Automation In the Illinois Basin- A Unique Solution for Low Volume Wells

Agenda

- Introduction
- Digital Transformation
- Timeline of CountryMark's Automation Initiatives
- SMARTEN Pump Off Controllers
- XSPOC™ Production Optimization Platform
- Lorentz Pumps
- Automatic Tank Gauging
- Vehicle Monitoring
- Conclusion

Commitment to Innovation and Automation

Digital transformation is how organizations use technology to solve traditional problems.

Rather than enhance traditional methods, digital solutions enable new types of innovation and creativity.

DIGITAL TRANSFORMATION IN OIL & GAS

What Drives the Commitment to Innovation and Automation

- Provides employees time for higher value add tasks
- Drives operational efficiencies
- Lends to safer operations
- Offers insight into possible shortcomings
- Completely aligns with CountryMark company values

2018
First 8 POC's were installed.

2020
Samsara implemented.

2022
~55 POC's. XSPOC implemented. First (A)uto (T)ank (G)auging equipment installed.

2023
~45 POC's. First Lorentz pumps installed. First automated chemical batch treating skids installed.

2024
~ 35 POC's. 3 Lorentz pumps.

Developing the Right Fit is Critical

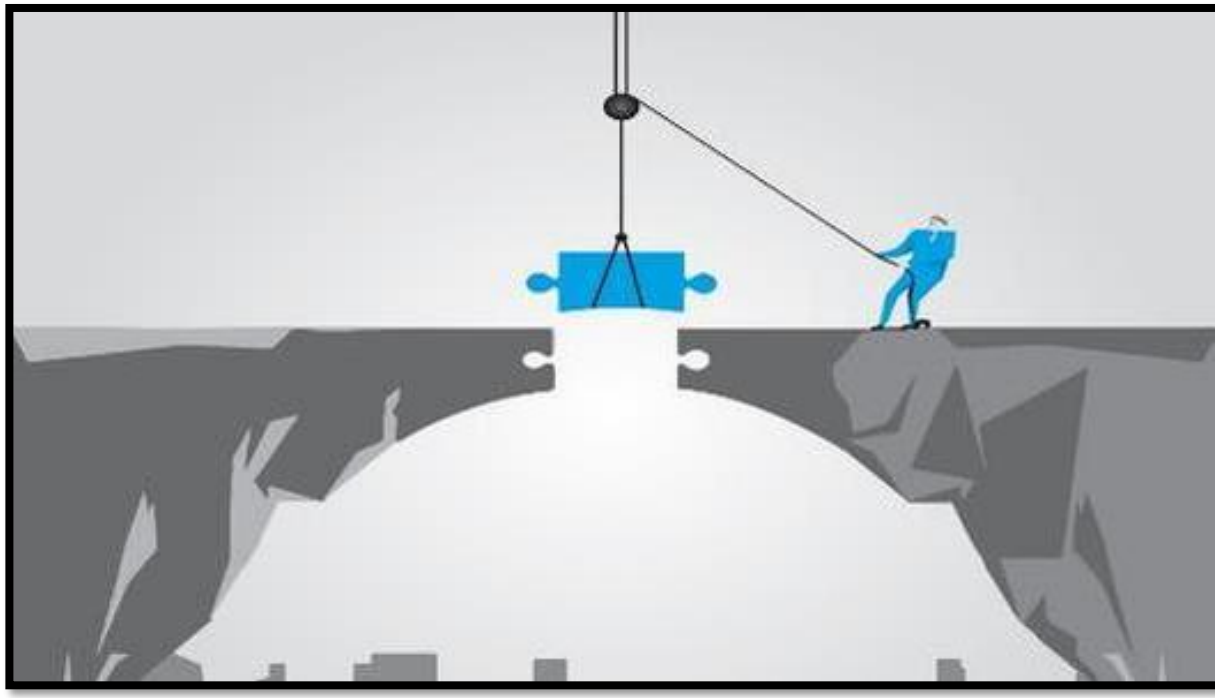
- Automation is not one size fits all
- Finding the solution that works for you is critical
- Definition of goals is critical

LORENTZ

XSPOC

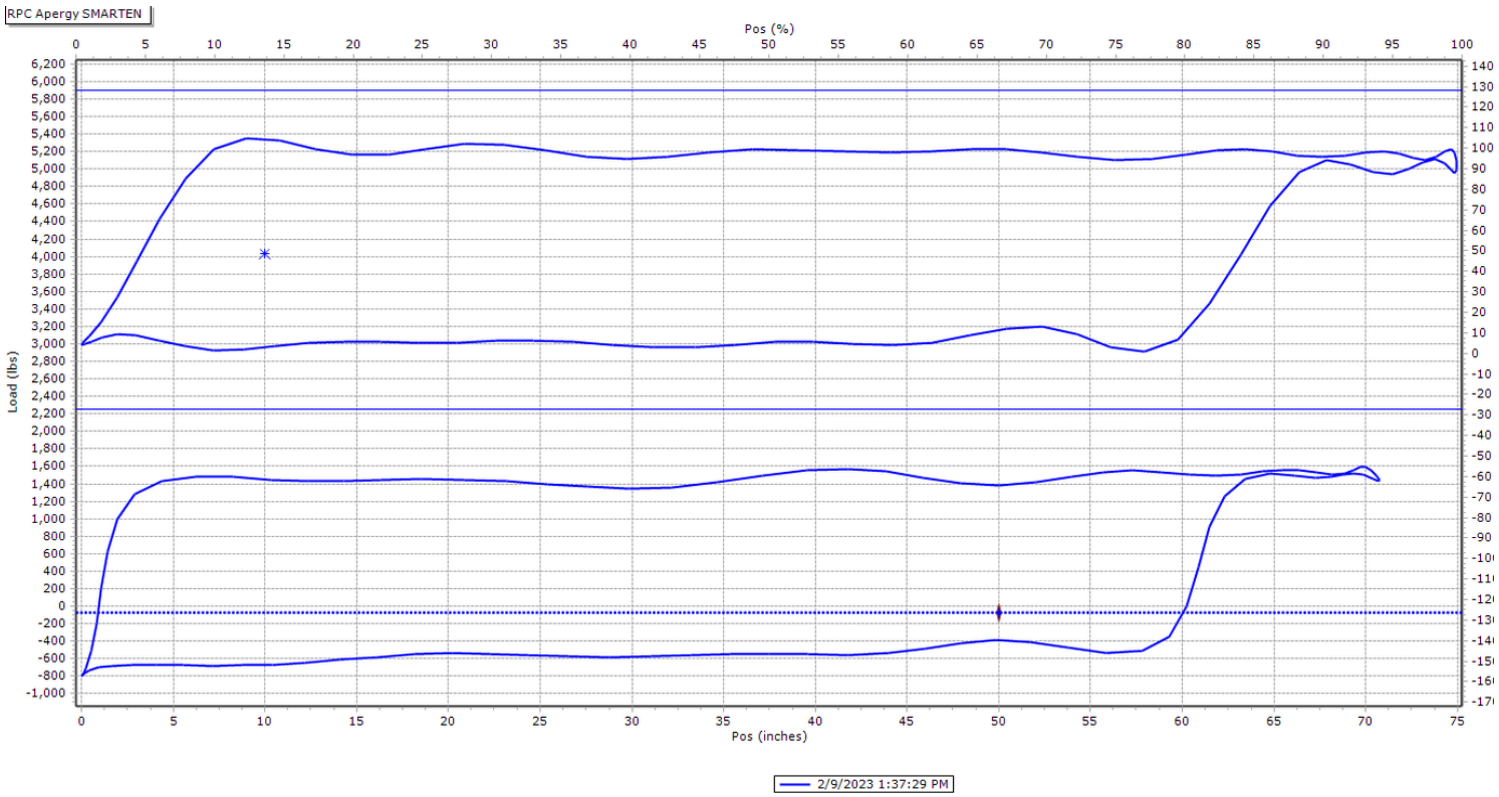
PETROPOWER
THE POWER OF KNOWING

samsara



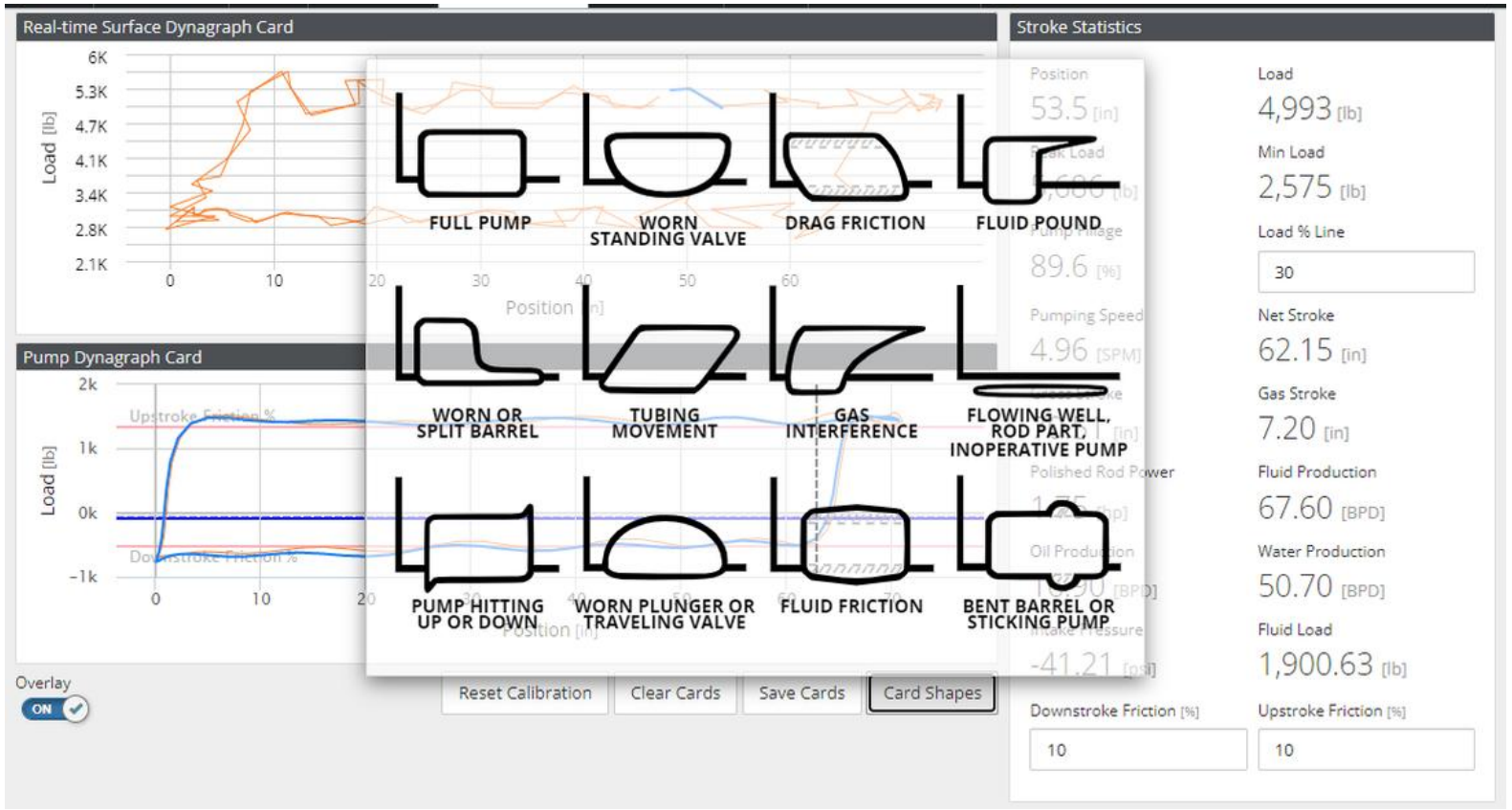
POCs Explained

- Devices measure load and position
- POC plots measured data to create a surface dynamometer
- Gibbs wave equation used to transform to downhole pump card
- Well shut down when pump off detected or load violation



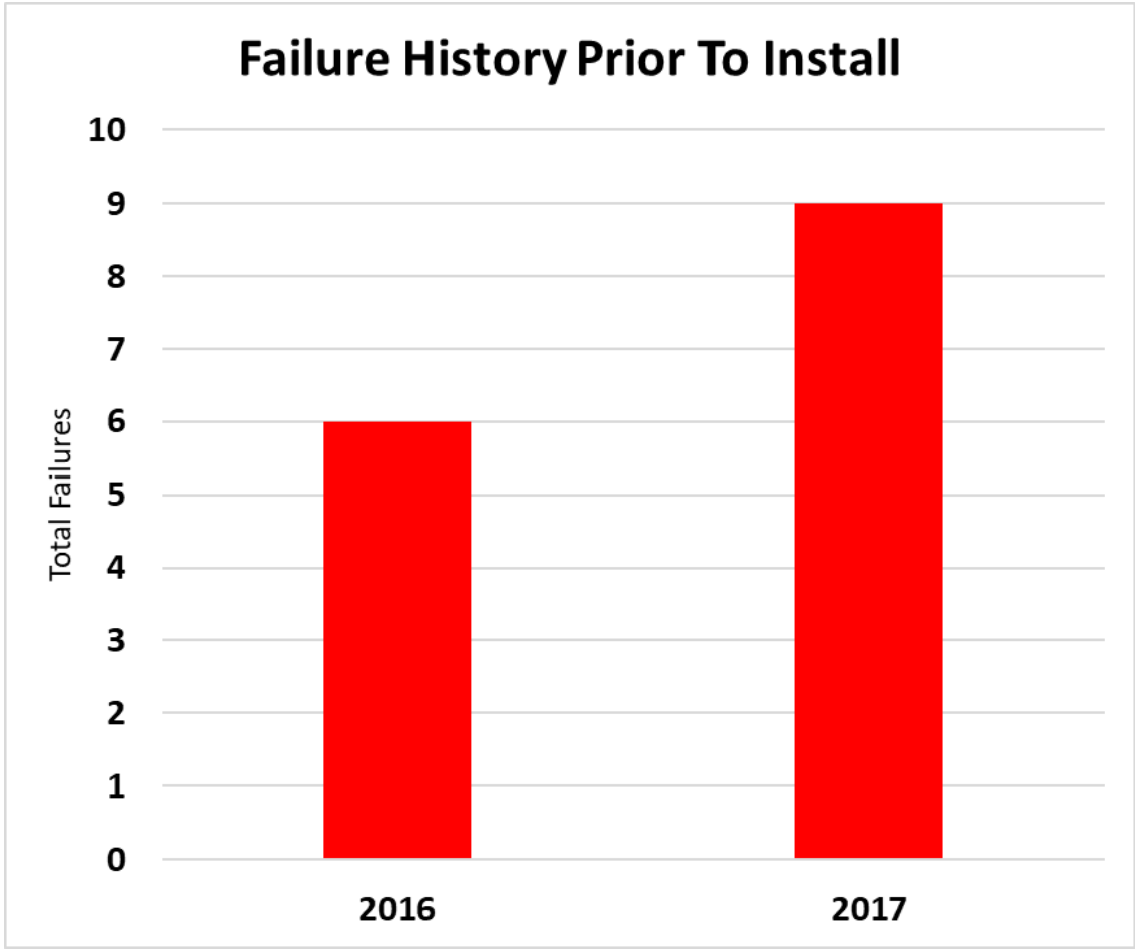
Benefits of POCs

- Limits damage from fluid pound
- Reduces electric consumption
- Allows lease operator to better diagnose downhole issues
- Allows for optimal downtime



CountryMark's First POC Deployment

- Sesser Unit in Franklin Co., IL
- 8 producers, ninth drilled 2018
- 1 well had dedicated electric meter
- Failure rate of 0.9 failures per well per year
- POCs installed summer 2018



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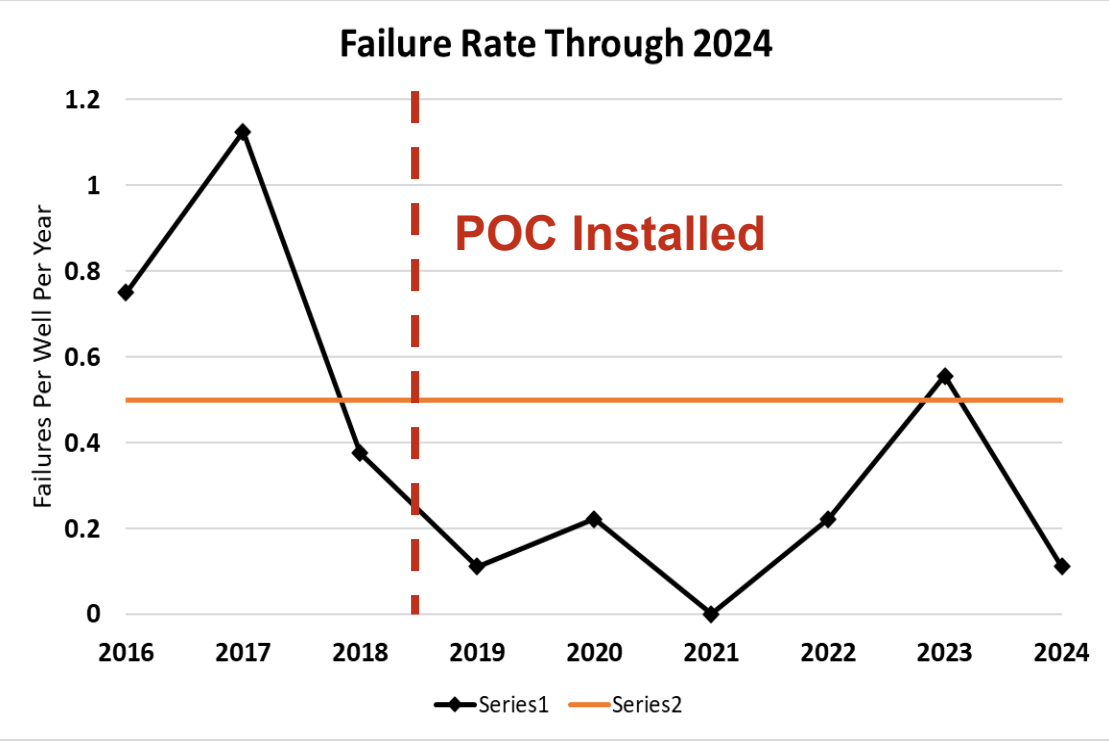
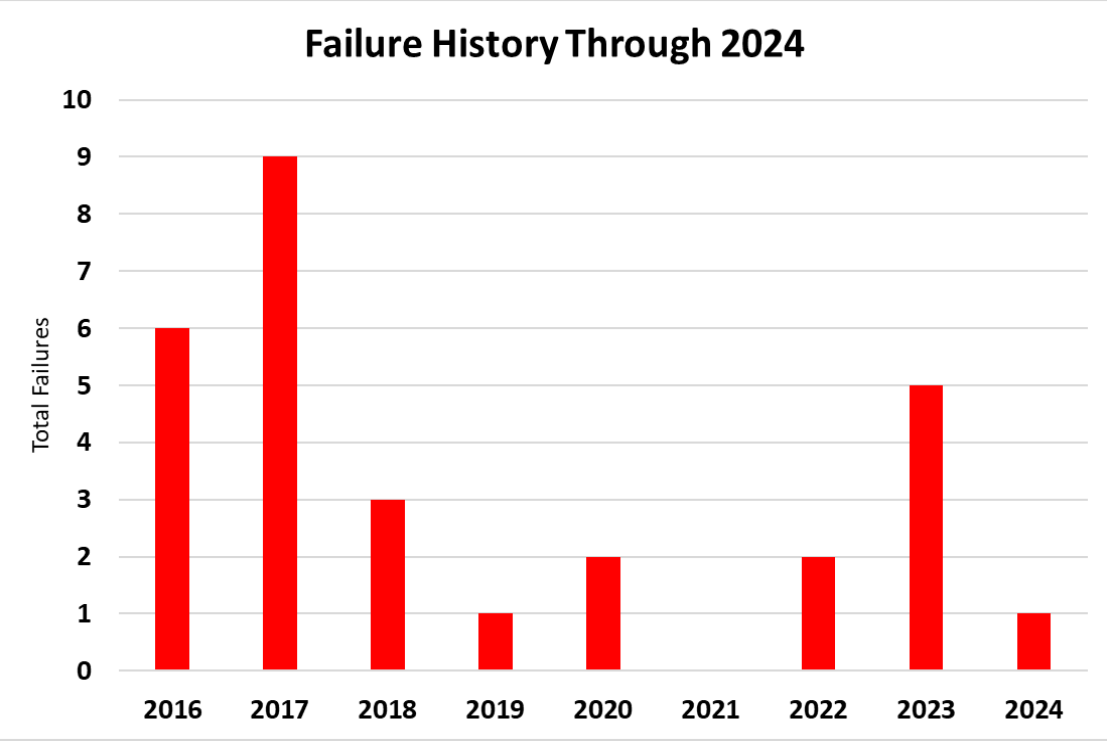
Pilot Results Better Than Expected





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The Challenge With Expansion

- Optimizing individual wells on-site time consuming
- Removed technical employee from higher value-add tasks
- Needed a solution that
  - *Cost effective yet secure*
  - *Remote optimization*
  - *Easily scalable*
  - *Mobile capabilities*

XSPOC™ Checked All The Boxes

- XSPOC™ Production Optimization Software
- All forms of artificial lift
- Integrated seamlessly with SMARTEN POCs installed at Sesser Unit, including a “SMARTEN Live” view
- Met IT security requirements

Benefits of XSPOC™

Maximize productivity

- Increase production of suboptimal wells
- Quickly and easily identify uplift opportunities

Do more with less

- Reduce resource constraints
- Focus people on the right assets at the right time
- Manage by exception

Lower expenses and risks

- Less visits to wellsite with remote monitoring
- Optimize energy consumption
- Avoid failures and extend run time

Daily Status Report Email

Well	Enbld	Comm	Run Status	TIS	Alarms	Comment	%RT	%RTY	Cycl	Ycycl	Pump Cond	Oil	Last Good Scan
Click...													
SWRU 13		OK	Idle, HOA in Off	7.0 h	HOA in Off		53	100	1	0	Bent pump barrel or sticking plunger.	3	02/15/23 03:09:07 PM
SWRU 14		OK	Running - Pu...	19.1 d	OK		100	100	0	0	Bent pump barrel or sticking plunger.	13	02/15/23 03:09:18 PM
SWRU 3		OK	Running - Mini...	0 m	OK		20	25	13	21	Fluid pound.	4	02/15/23 03:08:35 PM
SWRU 38					HOA in Off		0	0	3	0		0	03/24/22 02:15:12 PM
SWRU 45		OK	Running - VFD...	1 m	OK		70	78	18	21	Pump hitting down.	26	02/15/23 03:09:21 PM
SWRU 46		OK	Idle - Pumped...	13 m	OK		55	56	27	42	Pump hitting down.	35	02/15/23 03:09:23 PM
SWRU 47		OK	Idle - Pumped...	3 m	OK		9	9	34	52	Fluid pound.	2	02/15/23 03:09:17 PM
SWRU 48		OK	Running - VFD	1.3 h	OK		98	94	3	6	Full pump.	4	02/15/23 03:09:26 PM
SWRU A-10		OK	45	2 m	OK		30	29	25	41	Full pump.	2	02/15/23 03:09:28 PM
SWRU A-11		OK	Idle - VFD Slo...	2 m	OK		36	37	38	61	Incomplete pump fillage.	1	02/15/23 03:09:30 PM
SWRU A-14		OK	Running, HOA...	7.3 h	OK		50	2	4	15	Fluid pound.	1	02/15/23 03:08:37 PM
SWRU B-10		OK	Running - VFD	19.1 d	OK		100	100	0	0	Fluid pound. High rod-tubing friction.	2	02/15/23 03:08:39 PM
SWRU B-11		OK	Idle - Pumped...	1.2 h	OK		19	17	7	12	Full pump.	2	02/15/23 03:08:41 PM
SWRU B-13					HOA in Off		0	0	1	0		0	03/24/22 01:44:55 PM
SWRU B-14		OK	Running - Pu...	19.1 d	OK		100	100	0	0	Incomplete pump fillage. Pump hitting down.	3	02/15/23 03:09:14 PM
SWRU C-11		OK	Running - Pu...	2 m	OK		52	24	31	72	Full pump.	3	02/15/23 03:08:43 PM
SWRU D-10		OK	Running - Pu...	19.1 d	OK		100	100	0	0	TV leak. Pump hitting down.	11	02/15/23 03:08:46 PM
SWRU E-10		OK	Running - Pu...	5.3 d	OK		100	100	0	0	Full pump.	5	02/15/23 03:08:48 PM
SWRU F-10		OK	Running - VFD	20 m	OK		69	69	19	30	Fluid pound.	21	02/15/23 03:08:52 PM
SWRU F-9		OK	Running - VFD	2.0 d	OK		100	100	0	0	Fluid pound. Pump hitting up.	1	02/15/23 03:08:50 PM
SWRU G-10		OK	Idle - Pumped...	38 m	OK		19	17	11	18	Fluid pound.	9	02/15/23 03:08:54 PM
SWRU G-11		OK	Running - Pu...	2.7 h	OK		28	24	8	13	Severe pump wear or rod part.	2	02/15/23 03:09:05 PM
SWRU G-12		OK	Idle - Pumped...	6 m	OK		71	75	10	12	Full pump. Phase shift in dyno card.	11	02/15/23 03:09:09 PM

Artificial Intelligence Optimizing Setpoints

Asset	Setpoint	Mode	Current	Recommended	Info
SWRU 14	Peak Load		10700	9900	Decrease the peak load setpoint to 9900 to protect equipment from pumping with unusally high loads.
SWRU 14	Malfunction		5900	7337	Increase the malfunction load setpoint to 7337 to protect equipment from pumping with unusually low loads or rod parts.
SWRU 45	Peak Load		9200	10200	Increase the peak load setpoint to 10200 to avoid unwanted well shutdowns.
SWRU 45	Malfunction		6701	7202	Increase the malfunction load setpoint to 7202 to protect equipment from pumping with unusually low loads or rod parts.
SWRU 47	Minimum Load		4100	2900	Decrease the minimum load setpoint to 2900 to avoid inadvertent well shutdowns.
SWRU 47	Peak Load		8600	11500	Increase the peak load setpoint to 11500 to avoid unwanted well shutdowns.
SWRU 47	Malfunction		6517	8649	Increase the malfunction load setpoint to 8649 to protect equipment from pumping with unusually low loads or rod parts. Malfunction setpoint is currently disabled, implementing setpoint recommendations will enable the setpoint.
SWRU A-10	Malfunction		5450	5706	Increase the malfunction load setpoint to 5706 to protect equipment from pumping with unusually low loads or rod parts. Malfunction setpoint is currently disabled, implementing setpoint recommendations will enable the setpoint.
SWRU A-11	Malfunction		6019	6751	Increase the malfunction load setpoint to 6751 to protect equipment from pumping with unusually low loads or rod parts.
SWRU B-10	Base Fill Line		30	25	Move the base fill setpoint to 25% to more accurately calculate POC pump fillage
SWRU B-10	Minimum Load		3100	4900	Increase the minimum load setpoint to 4900 to protect equipment from pumping with unusually low loads.
SWRU B-10	Malfunction		9393	11379	Increase the malfunction load setpoint to 11379 to protect equipment from pumping with unusually low loads or rod parts. Malfunction setpoint is currently disabled, implementing setpoint recommendations will enable the setpoint.
SWRU B-14	Malfunction		6493	8120	Increase the malfunction load setpoint to 8120 to protect equipment from pumping with unusually low loads or rod parts. Malfunction setpoint is currently disabled, implementing setpoint recommendations will enable the setpoint.

Discovering The Unknowns

- XSPOC™ confirmed what we already thought
- Also shed light on information we didn't expect
- Initially, more questions than answers

Why Lorentz Pumps???

- POC's and XSPOC are great, but have limitations
- Low volume wells benefit, but can be more efficiently pumped

- Lorentz – Submersible Progressive Cavity Pumping Systems
  - *Utilize small downhole DC motors*
  - *Can be run on solar power alone or in tandem with grid tie*
  - *Setpoints are simplified and more directly match deliverability*
  - *Online dashboard interface*
  - *Slow and steady wins the race*

Matching Deliverability

- Stop pump and le
- Set the “Switch P
  the designated flu
- It is that easy!

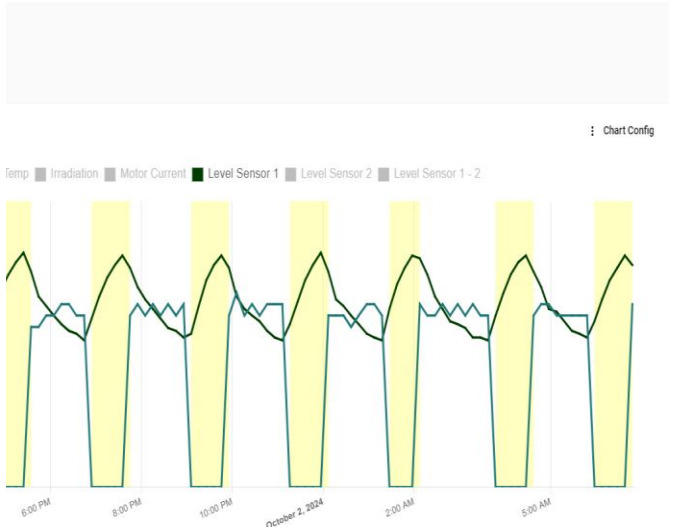
rage
ove*” fields to

Switch pump OFF *below**

15.1

Switch pump ON *above**

24.9



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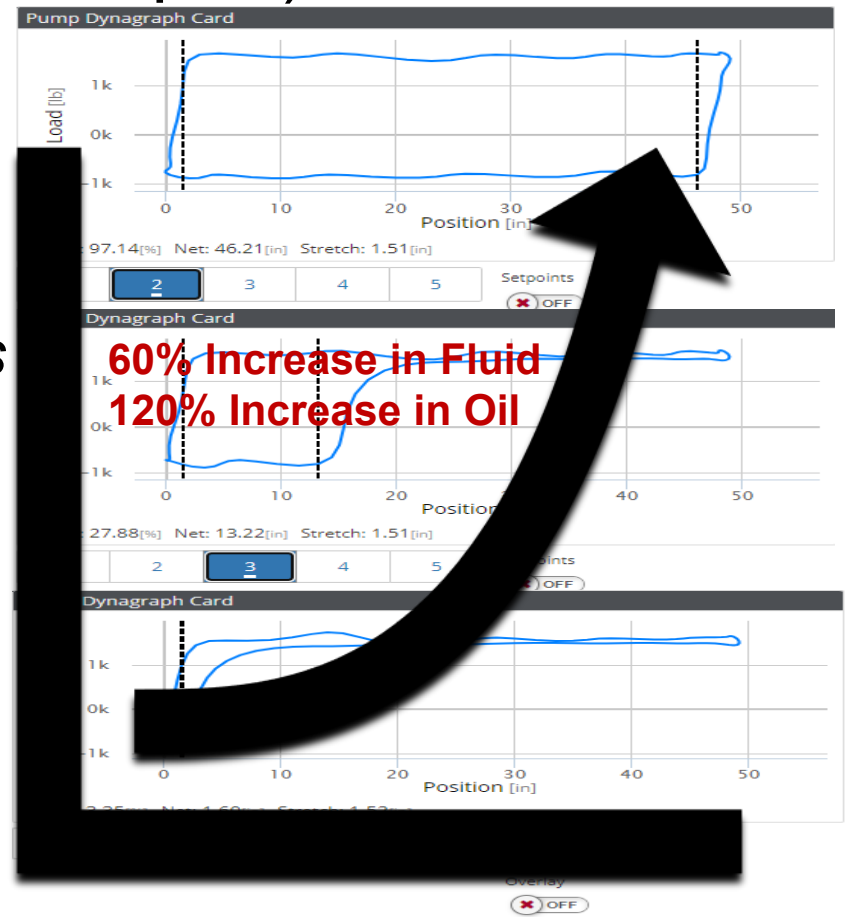
Well 1 Case History

Benoist and Aux Vases Producer (3,030’ to bottom perf)

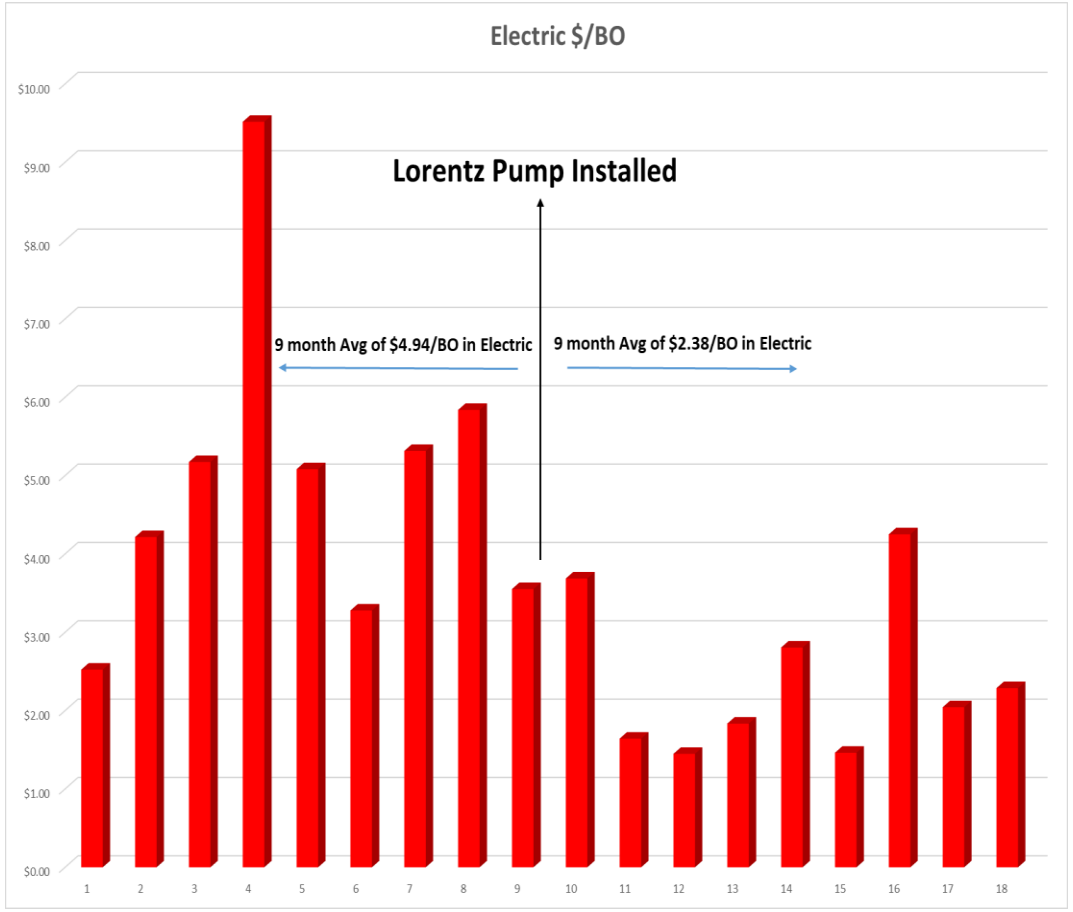
- Pre Lorentz Install
  - *~25 bbls of total fluid/day, 1.25 BOPD*
  - *On POC and XSPOC cycling 70+ times a day*
  - *Full pump card to <10% pump fill in a two strokes*
  - *Pump set at ~3,075’*
- Post Lorentz Install
  - ***~40 bbls of total fluid/day, 2.75 BOPD***
  - *11 cycles per day*
  - *Pump set at ~2,975’*



Well 2 Case History

Aux Vases, St. Louis, and Salem producer (3,598’ to bottom perf)

- Pre Lorentz Install
  - *~10 bbls of total fluid/day, 1.5 BOPD*
  - *Pump set at ~3,563’*
- Post Lorentz Install
  - *~10 bbls of total fluid/day, 1.5 BOPD*
  - *6 cycles per day*
  - *Pump set at ~3,462’*
  - ***52% reduction in electric $/BO***



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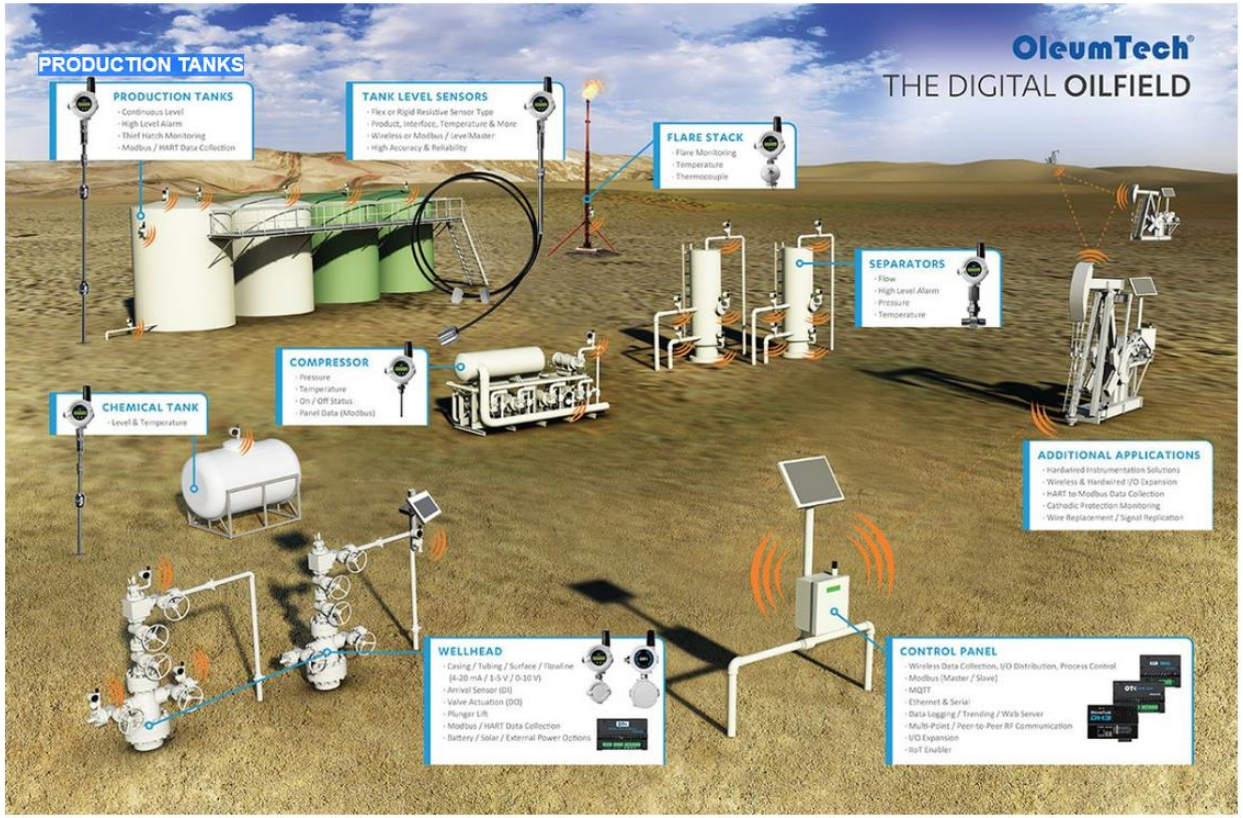
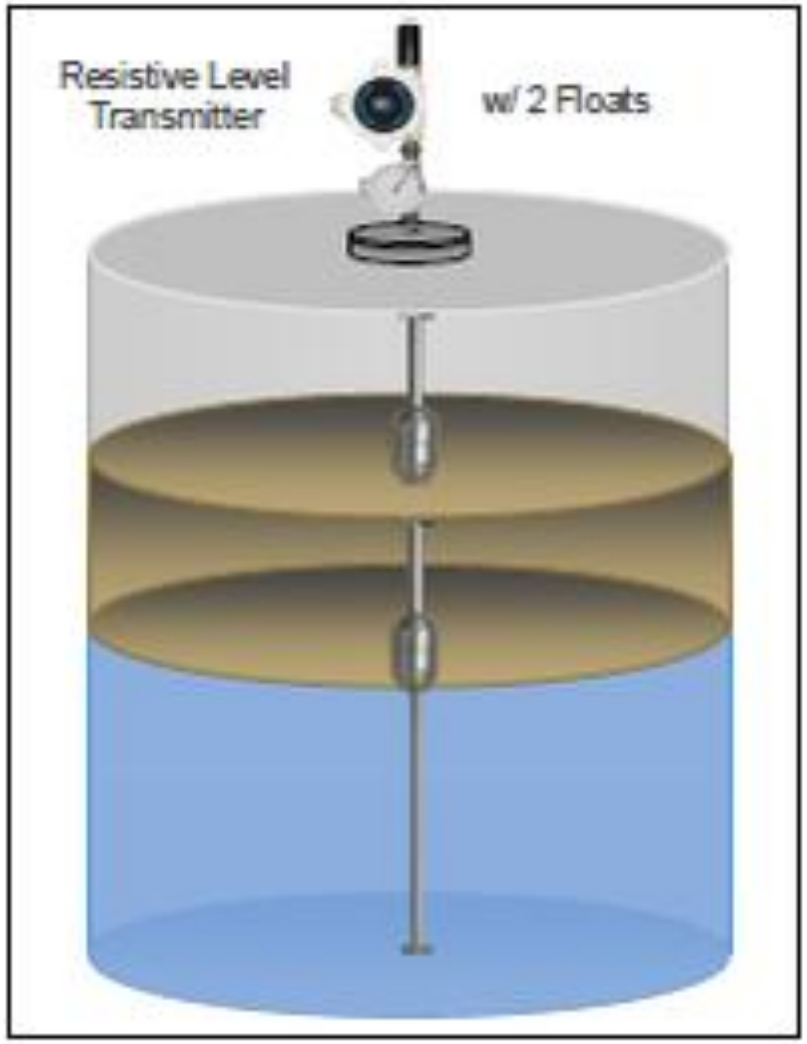
Automated Measurement For Value-Add

- Automation isn't restricted to producers
- Automated tank gauges (ATG) streamline duties
- Remote flow rate and pressure indication ideal for waterfloods
- Limits H_2S exposure



ATGs Shift Lease Operator Focus

- Gauges taken as quickly as every 5 minutes
- Pushed into Production Reporting Software daily
- Emails GaugeMyTank from CountryMark when tank is full
- Full suite of customizable alarms
- Remote visibility



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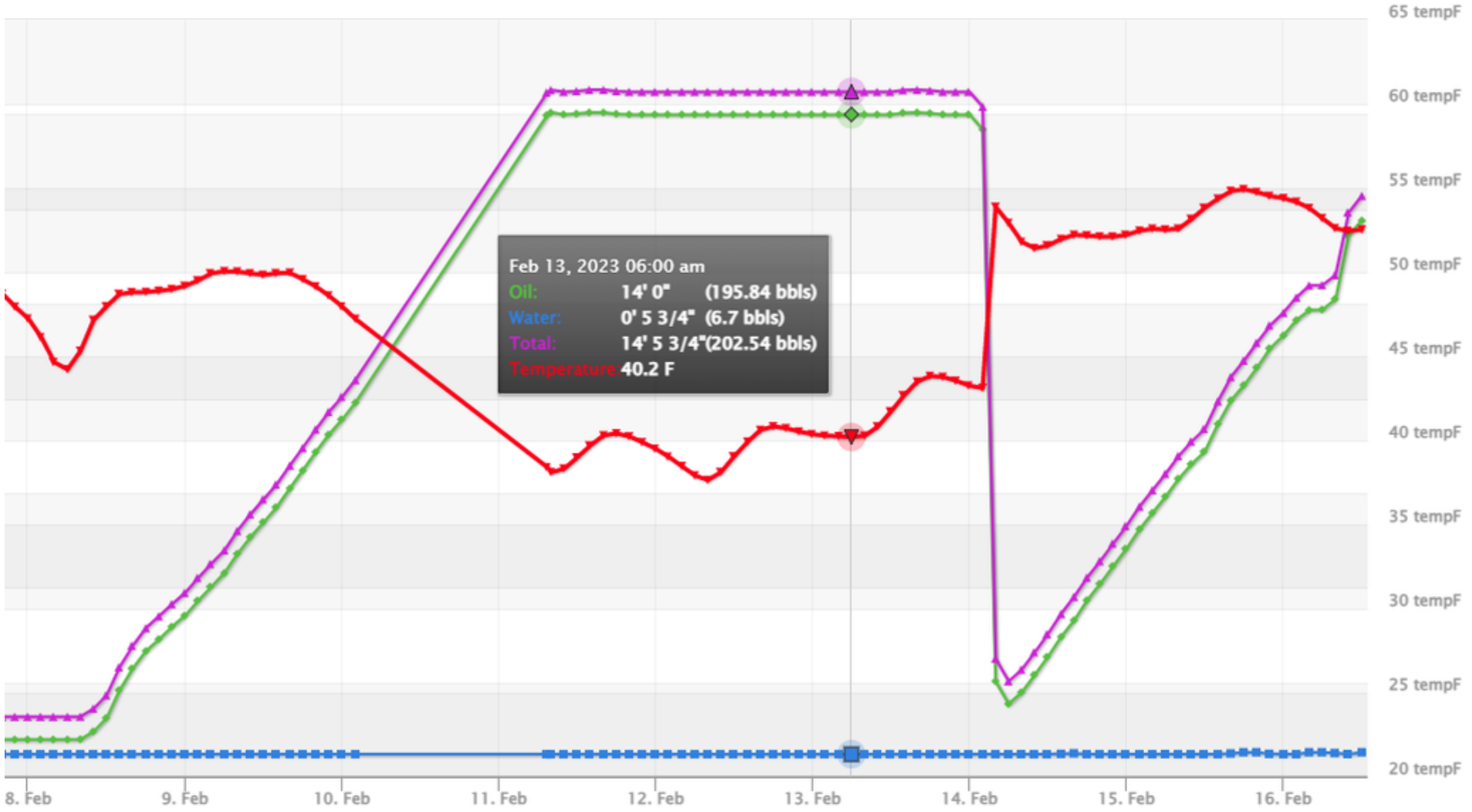
PetroPower Dashboard Provides Tank Insight



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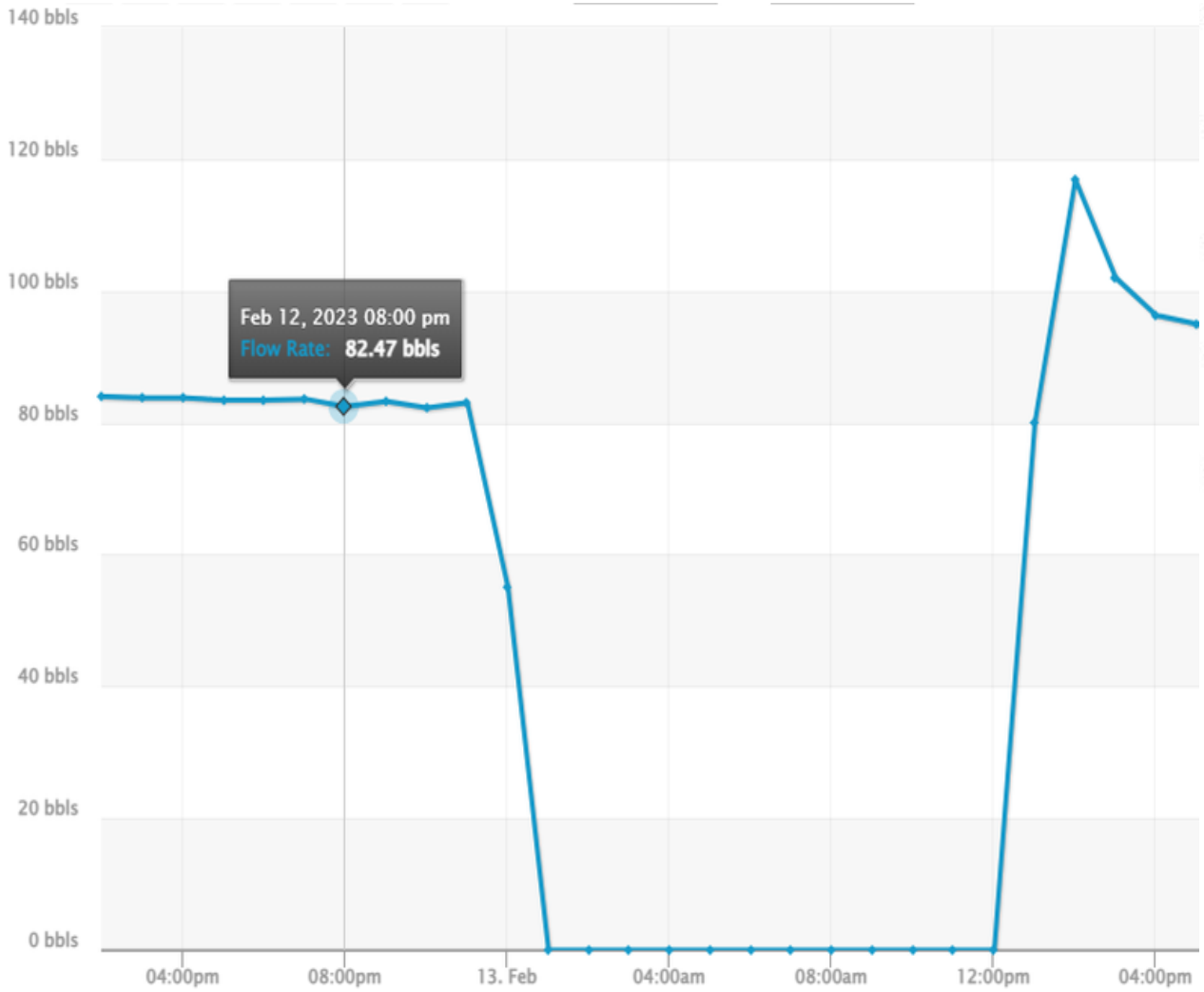
Next Level Waterflood Injector Monitoring



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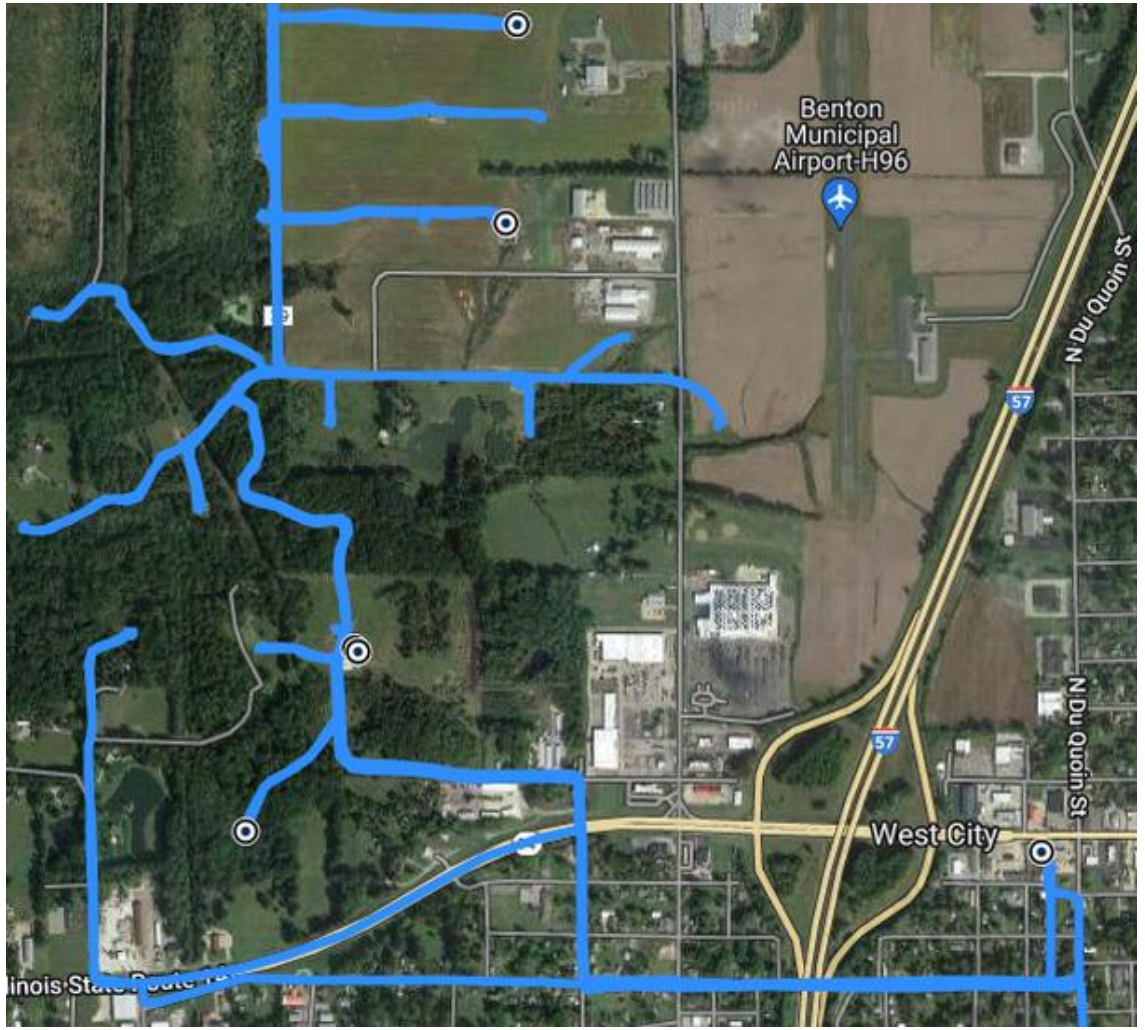
Safety Tied To Automation and Efficiencies

- Safe work is core of daily duties
- ATG's limit exposure to H2S
- Reduced slips, trips, and falls on stairs
- How do we care for the lone worker?

Vehicle Monitoring By Samsara

- Alerts for being stationary too long
- Crash detection
- Vehicle code reporting for maintenance
- Interfacing with public on complaints
- Dispatching employees for emergencies
- Optimizing routes



Tying It Together For The Future

- Pairing PetroPower and XSPOC™ (or Lorentz) for Pumping-By-Exception
- Automated chemical treating with POC
- Lease Operator route optimization with Samsara
- Streamlined crude purchasing with ATG's
- Adapt to changing workforce

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Conclusions

- Automation provides solutions for a multitude of situations
- Low volume wells can benefit despite low revenue streams
- Continual improvement requires some appetite for risk
- Finding the correct solution or combination for each application is imperative
- Automation can help to move personnel to higher value add tasks

Giving Credit Where Credit Is Due

- Special thanks to…
  - *CountryMark*
  - *ChampionX*
  - *OleumTech*
  - *PetroPower*
  - *Samsara*
  - *Lorentz*