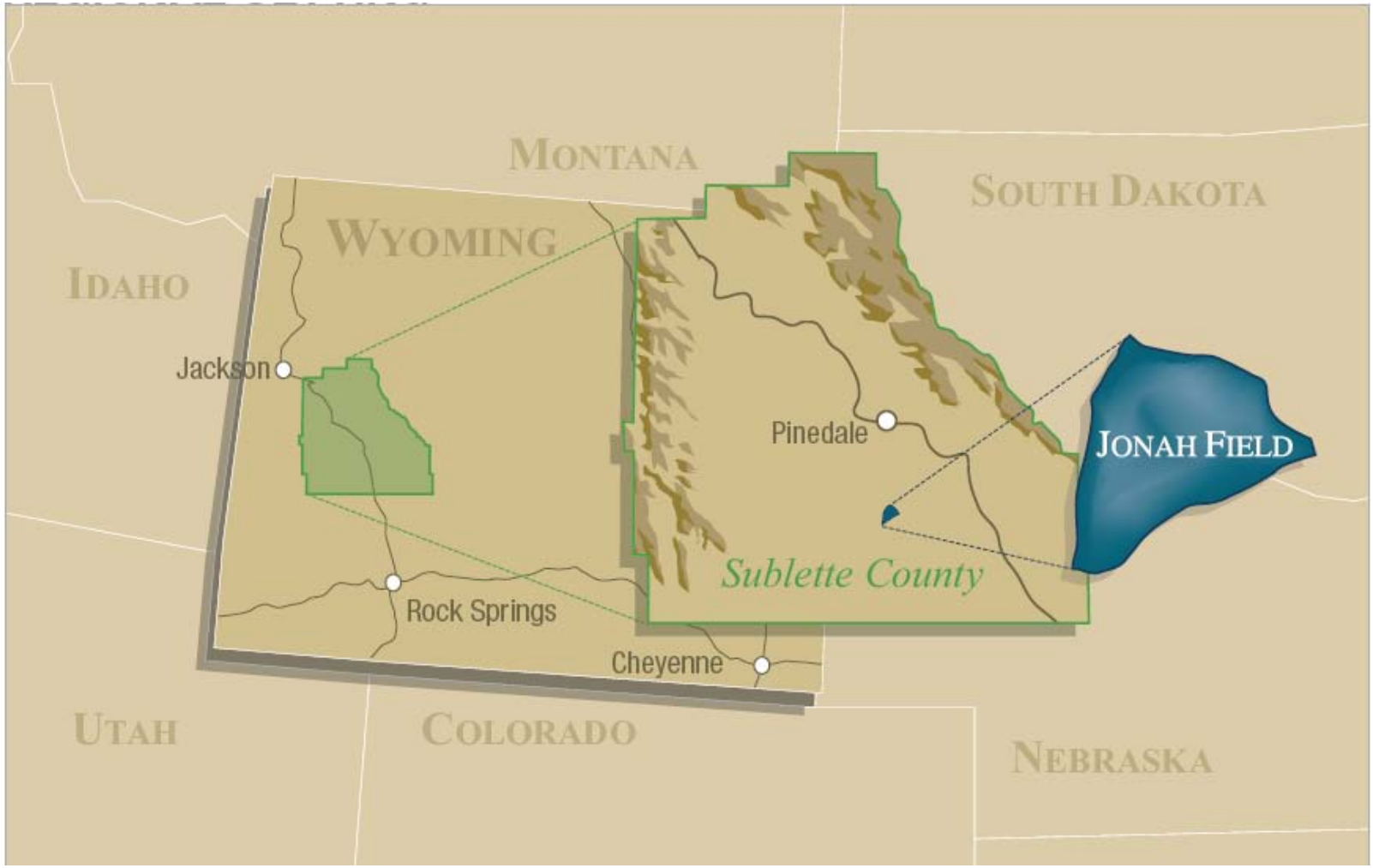
Distinct Phases



Non applicable scenarios

- **No permanent sales line**
  - Step out wells, exploratory, wild cat
- **Gas pressure relative to the sales line**
- **Energized fluids**
  - N2 and CO2 limits for sales gas
- **Distinctive liquid to gas interface with no sand**
  - Time
  - Volume of gas
  - Gas pressure for level controller pneumatics

Jonah Field Location

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Estimated Flared Volume

Year	Total Gas thru Unit	% Flared
	MMCF/YR	
2001	0	0.00%
2002	0	0.00%
2003	459	3.70%
2004	6,237	1.01%
2005	17,985	0.61%
2006*	9,461	1.46%
2007	8,492	0.87%
2008	14,832	0.45%
2009YTD	2,848	0.10%

Cost of REC

- **Daily rate * number of days in completions**
  - Flow back unit
  - Crew
  - Iron rentals
  - Temporary meter skid

- **Cost to install pipeline to well head after completions**

Economics of Captured Gas

Year	Gas to Sales	Price NWP	Cost of Flow Back	Gas Sale Revenue
	MMCF/YR	$/MCF	Unit and Crew	
2003	442	$4.62	($3,036,200)	$2,040,973
2004	6,174	$5.87	($8,857,800)	$36,260,555
2005	17,876	$7.80	($9,112,400)	$139,454,713
2006*	9,323	$6.34	($16,800,000)	$59,151,099
2007	8,418	$4.43	($37,728,000)	$37,268,080
2008	14,766	$7.01	($40,425,000)	$103,438,462
2009YTD	2,845	$3.19	($9,075,000)	$9,063,281

NPV 2003: US$190,070,000

Conclusions

- **Fits well into resource play development**
- **Economical**
- **Environmental benefit**
- **Not always viable**
- **Improves our social license to operate**

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Thank You