2024 GAS LIFT WORKSHOP

Unlocking Future Well Productivity: Insights from Historical Data-Driven Analysis of an Intelligent Surface-Controlled Gas Lift Technology

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Objectives

- To examine and compare oil/ liquid/ gas production in wells using Intelligent vs. Traditional Gas Lift Technologies
- To analyze production curve declines for each technology
- To outline a workflow for real-data performance assessment of each technology

Why Intelligent Surface-Controlled Gas Lift

- Operators ↑ production, ↓ lifting costs, ↓ gas lift valve failures, and ↑ overall system efficiency
- Ensures stable injection by actively controlling the size of the orifice as wellbore conditions change
- Provides the opportunity to inject gas in the deepest possible depth
- Demand remarkably low power consumption and can be effectively operated using a single solar panel
- Reactive automation software that adjusts port size, depth of injection, or shuts in based on changing surface and well conditions
- System maintains stable injection by adjusting orifice size to maintain a set differential pressure across the operating valve

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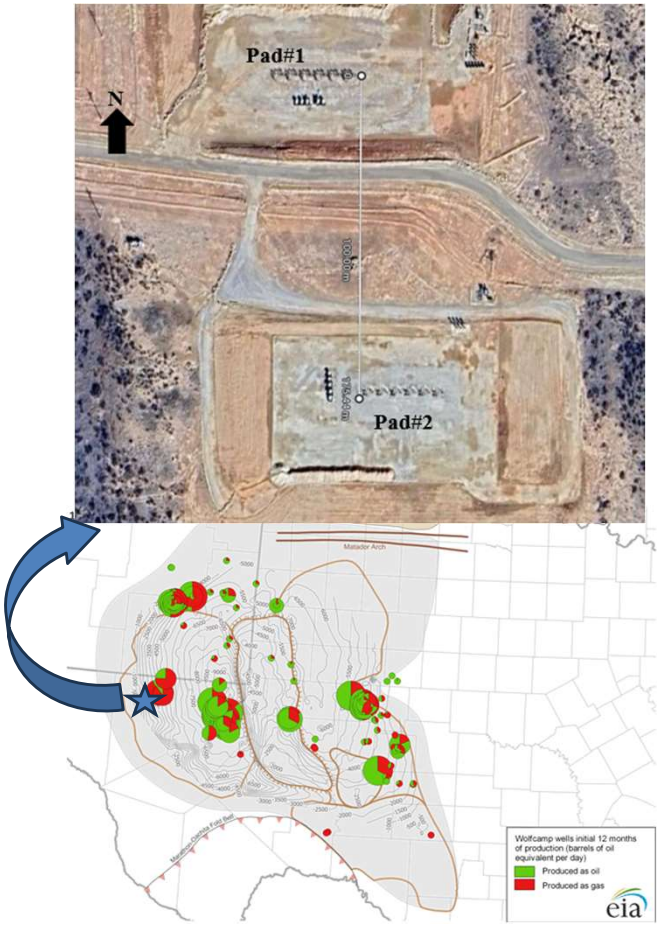
Database

Location

- Pad#1: Six wells with Intelligent Remote Controlled Gas Lift Technologies
- Pad#2: Six wells with Conventional Gas Lift Technologies
- 175 meters apart
- Wolfcamp formation, Delaware Basin (A,B,C and D)
- Tight reservoir, needs to be fractured



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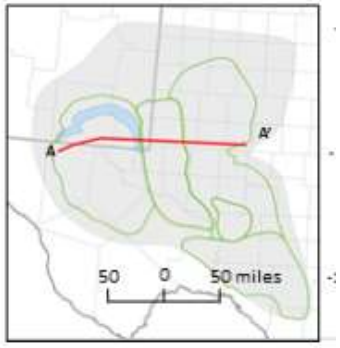
Database

Location

- Large amount of organic material
- Marine type 2 kerogen
- Average porosity 6%
- Average permeability 10mD
- TOC content 2-8%



Delaware Basin

Period	Epoch	Stage
Permian	Guadalupian	Bell Canyon
		Cherry Canyon
		Brushy Canyon
	Leonardian	Bone Spring Lime
		Avaon Sand
		First Bone Spring
		Second Bone Spring
		Third Bone Spring
	Wolfcampian	Wolfcamp A
		Wolfcamp B
		Wolfcamp C
		Wolfcamp D
Carboniferous	Pennsylvanian	Strawn
		Atoka

Central Basin Platform

Clearfork Upper
Clearfork Lower
Wichita Albany
Wolfcamp
Strawn
Atoka

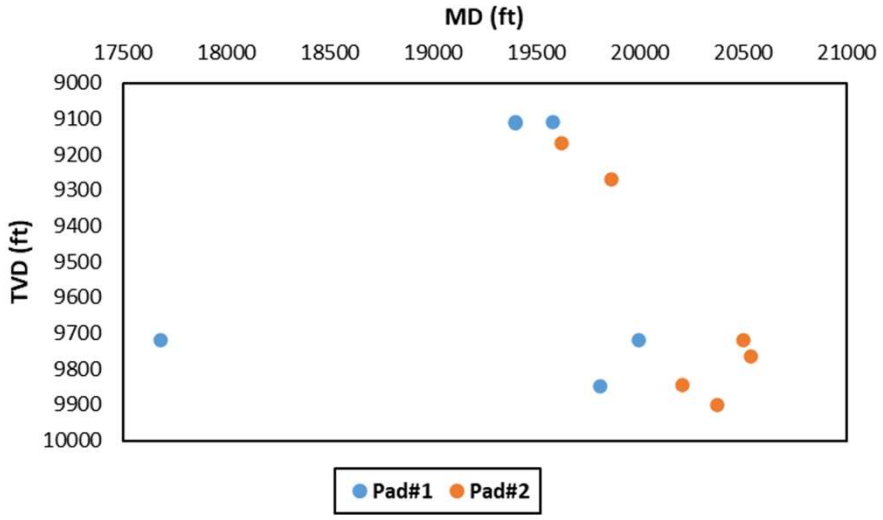
Midland Basin

Clear Fork	Guadalupian	Permian
Upper Spraberry	Leonardian	
Lower Spraberry		
Dean		
Wolfcamp A	Wolfcampian	
Wolfcamp B		
Wolfcamp C		
Wolfcamp D		
Strawn	Pennsylvanian	Carboniferous
Atoka		

Database

TVD vs MD

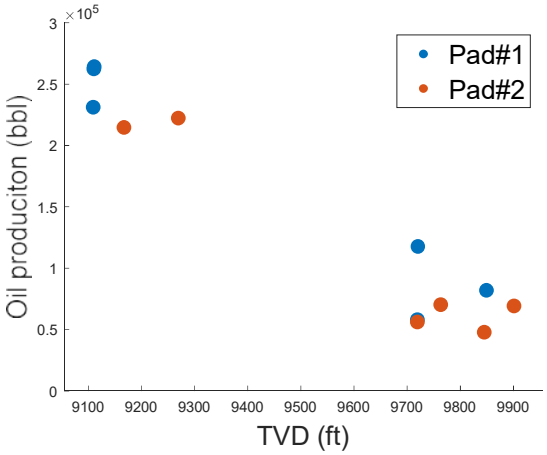
- Wells in both pads are drilled in the same ranges of TVD, same Wolfcamp benches
- On average, Pad#2 is drilled deeper as 1% (174 ft)
- On average, Pad#2 is longer deeper as 5% (874 ft)

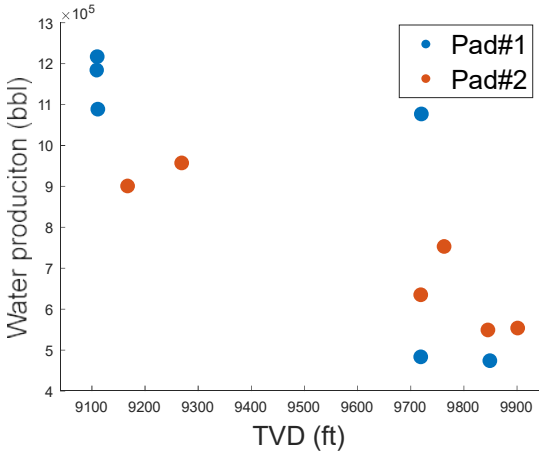


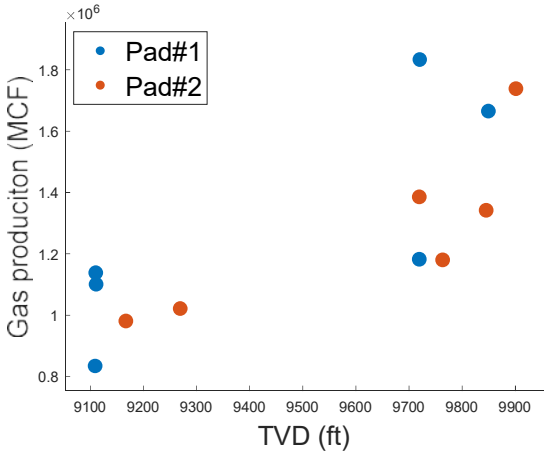
Database

Production Pattern

- As the depth increases, oil production becomes predominant in Pad#1.
- As the depth increases, water production becomes predominant in Pad#2.
- As the depth increases, gas production is almost the same for both pads.
- Pad#2 drilled slightly in lower TVD, so expecting more water production for Pad#2.



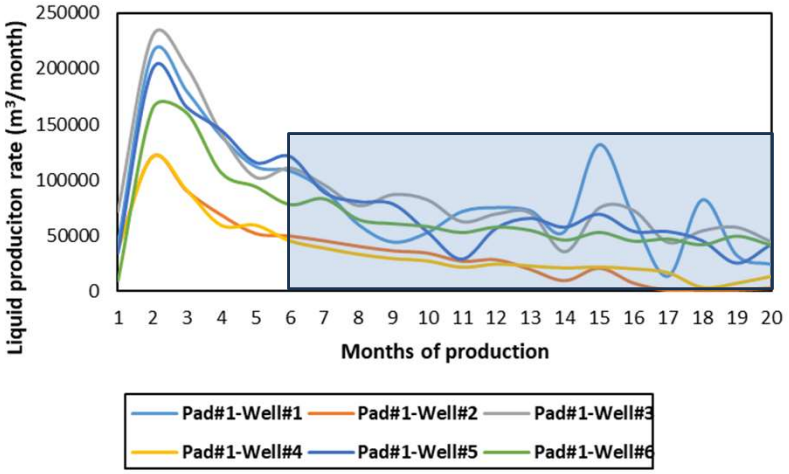




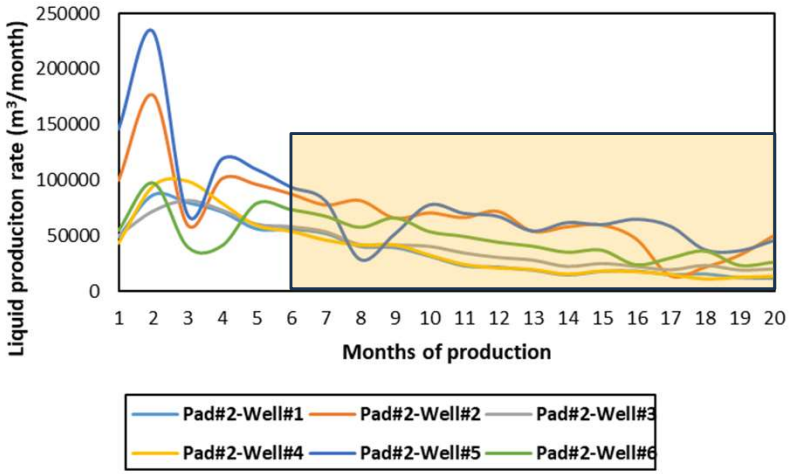
Database

Completion

- Despite different annular and tubular sizes, both pads operate within similar production ranges and not at their peak capacities.
- Variations in liquid production are not constrained by their respective maximum volume capacities.



5.5” casing, with 2-3/8” tubing



4.5” casing, with 2-7/8” tubing

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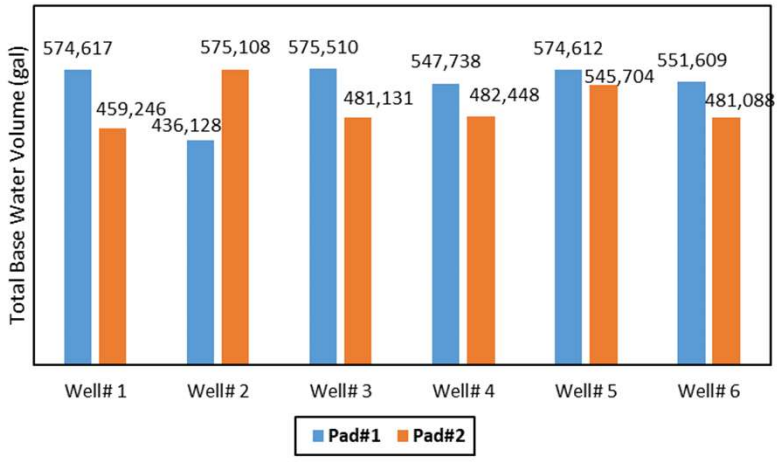
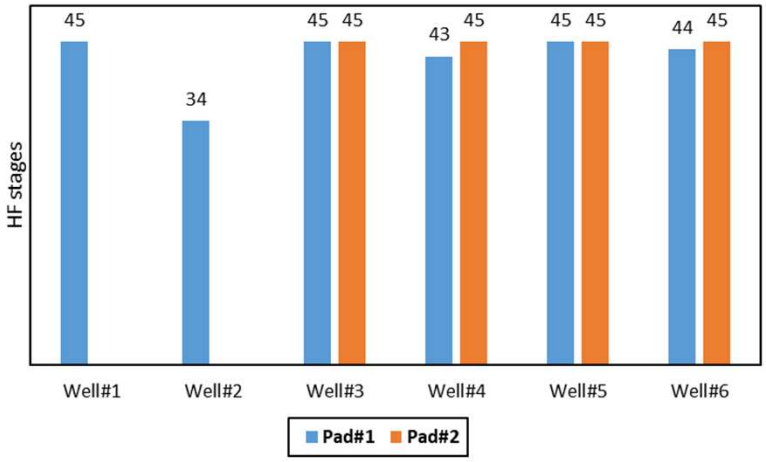
Database

Hydraulic Fracturing

- The HF stages for Wells#1&2 in Pad#2 is not available.
- Based on the available data, on average, Pad #2 has undergone more 5% (2.5) stages in HF.
- Based on the available data, on average, Pad #1 has consumed more 8% (39,248 gal) more water in HF.





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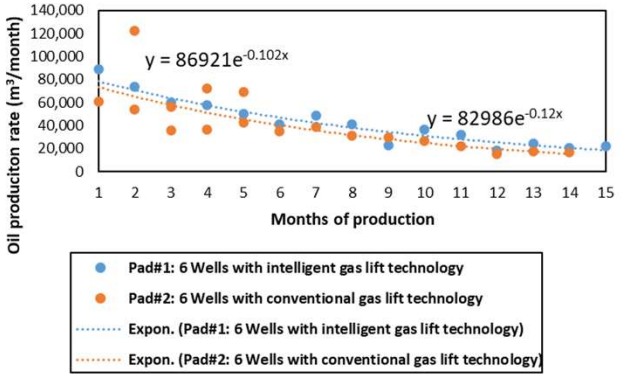
Methodology

- Oil, liquid, and gas production are compared.
- Normalized production:

$$Normalized\ production = \frac{Production}{Length\ of\ horizontal\ section}$$

- Decline curve analysis is investigated:



$$Fitted\ curve\ for\ Pad\#1\ (\mathbf{blue}) = A \times e^{B},$$

$$Fitted\ curve\ for\ Pad\#2\ (\mathbf{orange}) = C \times e^{D}$$

$$decline\ curve\ analysis = sum\left(\frac{A}{C}, \frac{D}{B}\right) - 2$$

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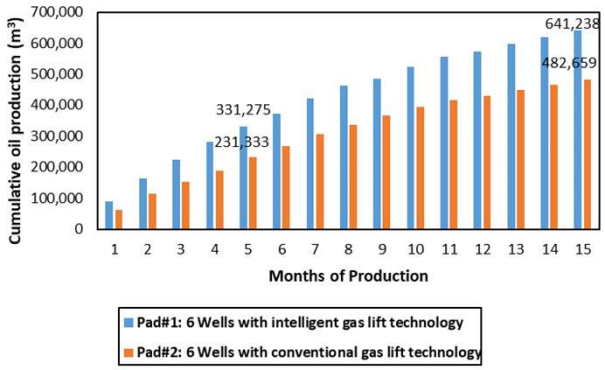
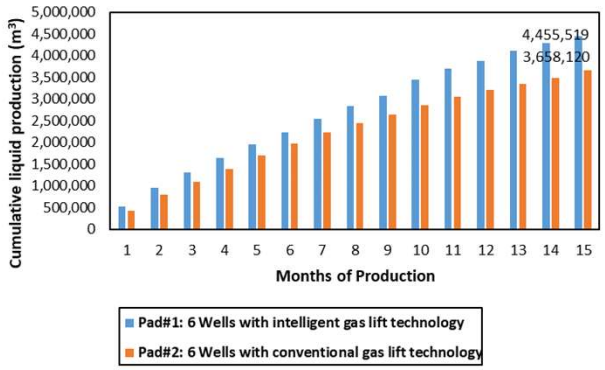
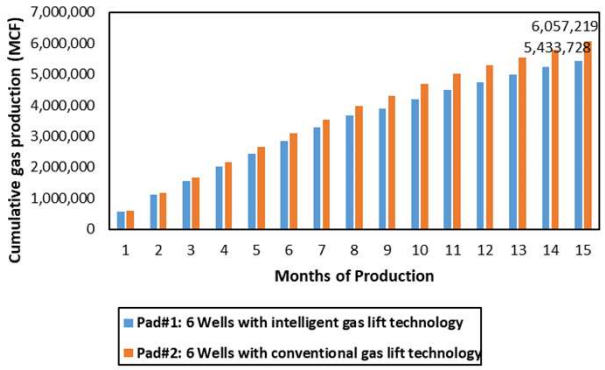
Results

Cumulative Production



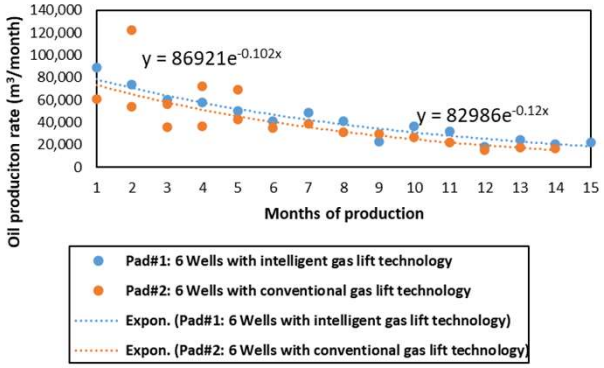


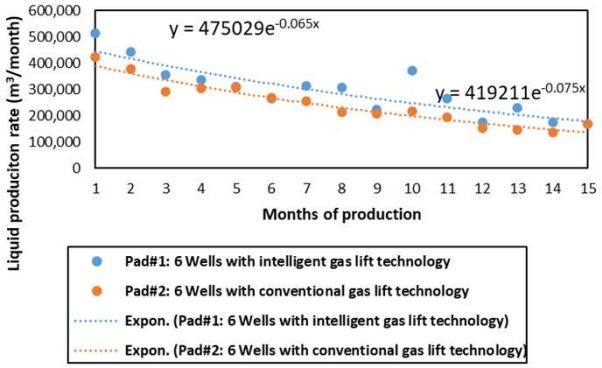


- Cumulative oil production:
  - First five months (normalized): Pad#1 produced 27,869 bbls more oil as 46% (53%), superior profit of over $9.00 Million, leading to NPV as $6.60 Million to $20.90 Million.
  - 18 Months: Pad#1 produced 158,579 bbls more oil as 33% (38%), superior profit of over $13.00 Million, leading to NPV as $30.60 Million to $10.80 Million.
- Cumulative liquid production:
  - 18 months (normalized): Pad#1 produced 797,399 bbls more liquid as 22% (24%).
- Cumulative gas production:
  - 18 months (normalized): Pad#2 produced 623,491 MCF more gas as 10% (11%).

Results

Decline Curve





- Oil production rate:
  - Pad#1 was 22% more successful to prevent decline in the oil production curve.
- Liquid production rate:
  - Pad#1 was 29% more successful to prevent decline in the liquid production curve.

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Comparisons and Conclusions

	Pad#1 compared to Pad#2
Operators	The same company
Formation	The same Wolfcamp benches
TVD vs MD	Pad#2 is drilled deeper as 1% (174 ft). Pad#2 is longer as 5% (874 ft)
Completion	The same volume
HF stages	Less 5% (2.5) stages performed
Water consumed for HF (gal)	More 8% (39,248 gal) consumed
Oil production (normalized) (bbls)	5 months: more 46% (53%) produced
	15 months: more 33% (38%) produced
Profit (NPV)	5 months: Over $9.00 Million more profit ($6.60 Million)
	15 months: Over $13.00 Million more profit ($10.80 Million)
Liquid production (normalized) (bbls)	More 22% (24%) produced

- With Intelligent Surface-Controlled Gas Lift:
  - Higher rate of investment return.
  - Consistent higher oil production vs conventional gas lift technologies.

Intelligent Remote-Controlled Gas Lift:
↑ Oil/ Liquid/ Gas Production ↑ Rate of Investment Return

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Question Time

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