The Coal-Seq Project: Results of the Allison and Tiffany ECBM Field Studies

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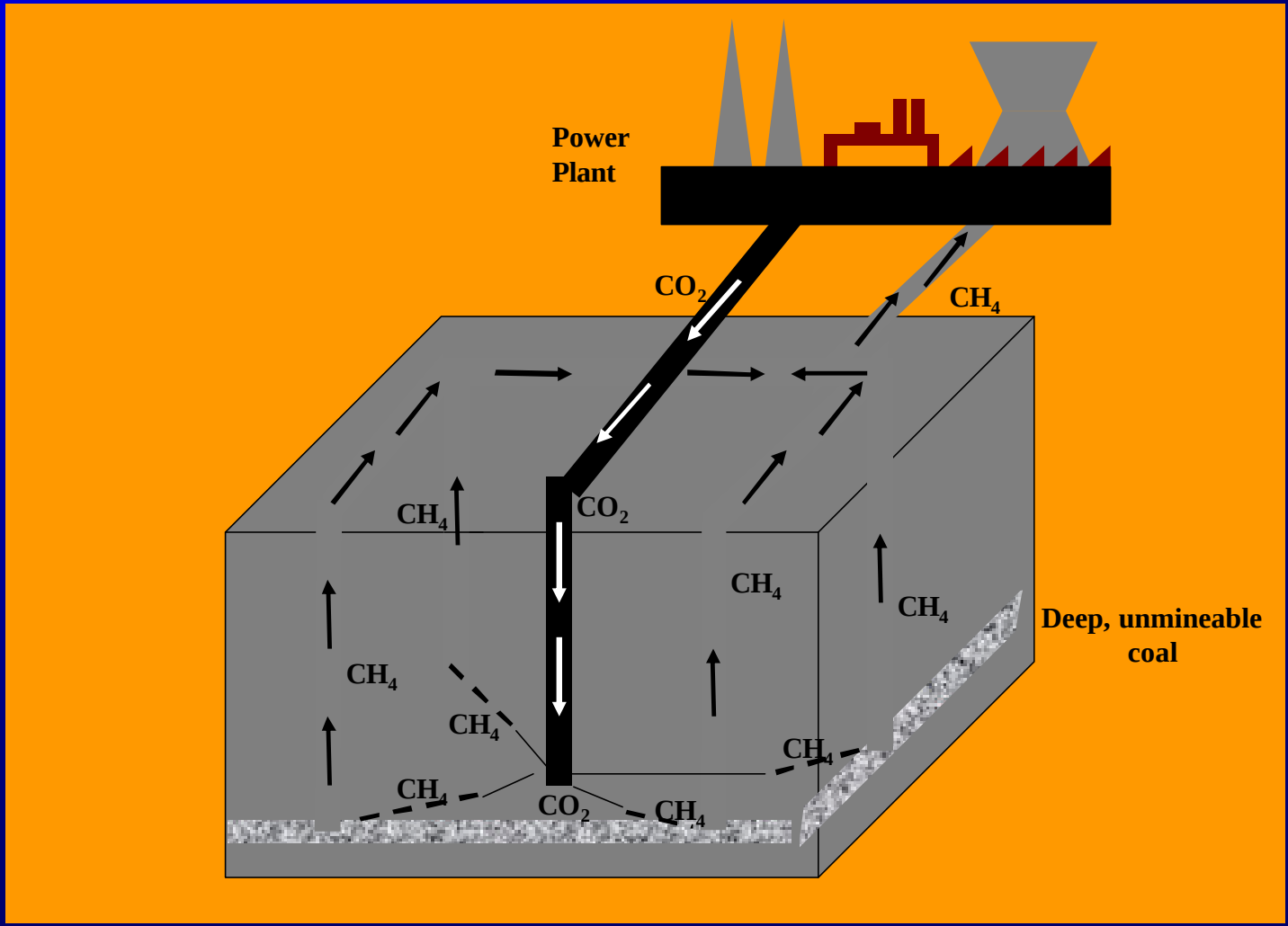
Presentation Outline

- Project Objectives
- Field Results
  - Allison
  - Tiffany
- Closing Remarks

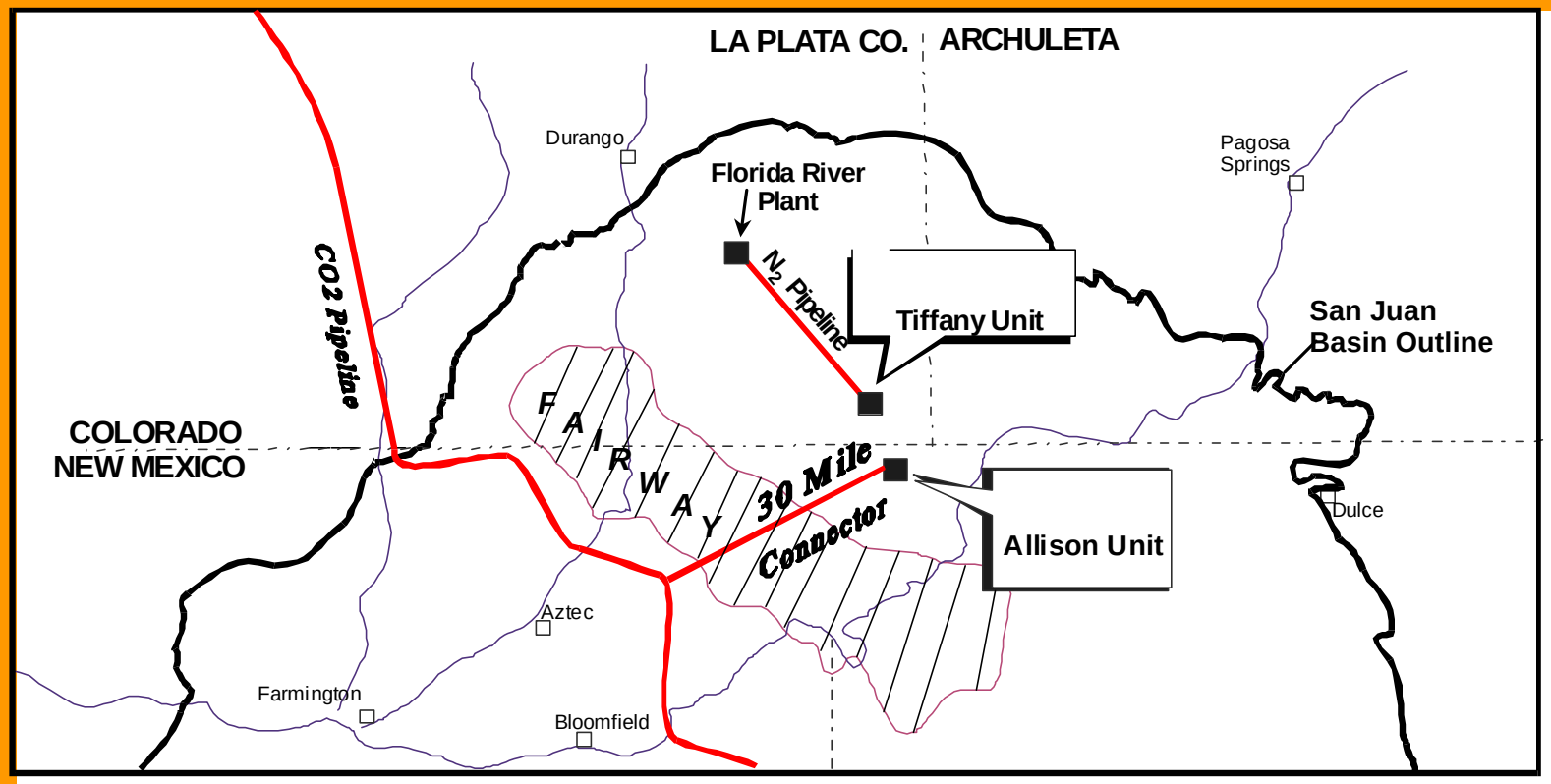
The Integrated Power Generation, CO_2 Sequestration & ECBM Vision



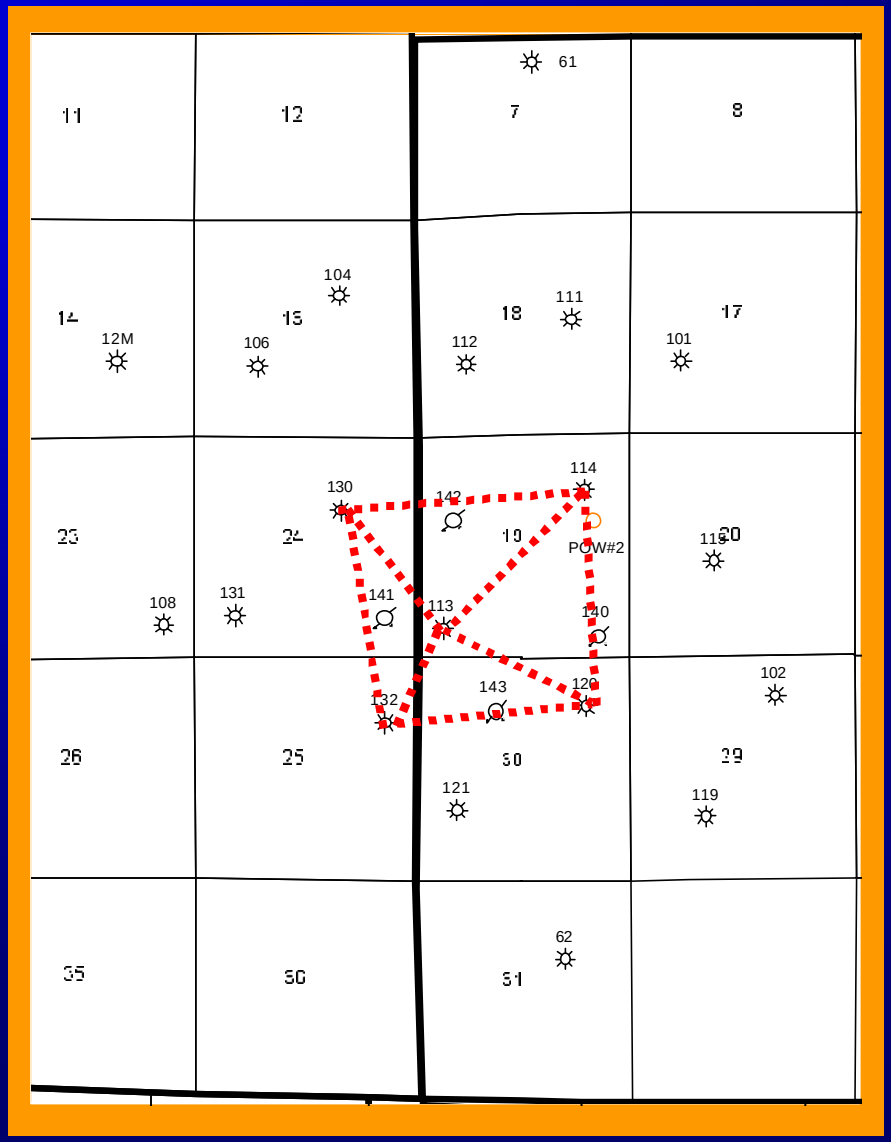
Coal-Seq Project Objectives

- Perform Detailed Field Studies of Existing CO_2/N_2 ECBM Projects
- Understand Critical CO_2 Sequestration Reservoir Mechanics
- Develop Screening Model to Evaluate Potential Coalseam Sequestration Projects
- Assess Potential for Coalseam Sequestration across U.S
- Disseminate Results to Industry

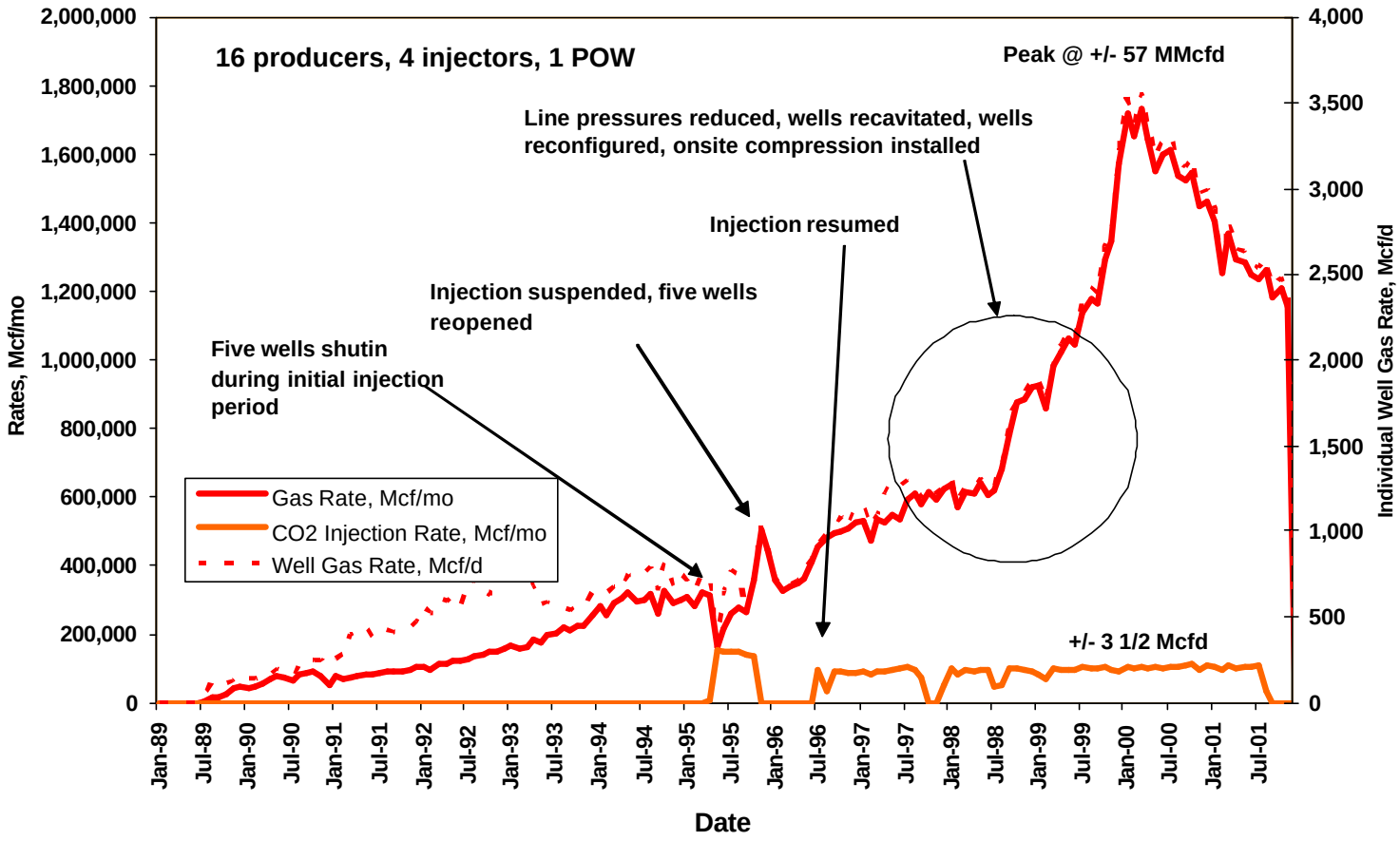
Field Sites, San Juan Basin



Allison Unit Base Map



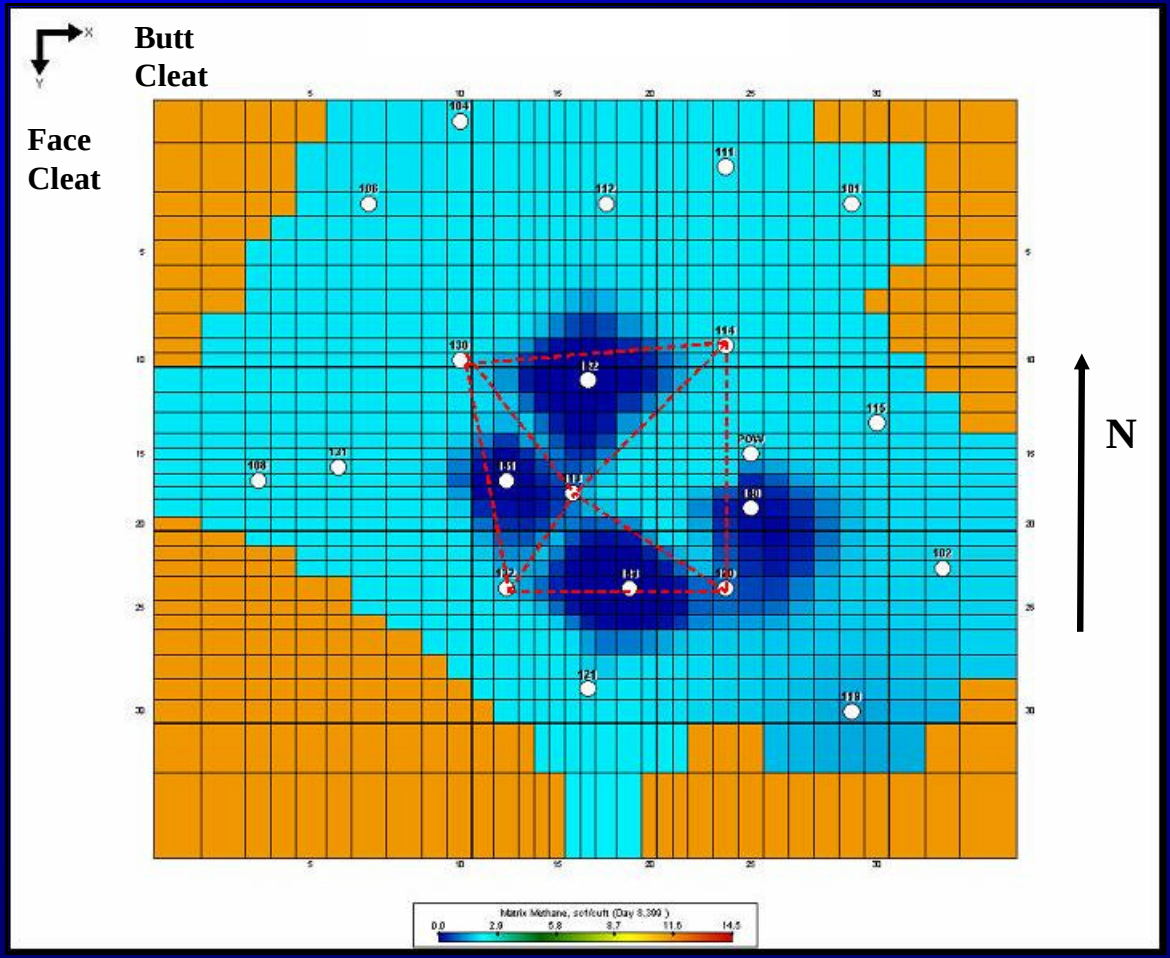
Allison Production History



Reservoir Description

Property	Value
Average Depth to Top Coal	3100 feet
No. Coal Intervals	3 (Yellow, Blue, Purple)
Average Total Net Thickness	43 feet Yellow – 22 ft Blue – 10 ft Purple – 11 ft
Permeability	100 md
Initial Pressure	1650 psi
Temperature	120°F

Progression of CO_2 Displacement



ECBM Recovery

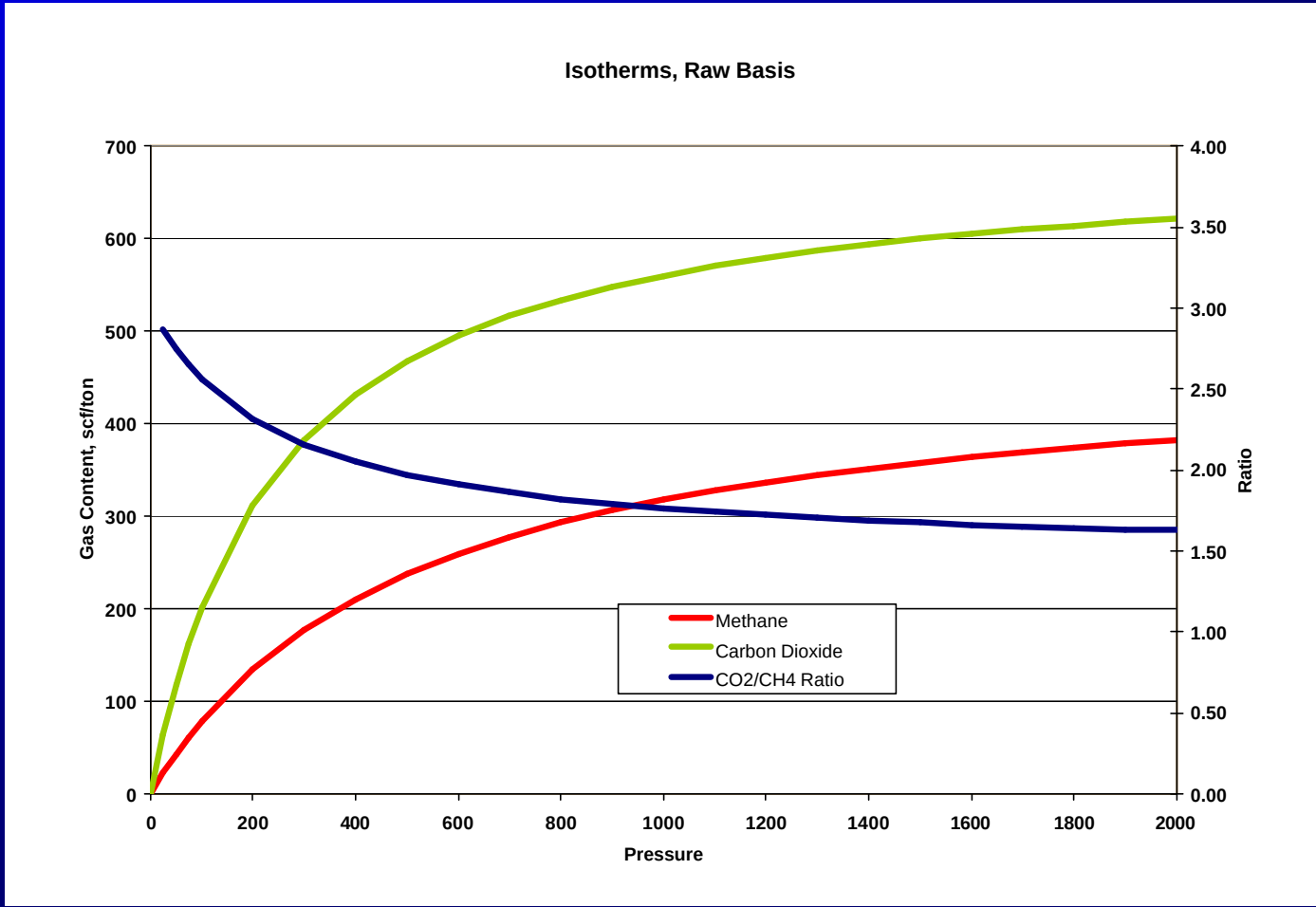
Case	Total Methane Recovery (Bcf)	Incremental Recovery (Bcf)	Total CO_2 Injection (Bcf)	CO_2 Production (Bcf)	CO_2/CH_4 Ratio
W/o CO_2 injection	100.5*	n/a	n/a	n/a	n/a
W/CO_2 injection	102.1	1.6	6.4**	1.2	3.2

*6.3 Bcf/well
** 20 Mcfd/ft

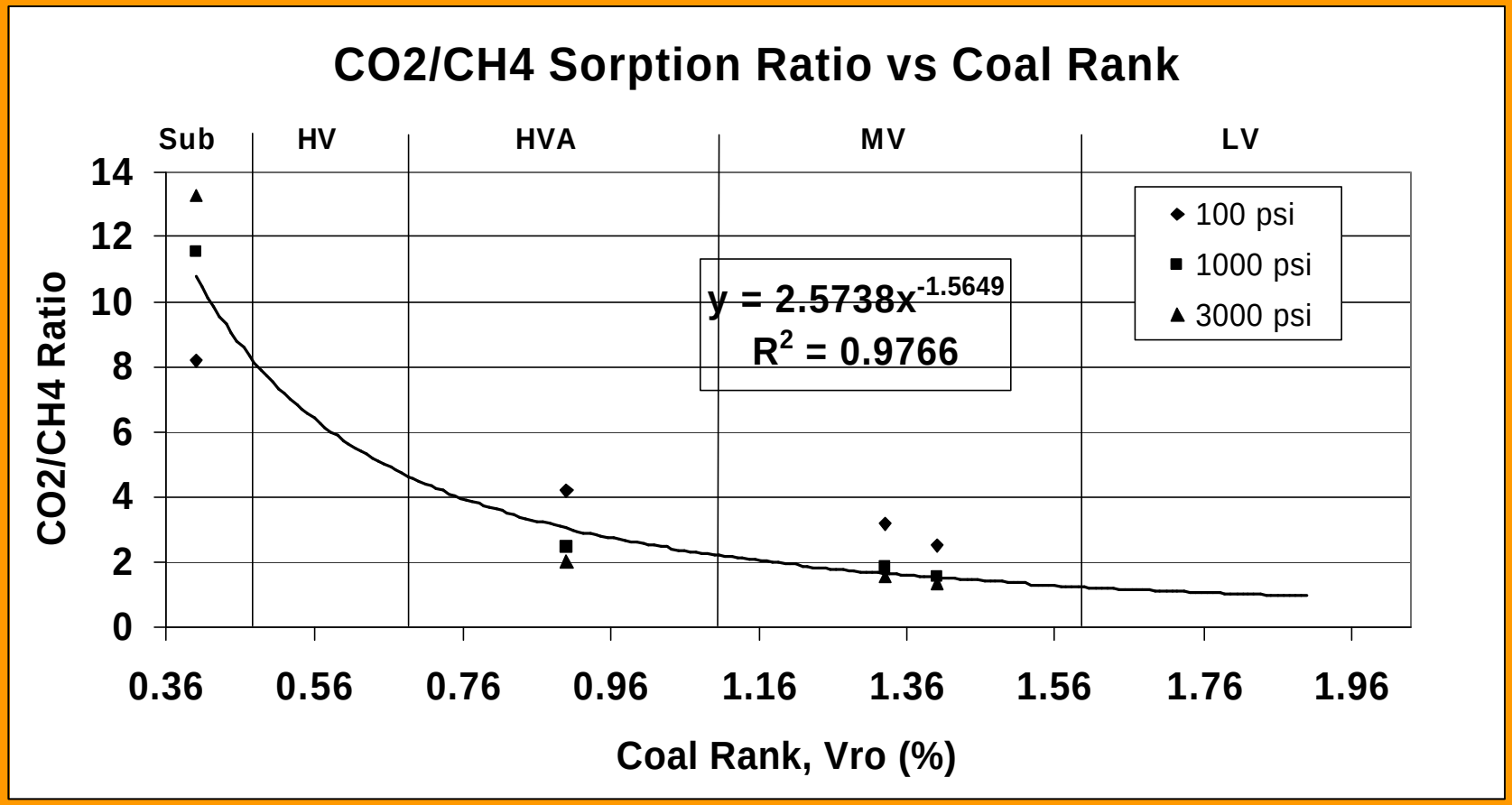
Small incremental recovery due to limited injection volumes.
INJECTIVITY IS CRITICAL!

Note: OGIP for model = 152 Bcf.

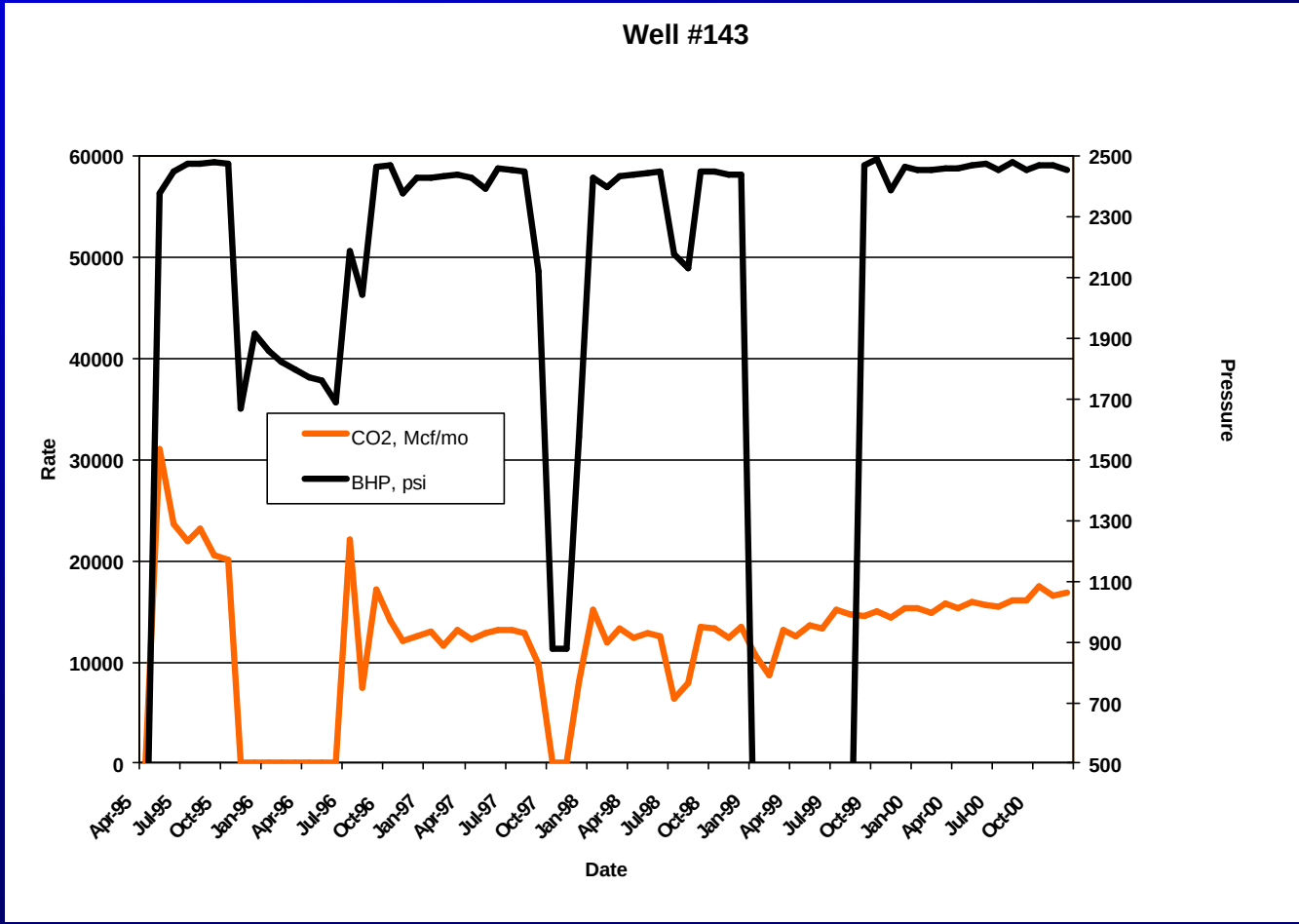
CO_2/CH_4 Ratios @ Allison



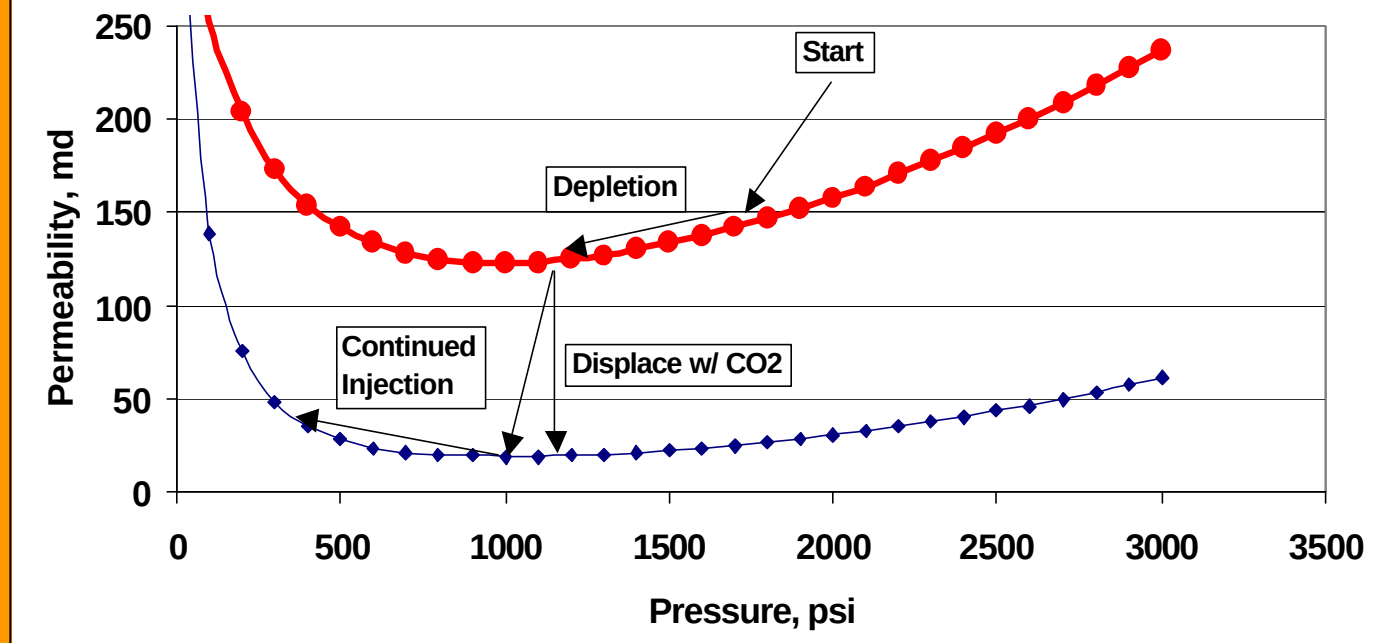
Variability of CO_2/CH_4 Ratio



Typical Injection Profile, Allison Unit



Permeability History for Injector Well



Economic Performance

Assumptions

Capex:	$2.6 million
CO_2 Cost:	$0.30/Mcf ($5.19/ton)
Gas Price:	$2.20/MMBTU

Results

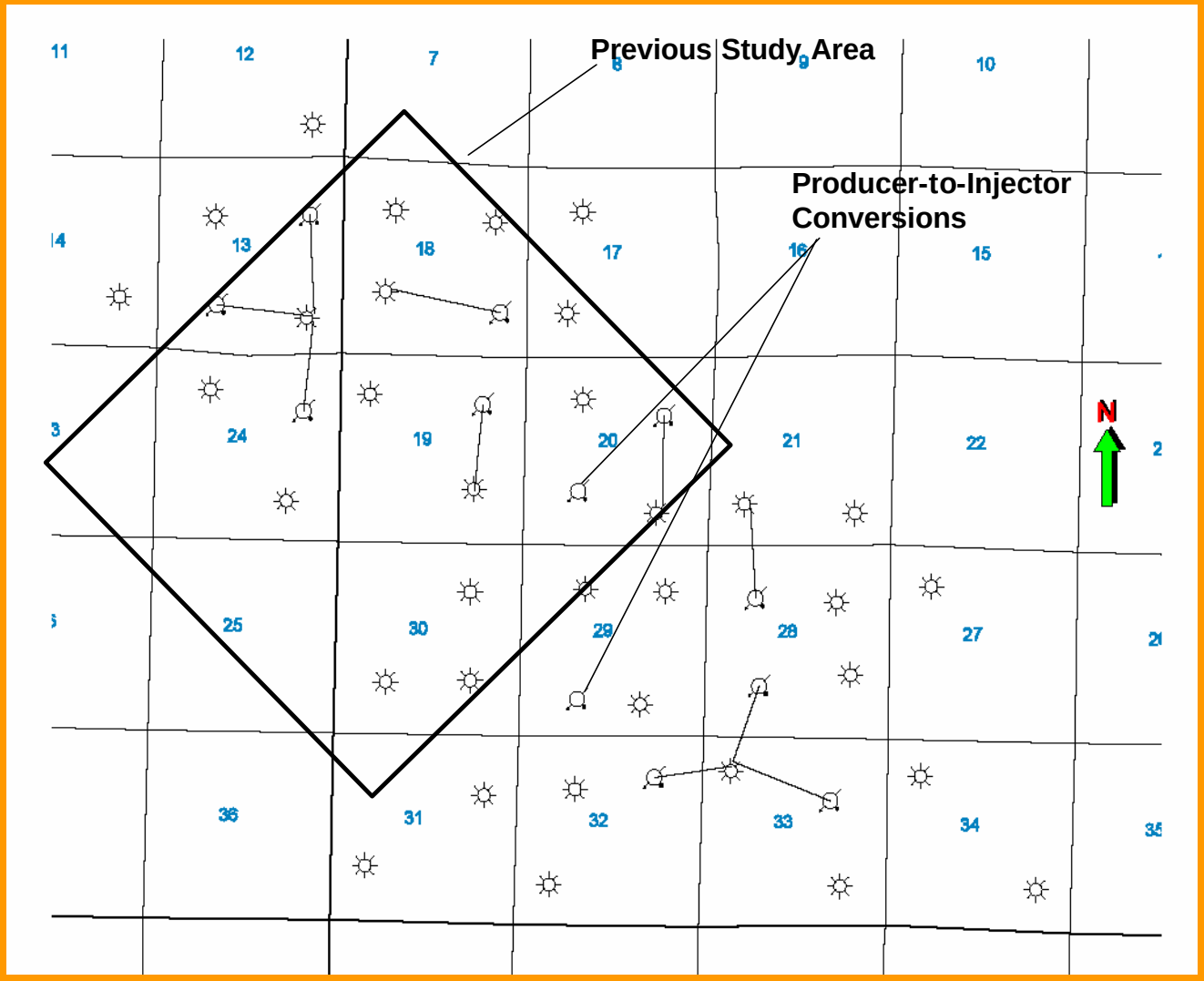
Net Present Value:	($627k)
Breakeven Gas Price:	$2.57/MMBTU
Breakeven CO_2 Cost:	$3.11/ton

Impact of Increased Injectivity

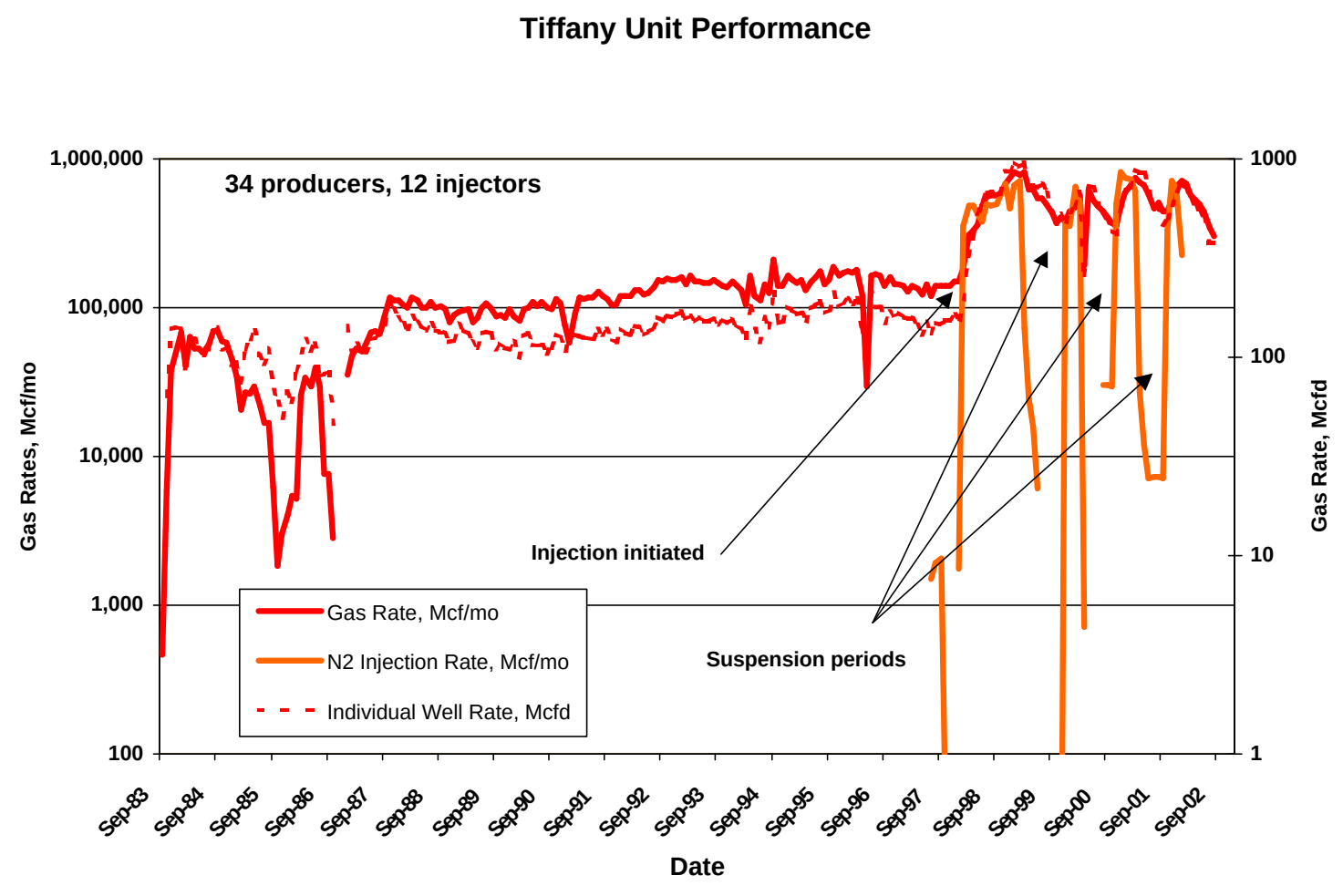
	Current	Injection Rate x4	x4 @$4/Mcf
Net Present Value	($627k)	$3,624k	$15,266k
Breakeven Gas Price ($/MMBTU)	$2.57	$1.63	n/a
Breakeven CO_2 Cost ($/ton)	$3.11	$8.65	$19.38

Note: S & C cost of MHI KS-1 process is +/- $35/ton.

Tiffany Unit Base Map



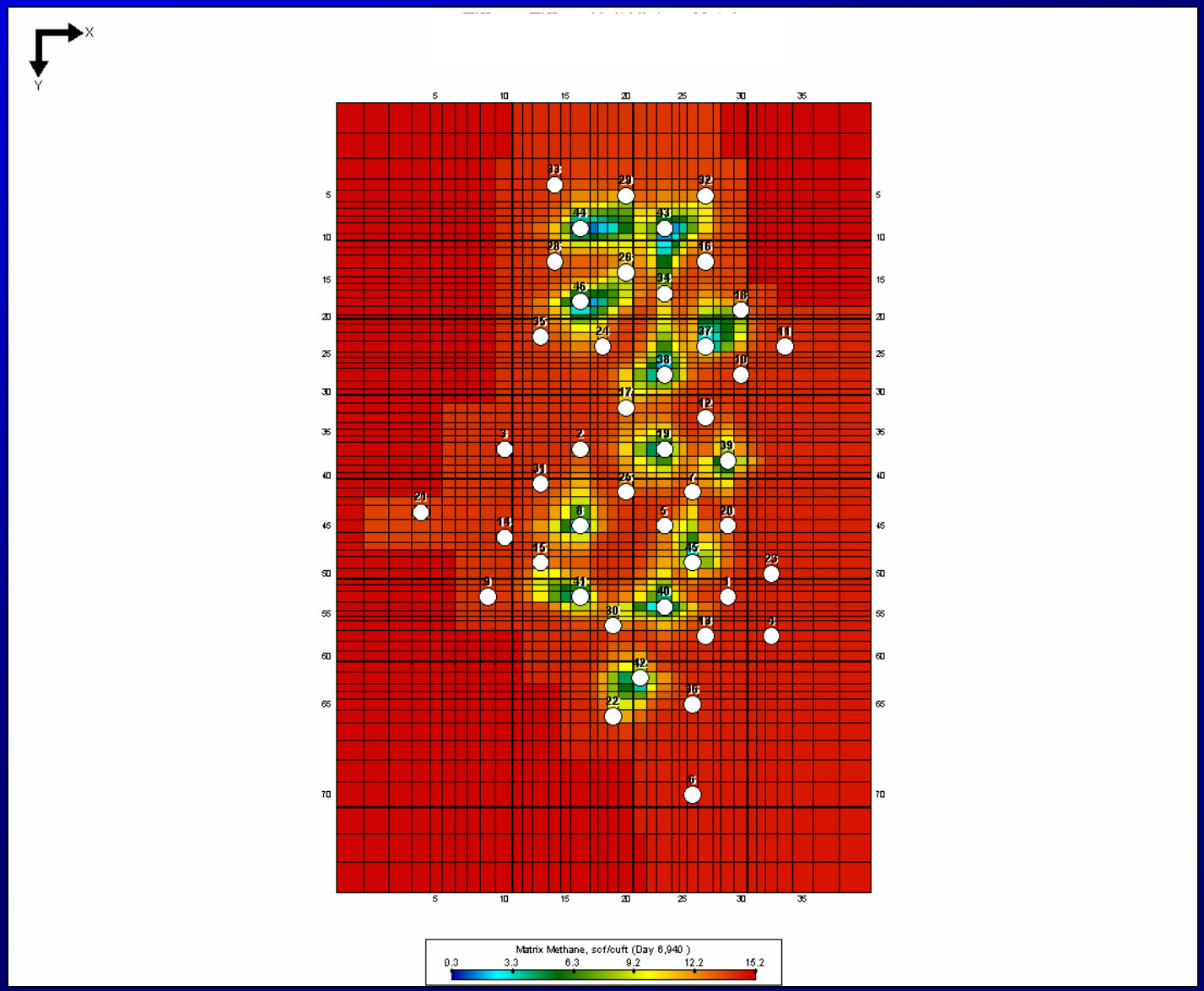
Tiffany Production History



Reservoir Description

Property	Value
Average Depth to Top Coal (A)	2970 feet
No. Coal Intervals	7 total (A, A2, B, C, D, E, F) 4 main (B, C, D, E)
Average Net Thickness	47 feet B – 13 ft C – 11 ft D – 9 ft E – 14 ft
Permeability	<5 md
Initial Pressure	1600 psi
Temperature	120°F

Progression of N_2 Displacement
(@ mid-2002)



ECBM Recovery

(through mid-2002)

Case	Total Methane Recovery (Bcf)	Incremental Recovery (Bcf)	Total N_2 Injection (Bcf)	N_2 Production (Bcf)	N_2/CH_4 Ratio
W/o N_2 injection	*35.3	n/a	n/a	n/a	n/a
W/N_2 injection	45.8	10.5	14.0**	1.3	1.2

*1.0 Bcf/well
** 46 Mcfd/ft

At N_2/CH_4 ratio of 0.75:1 and reproduced volume of 25%, ultimate incremental recovery estimated to be +/- 14 Bcf or 40% improvement over primary.

Note: OGIP for model = 438 Bcf.

Closing Remarks

- CO_2 sequestration in coalseams is feasible and appears to hold considerable promise; second-best economic option to CO_2-EOR.
- Carbon credits would substantially improve financial performance and accelerate commercial adoption (much greater impact than higher gas prices).
- In U.S., CO_2-ECBM/sequestration potential is substantial; recently assessed at 90 Gt CO_2 and 150 Tcf of incremental gas recovery.

Closing Remarks

- Considerable more work is needed to improve the process.
  - **Critical Need**
    - CO_2 injectivity
    - Micro-mechanics (competitive adsorption, bi-directional diffusion)
  - N_2/CO_2 mixtures
  - Reservoir settings (coal rank)
  - Spacing, patterns, rates, etc.
- Acknowledgements:
  - U.S. Department of Energy
  - Burlington Resources
  - BP America
- For more information:

www.coal-seq.com

Questions?

Well Configurations - Allison

Well Configurations - Tiffany