

# The Economics of Refracting

Robert Barba and Mark Fleming

September 27, 2023



“Reducing Refrac Risk”

[www.refracs.com](http://www.refracs.com)

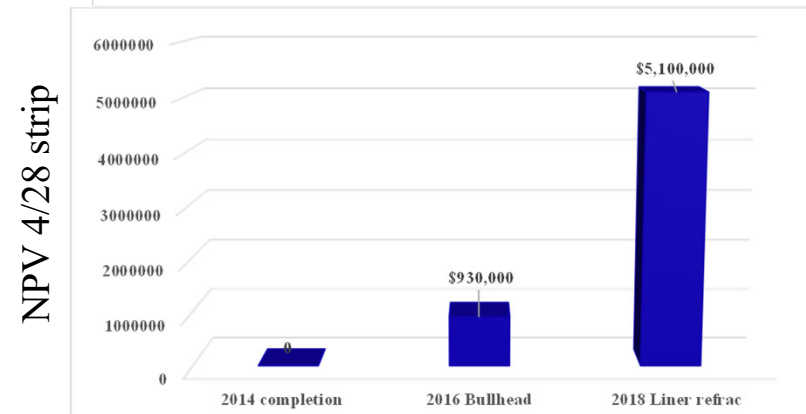
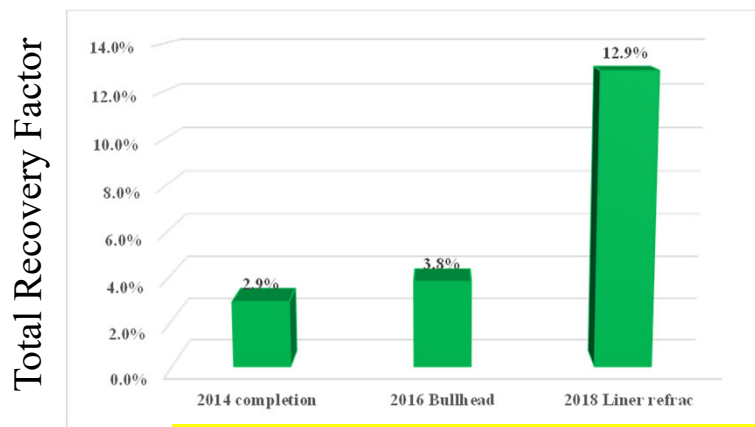
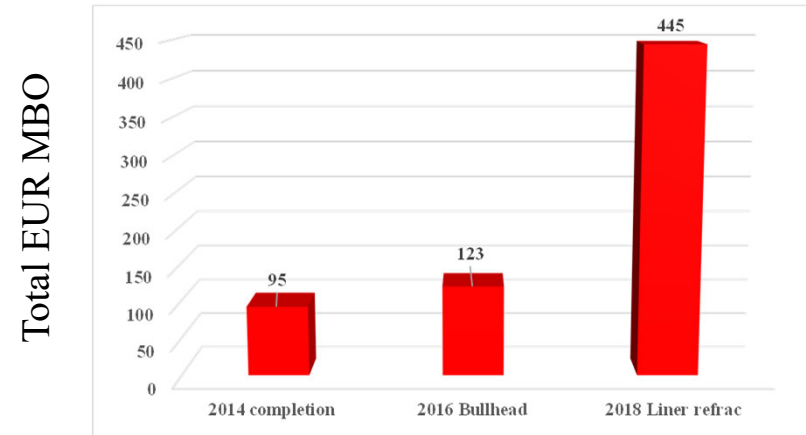
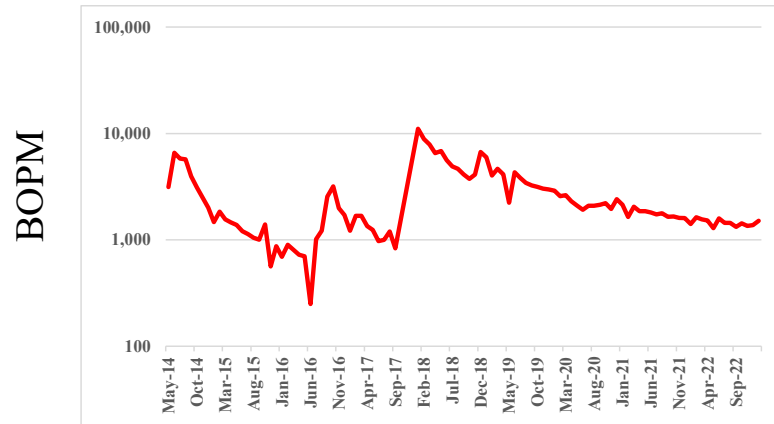
# Refrac Value Increase-Field Level

- Incremental cash flow from the refrac
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- Behind pipe proven refrac candidate zone P1 reserve certification

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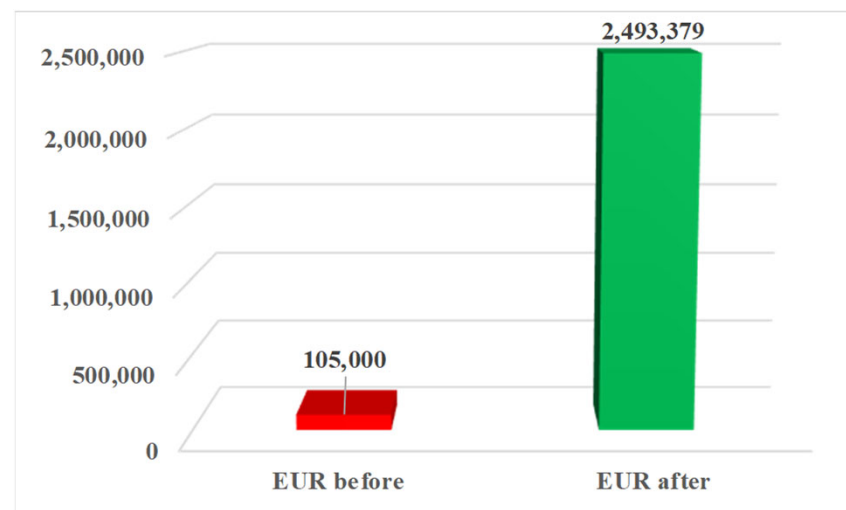
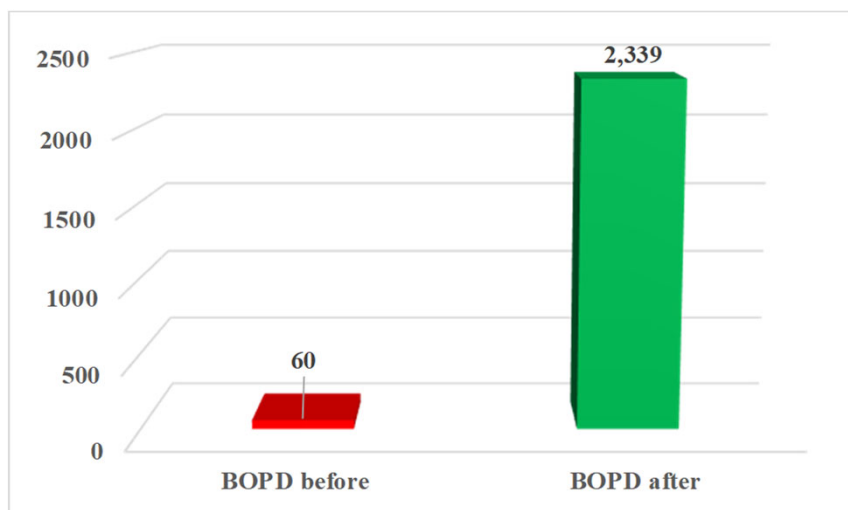
# Eagle Ford Refrac Economics Example



367 MBO post refrac EUR vs 321 MBO actual P50 for EFS, P10 464 MBO  
 Target candidates (excluding parent protection refracs) all above P50 case

# Eagle Ford Entire Pad Refrac Economics

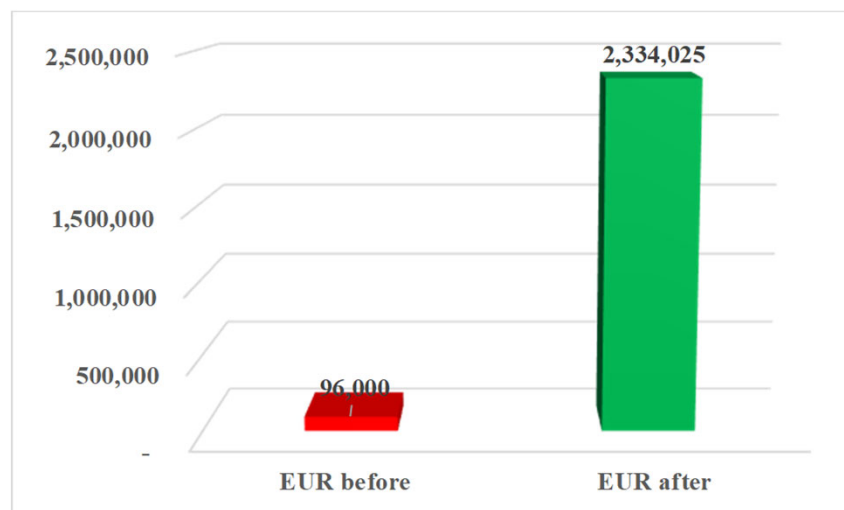
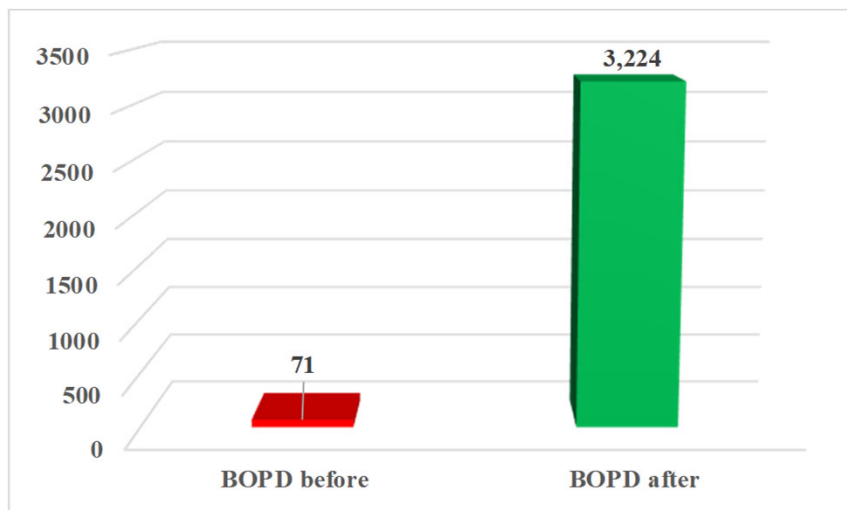
Well	Refrac Oil	Refrac Gas	AFE	Total PV0	NPV	IRR
A	319,334	494,274	\$ 3,999,500	\$ 16,722,715	\$ 6,149,704	77%
B	303,767	279,167	\$ 3,613,250	\$ 15,336,233	\$ 5,740,648	81%
C	288,493	143,703	\$ 3,313,250	\$ 14,174,076	\$ 5,370,459	84%
D	281,843	704,378	\$ 3,305,750	\$ 15,292,994	\$ 5,989,056	92%
E	277,355	162,273	\$ 4,124,000	\$ 13,634,343	\$ 4,241,988	52%
F	262,178	279,531	\$ 3,614,000	\$ 13,140,016	\$ 4,453,037	63%
G	235,526	187,897	\$ 3,163,250	\$ 11,491,686	\$ 3,945,254	64%
H	187,613	150,494	\$ 2,735,750	\$ 8,862,337	\$ 2,835,105	54%
I	183,978	91,662	\$ 3,493,250	\$ 8,516,023	\$ 1,879,359	30%
	<b>2,340,087</b>	<b>2,493,379</b>	<b>\$ 31,362,000</b>	<b>\$117,170,422</b>	<b>\$40,604,611</b>	<b>64%</b>
				<b>3.74</b>	<b>to 1</b>	
				<b>ROI</b>		



# Midland Basin Entire Pad Refrac EURS

## Wolfcamp A

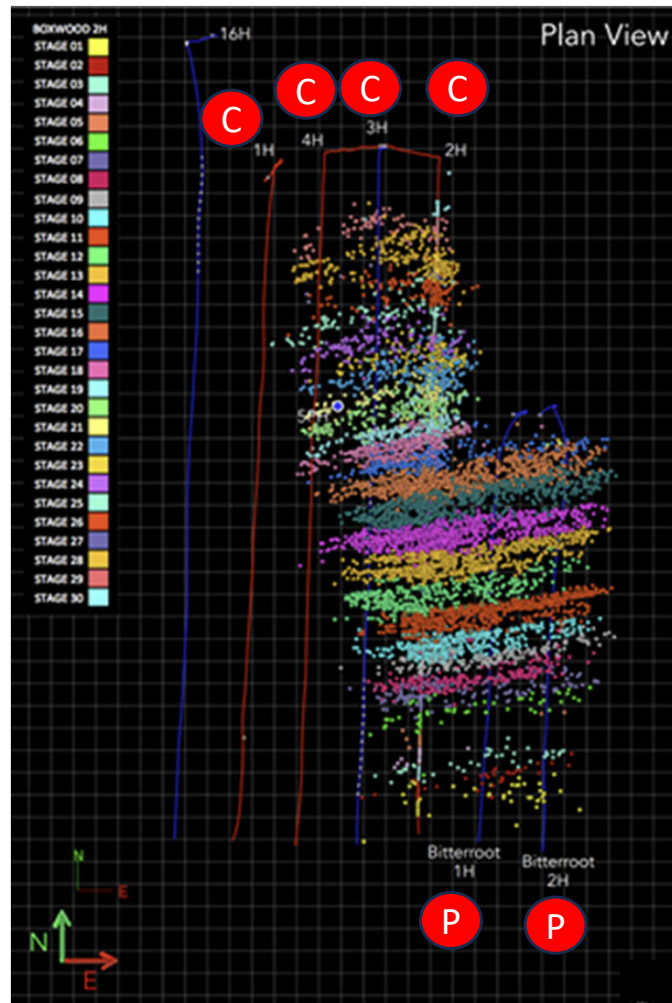
Completed	CSMax RF	Cum Gas	Cum Oil	EUR Oil	EUR Gas	Min OIP	Avg Spcg	RF Total	Total EUR	Refrac EUR	EUR Gas	11/23 BOPD	11/22 MCFD
4/22/2015	40 6.80%	345,912	255,351	285,666	463,358	4,200,966	755	13.7%	575,532	320,181	433,735	0.6	2.3
8/31/2015	40 6.80%	692,375	268,186	493,798	1,657,057	7,261,728	635	12.7%	922,240	654,054	1,688,568	18.2	158.8
2/17/2016	40 6.80%	1,219,243	361,735	606,832	3,238,378	8,923,996	1,002	13.7%	1,222,587	860,852	2,901,539	50.2	407.0
4/20/2016	40 6.80%	343,110	146,536	310,789	643,972	4,570,425	605	12.1%	553,021	406,485	951,774	8.1	86.9
4/20/2016	40 6.80%	411,580	291,304	390,933	504,945	5,749,007	671	13.4%	770,367	479,063	676,862	7.8	11.1
4/20/2016	40 6.80%	364,610	140,671	198,754	466,785	2,922,855	705	13.7%	400,431	259,760	673,281	4.6	15.7
									<b>Total</b>	<b>2,980,396</b>	<b>7,325,760</b>		
									<b>Avg per well</b>	<b>596,079</b>	<b>1,465,152</b>		



# Refrac Value Increase-Field Level

- Incremental cash flow from the refrac
- Protection from 60% EUR losses from offset infill well asymmetric fracs
- Behind pipe proven refrac candidate zone P1 reserve certification

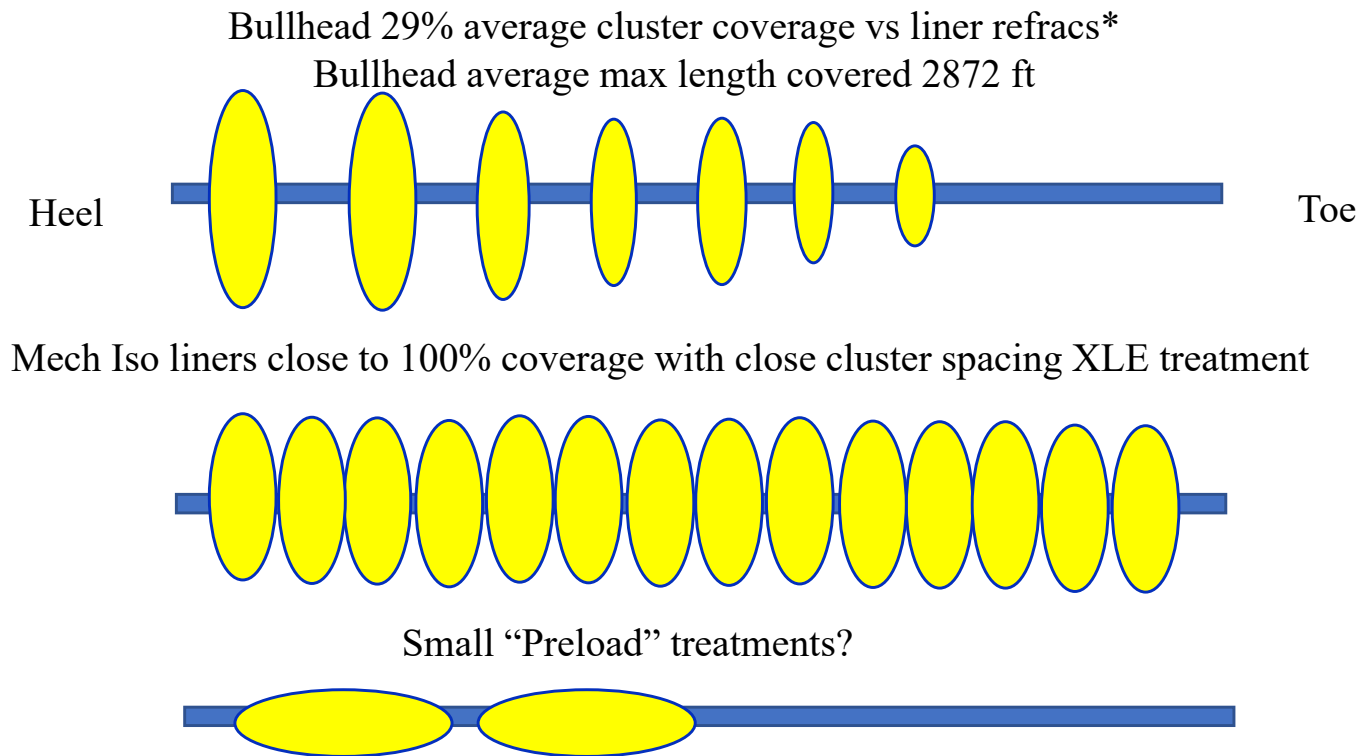
# Infill/Child Well Protection from Asymmetric Fracs



URTEC 5241 HFTS 2  
Delaware Wolfcamp



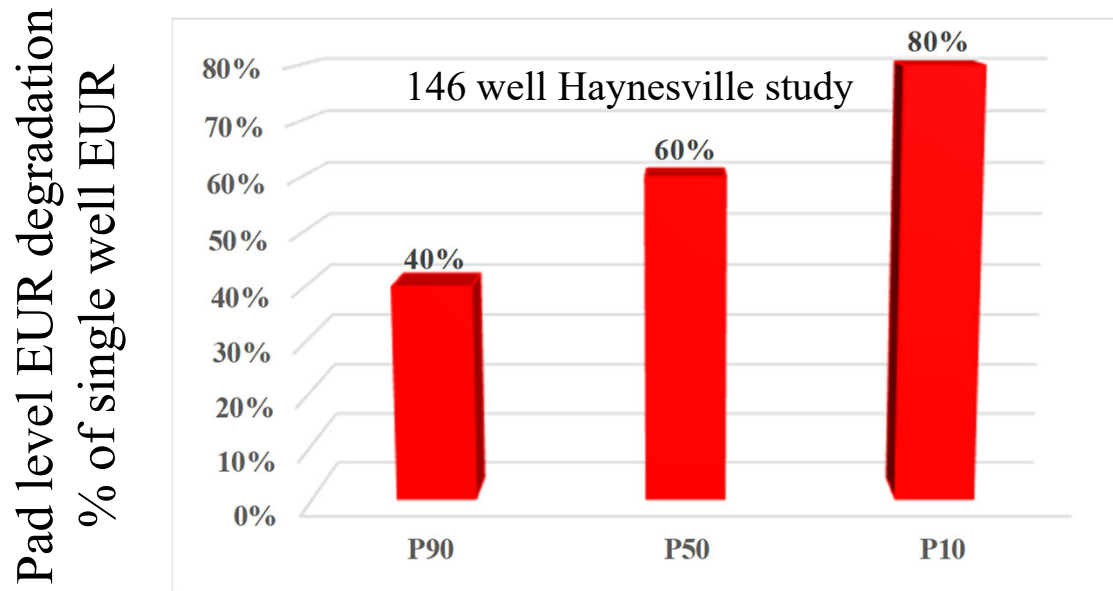
# Liner vs Bullhead Refracs for Infill Child Protection



Minimal far field impact expected with small volume preloads only helps primary wells  
Should have less asymmetric frac protection than larger volume diverted bullheads

\*SPE-174979 Leonard et al

# EUR Loss Without Protective Refracs

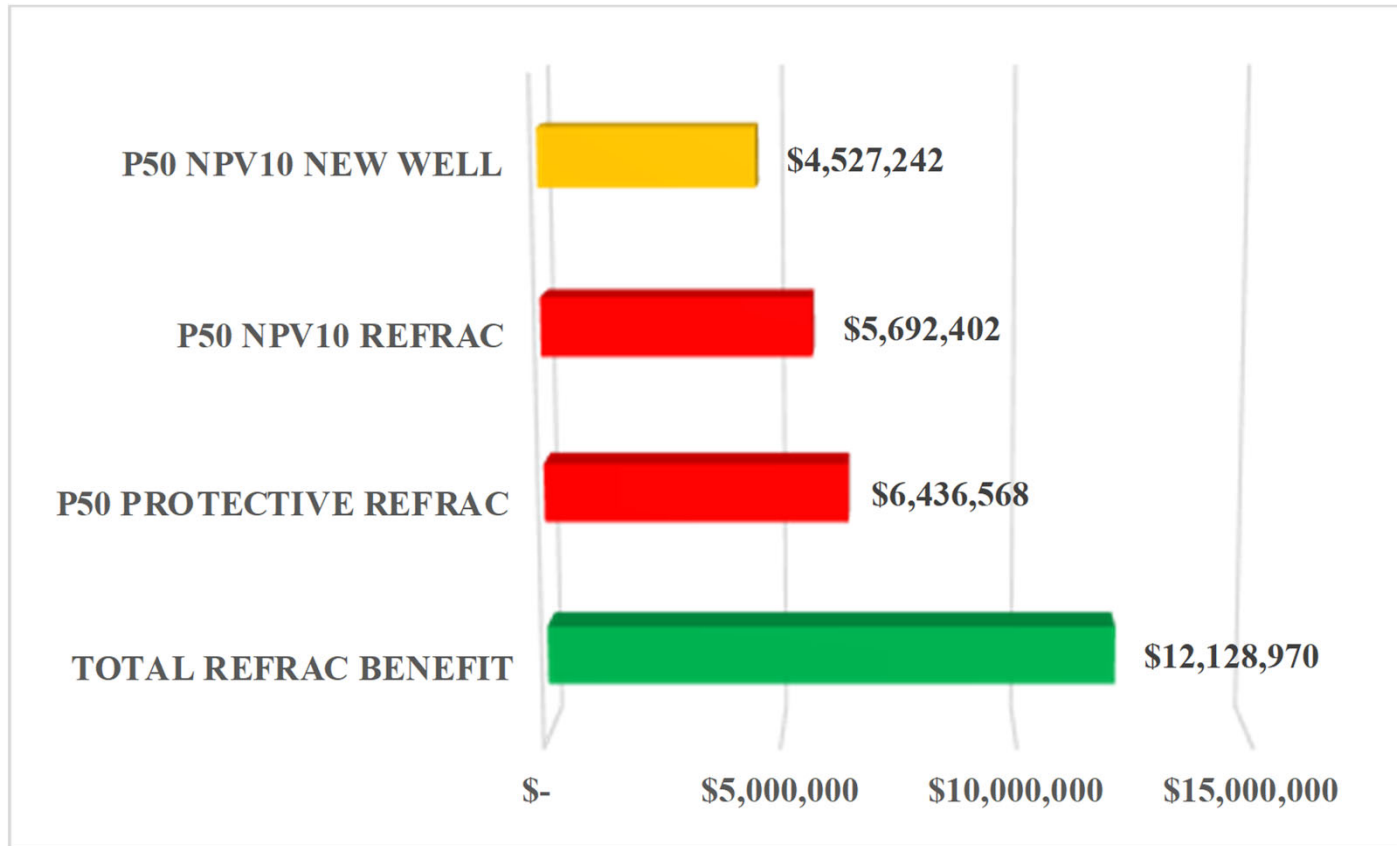


40% estimate made in initial Devon study (Elliott 2019)

Assumes only the 1<sup>st</sup> order is damaged for simplified pad level damage estimation

SPE 213075 indicates damage beyond first order offset

# EFS Refrac vs New Well NPVs

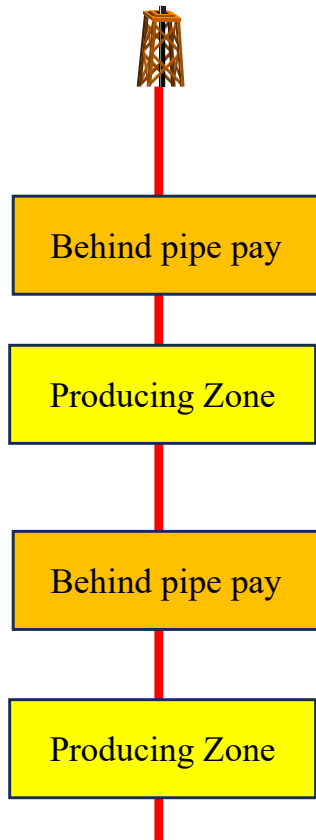


Present asset value

# Refrac Value Increase-Field Level

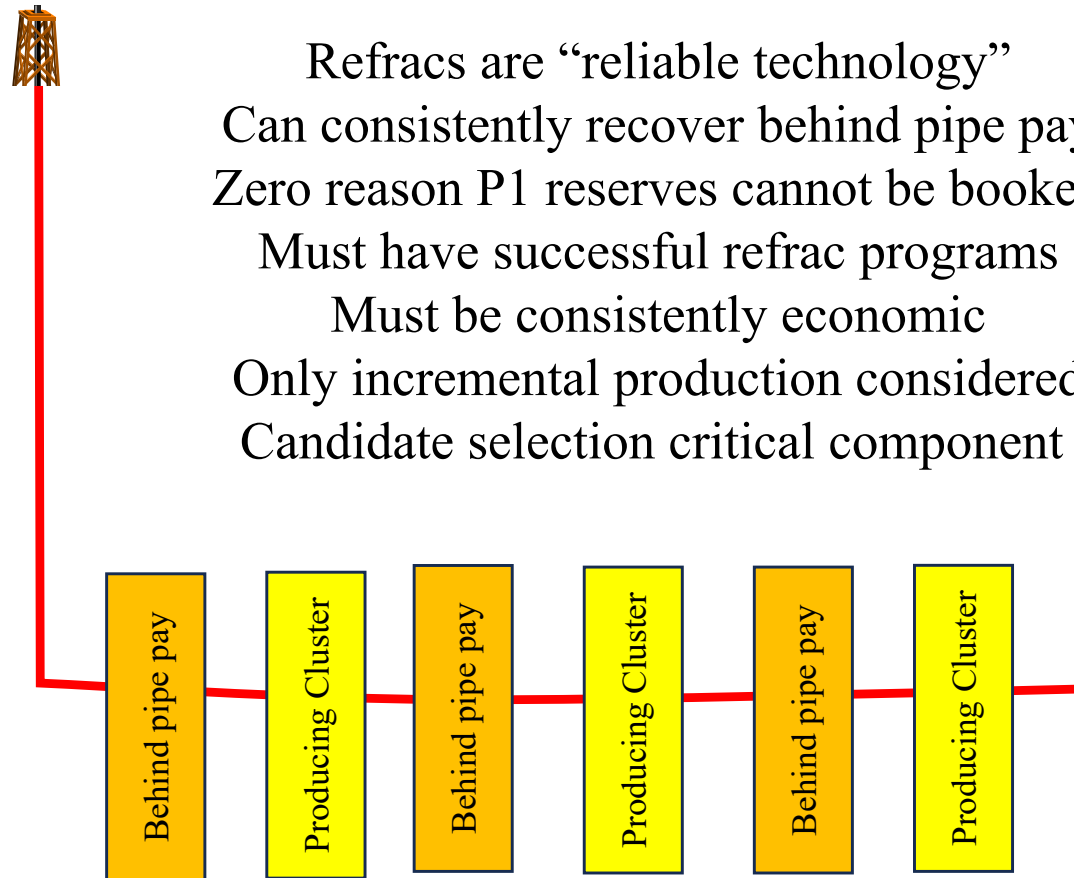
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# Refracs vs Re Completions



Can book P1 reserves  
for behind pipe pay  
PRMS addresses this

Refracs are “reliable technology”  
Can consistently recover behind pipe pay  
Zero reason P1 reserves cannot be booked  
Must have successful frac programs  
Must be consistently economic  
Only incremental production considered  
Candidate selection critical component

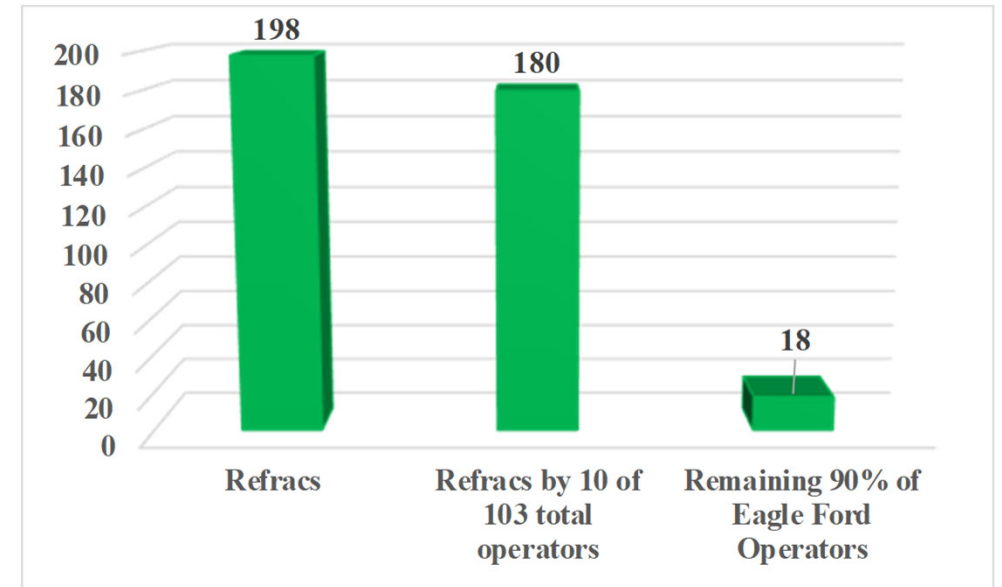
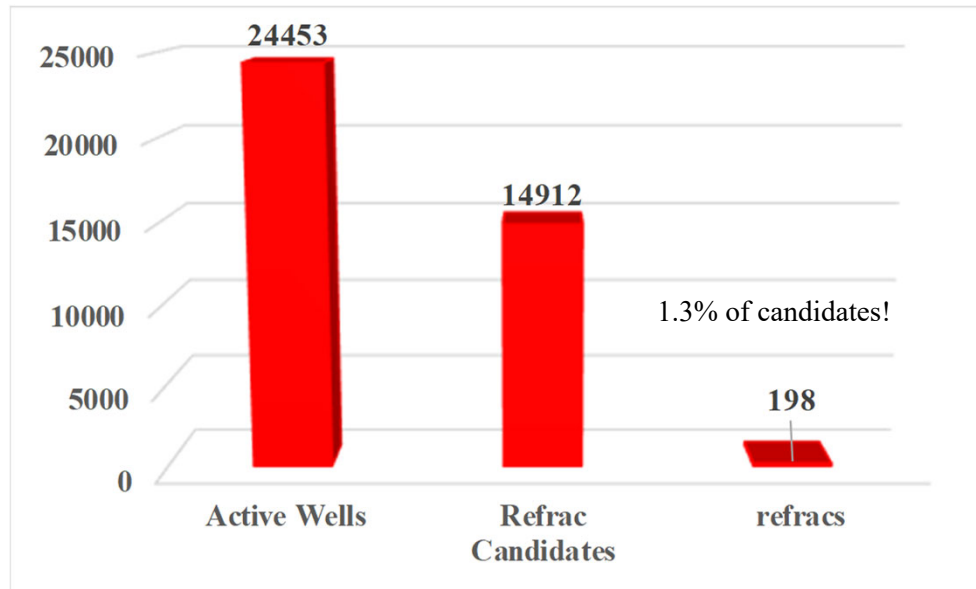


What is the difference between these two scenarios?

# Behind Pipe Reserve Booking

- Majority of wide cluster spacing wells pre-H2 2016
- Over 36,000 wells completed prior to that date in just 5 of the organic shale basins, 15,000 in the Eagle Ford
- Eagle Ford alone PV20 average of \$3,693,260 per well (based on P50 post refrac declines)
- 1% of 15,000 candidates PV20 value \$553,988,987
- Over half a billion dollar benefit per 1% to the industry
- “Money for nothing” isn’t just a song!
- Need consistent economic results for “reliable technology”

# Eagle Ford Refrac Statistics



14,912 wells completed prior to H2 2016 majority with >40 ft clusters  
Refracs sustainable greener process to grow production without rigs

**Q: What can be done to encourage more refrac activity?**

# Reducing Refrac Risk

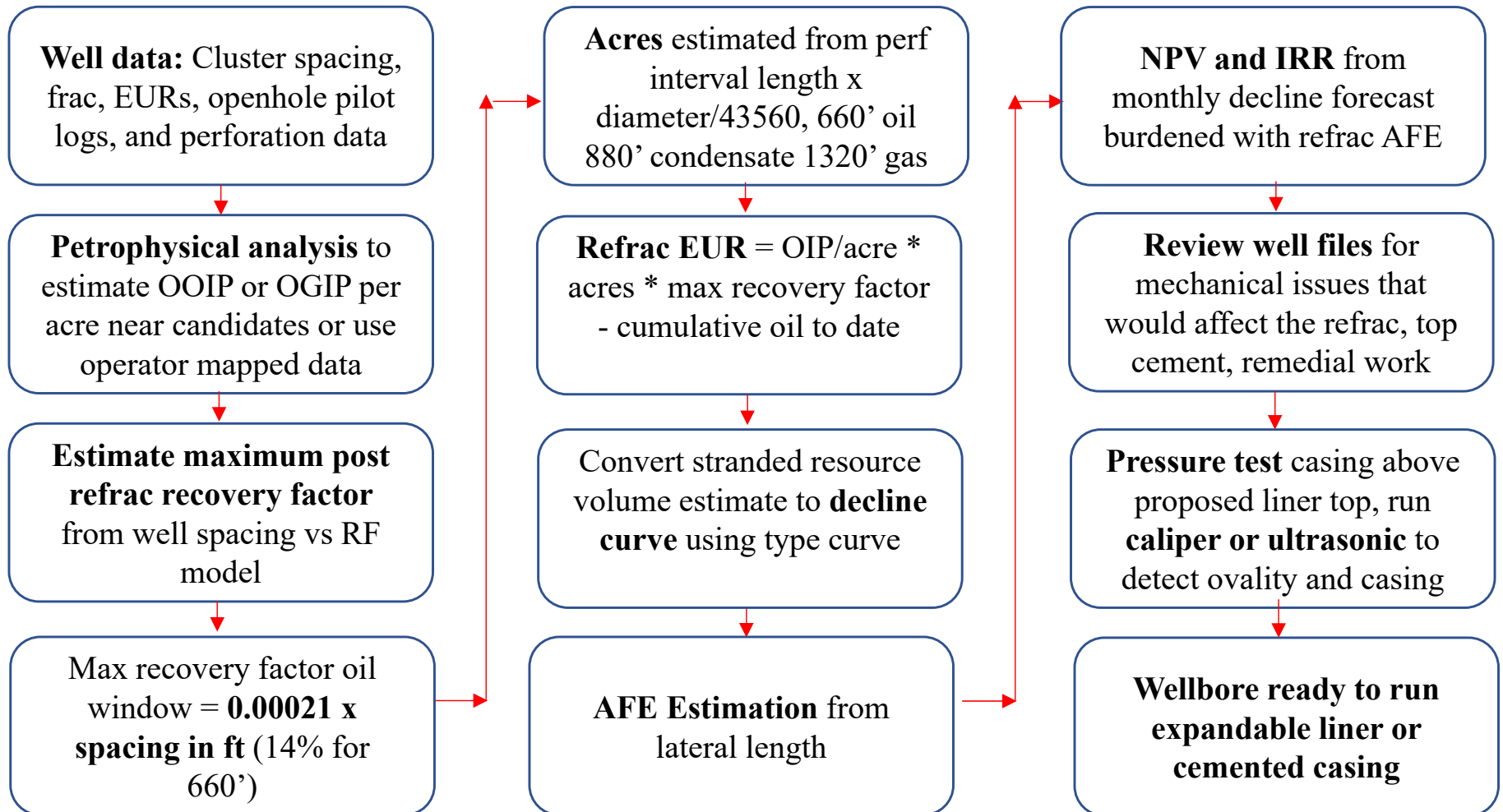
- Discussions with operators suggest that the underinvestment in the refrac market is driven by a perception that new wells have better returns with lower financial and operational risk
- The returns are competitive in the stand alone case and superior to new wells when parent-child issues exist as we discussed
- The risk factors can be minimized with three “best practices”
  - Proper candidate selection based on OIP/GIP and well spacing
    - Petrophysical analysis integrated with structure maps
  - Proper wellbore preparation prior to running mechanical isolation
    - COP and DVN 95% success rate, Dark Vision/EV and pressure testing
  - Proper execution of the refrac treatment
    - Identical to hundreds of plug and perf operations underway as we speak



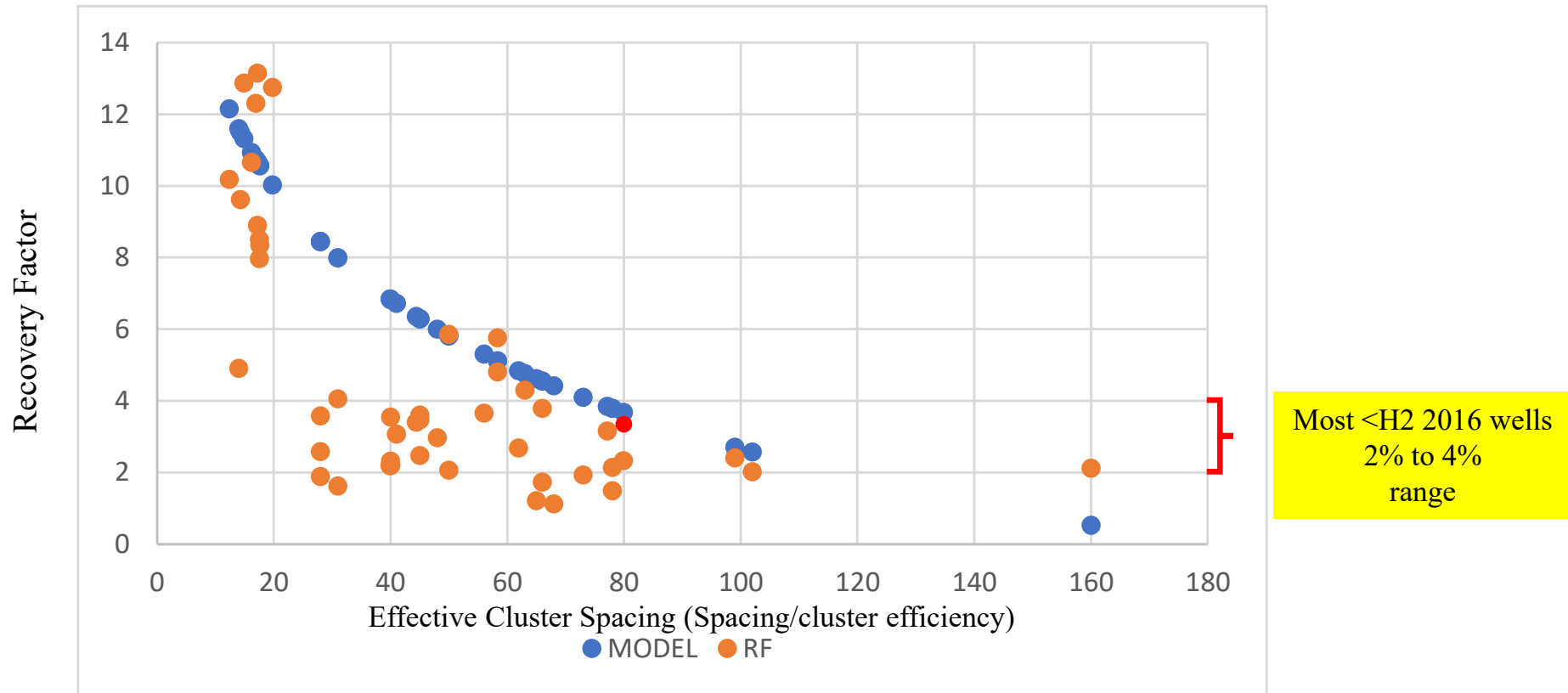
# Refrac Candidate Selection Process

- OIP or GIP per acre from openhole logs
- Maximum total recovery factor from well spacing
- Total OIP for the expected drainage area
- Post refrac EUR = Total OIP \* maximum recovery – cum production prior to refrac
- Post refrac EUR to decline using type curves
- AFE from lateral length
- NPV, IRR, and ROI for the refrac

# Refrac Candidate Selection Flow Chart



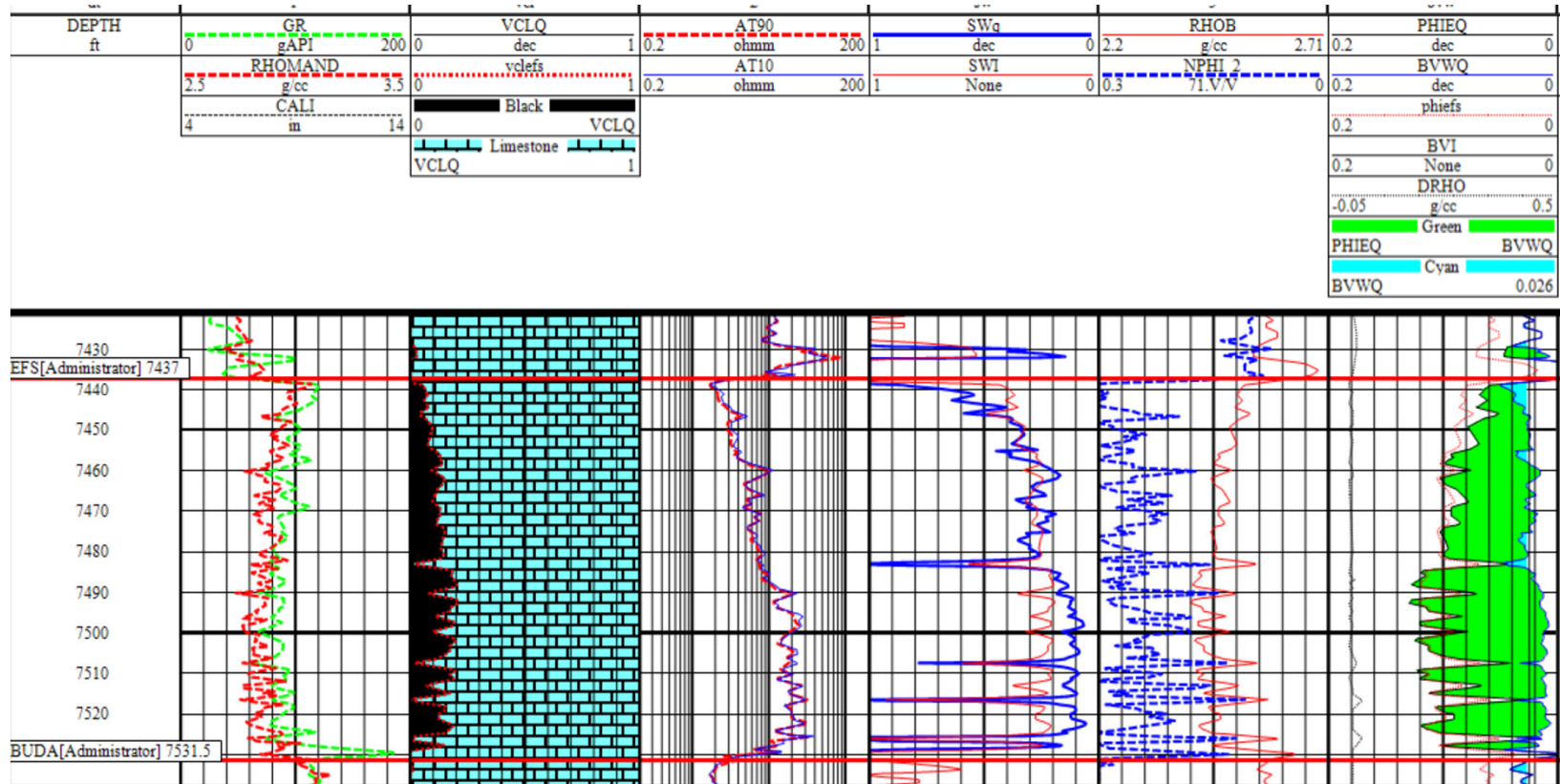
# Well Data (Oil Windows)



Recovery factors should typically be less than the blue curve, 100% cluster efficiency assumed for curve  
Abnormally high recovery factors suggest either a bust in the OIP/GIP or production allocation issues

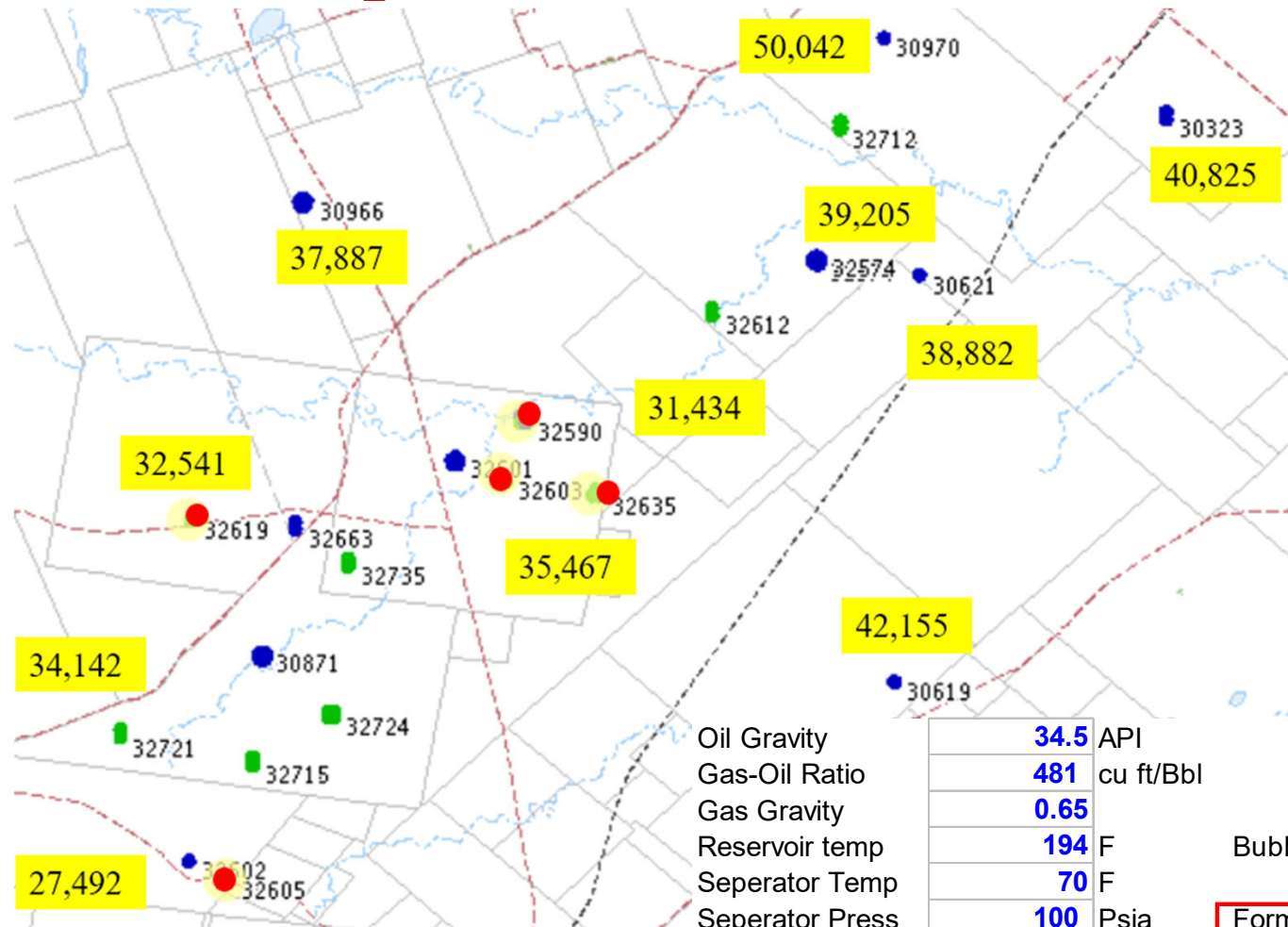
Orange dots URTEC 2662 Barba and Villarreal 2020  
Blue curve Xiong et al SPE 199721

# Eagle Ford OIP per Acre Analysis



Top	Base	Pay	Porosity	Swi	BVW	OIP/Ac
7438.25	7528.75	89.3	0.091	0.275	0.025	35,467

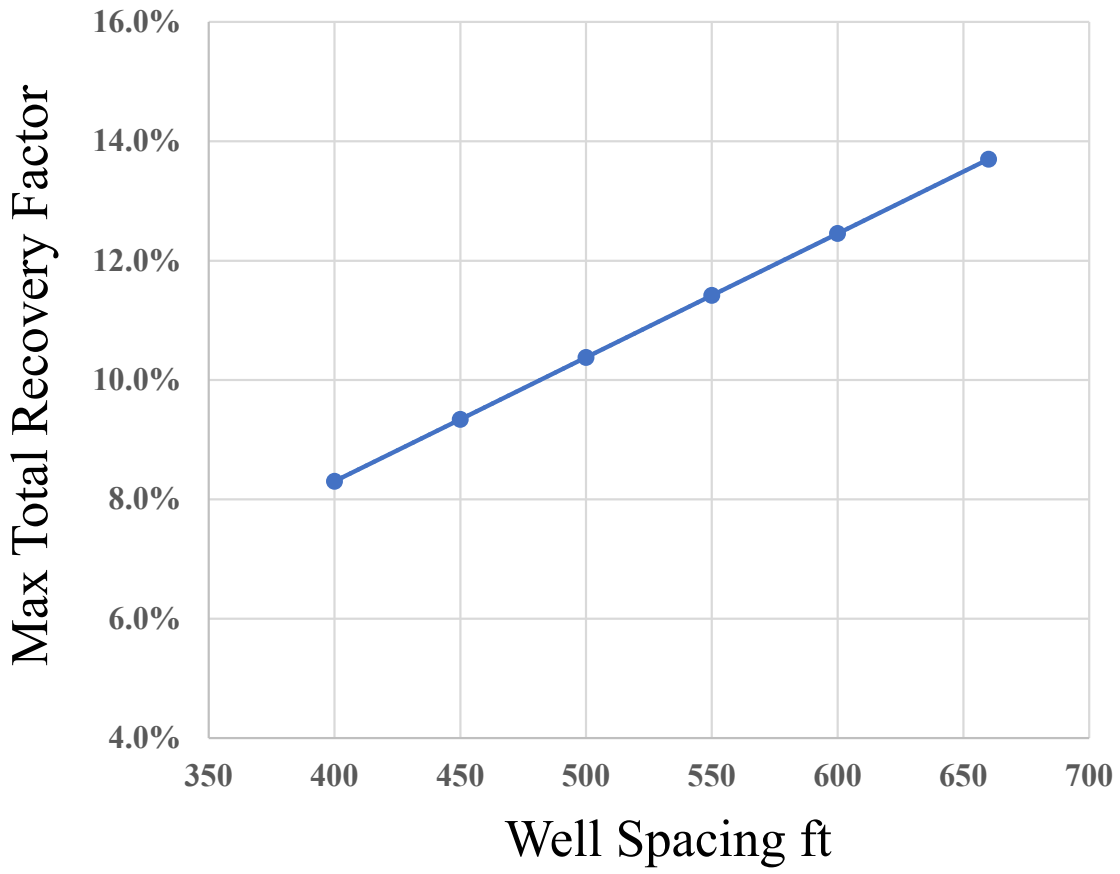
# OIP per Acre Distribution



Oil Gravity	34.5	API
Gas-Oil Ratio	481	cu ft/Bbl
Gas Gravity	0.65	
Reservoir temp	194	F
Separator Temp	70	F
Separator Press	100	Psia
Reservoir Press	4,473	Psia

Bubble Point Pressure	2,711
Formation Volume Factor	1.2878

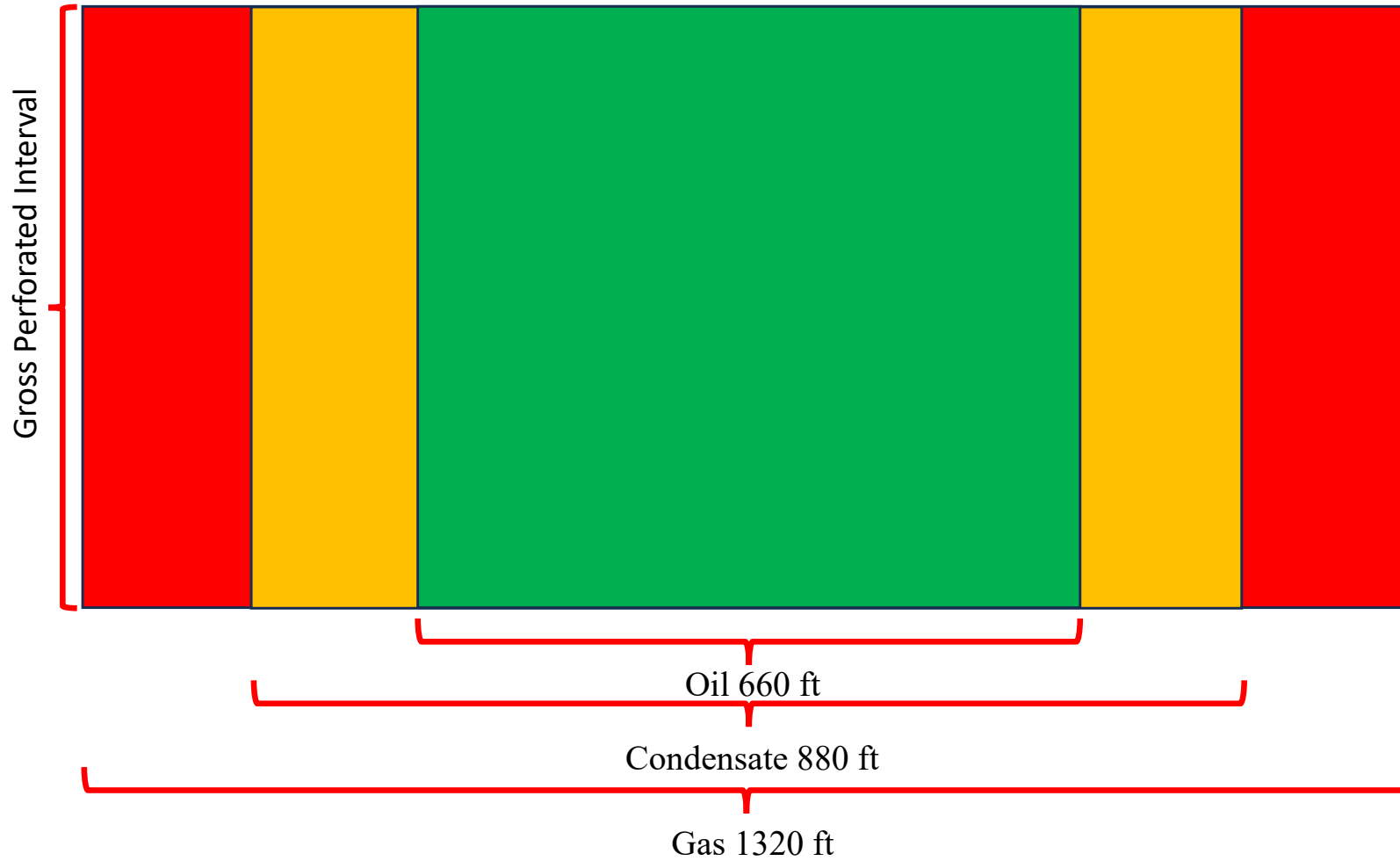
# Well Spacing vs Max Recovery Factor Oil Windows



Max RF = 0.0002121 \* spacing ft  
14% for spacing >= 660 ft

Eagle Ford and Permian Data

# Drainage Area Assumptions



# Refrac Wellbore Preparation

- Mechanical isolation preferred over bullheads, expandable liners or cemented flush joint
- Proper wellbore cleanout and preparation important
- “Best practices” recommended by active refrac operators:
  - Dark Vision or EV logging suite for borehole integrity
  - Pressure test casing above proposed liner top depth
- COP and DVN 95% success rate running mechanical isolation, may occasionally move liner overlaps based on mechanical integrity of the existing casing



# Refrac Execution “Best Practices”

- In 5.5 inch original casing recommend 4.25 inch expandable liner (4.1 ID) vs 4 inch flush joint (3.4 ID)
- Single 0.5 inch zero degree phased perforation per cluster
  - Cannot run in 4 inch flush joint need 3 1/8 guns
  - 15% higher cluster efficiency single vs dual perfs per cluster
- 25 ft cluster spacing to avoid legacy well longitudinal frac
  - Number of clusters = total rate/6 BPM per cluster
- Microproppant (fly ash) at least in the prepad for NWB friction reduction, possibly higher volumes in treatment
- 3000 psi pressure drop w/bioballs on standby if FDIs seen



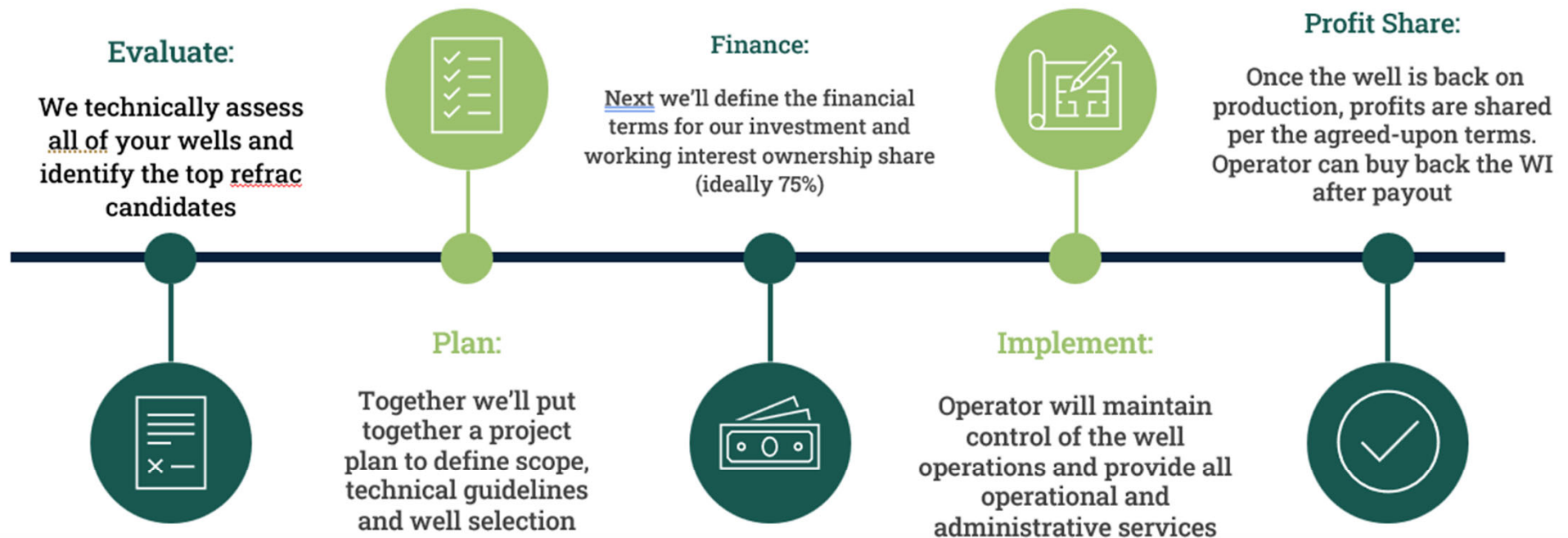
Reducing Refrac Risk™

# Transform Your Stranded Oil & Gas Assets into Profitable Income Streams with Triple R Energy Partners

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- Robert Barba and Mark Fleming
- September 27, 2023

# Providing Expertise and Capital to the Refrac Market



# Requirements for Partnering with RRR

- Refrac candidate has to be economic, > P50 EUR >3:1 cash ROI
  - Parent wells no economic cutoff if pad offered as second refrac opportunity
- Farm in minimum one initial well (parent with at risk DUC ideal) to have everyone on the same page with “best practices” and operations
- Subsequent to first well one pre-H2 2016 pad is requested (if 4 or more wells), two pads if less than 4 wells on first pad
- 75-90% of operator’s working interest requested, need other WI partners approval no non-consent issues
- After 1.5x payout operator can buy back the working interest at a PV10 valuation from an independent 3<sup>rd</sup> party approved by all parties
  - PV10 of production prior to refrac subtracted from buyback total
- RRR participation in subsequent wells welcome but not required