

# Innovative Mechanical Solutions For Scale Removal

Optimizing Pre Plug And Abandon Operation Through Robotic  
Milling Solution To Achieve Multiple Milling OD'S In One Run

# Agenda

The Idea

The Solution

How it Works

The First Job & Case Story

Value creation

Recap

# The Idea

On one of the LWI jobs, objective was to set 2 deep plugs, however both setting areas needed to be cleared out of debris and scale before the setting

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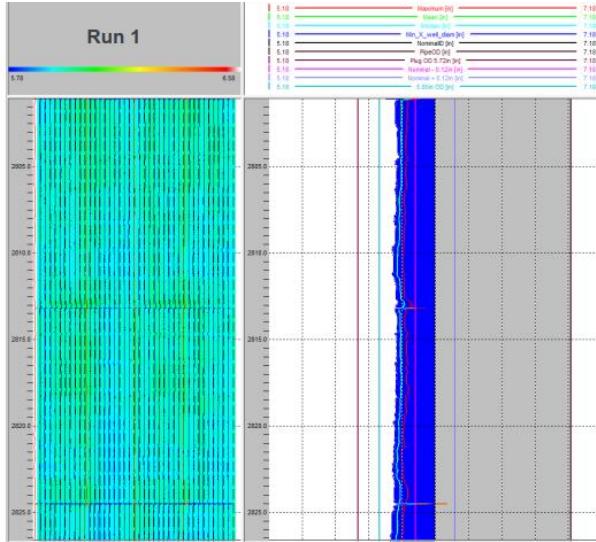
- Plug setting area 1 clean-out took
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  - 3 runs existing tech. 2
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- Total of ten runs to complete the objectives

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12	WL run 12: existing tech. 2 at 2735 m (Plug #2)	12-Mar 17:10	13-Mar 0:00
13	WL run 13: Caliper	13-Mar 0:10	13-Mar 6:35
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16	WL run 16: Remove Scale with Well Miller	13-Mar 23:15	14-Mar 7:45
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# The Idea

Plug 1 setting area

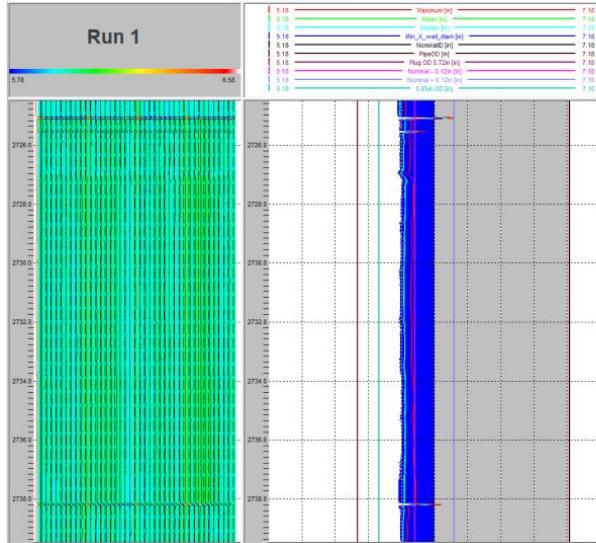
Before



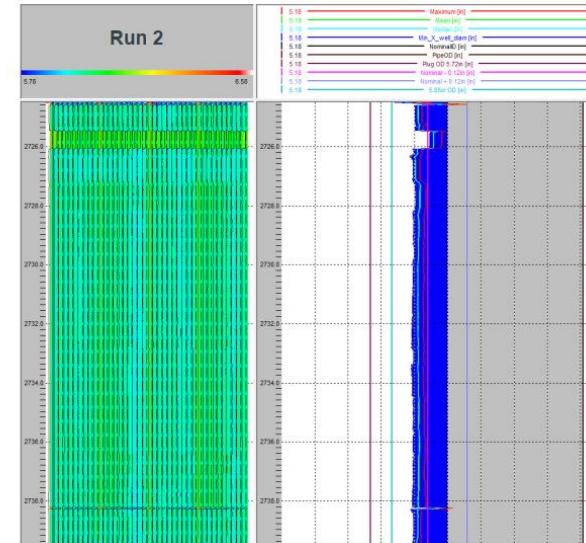
# The Idea

Plug 2 setting area

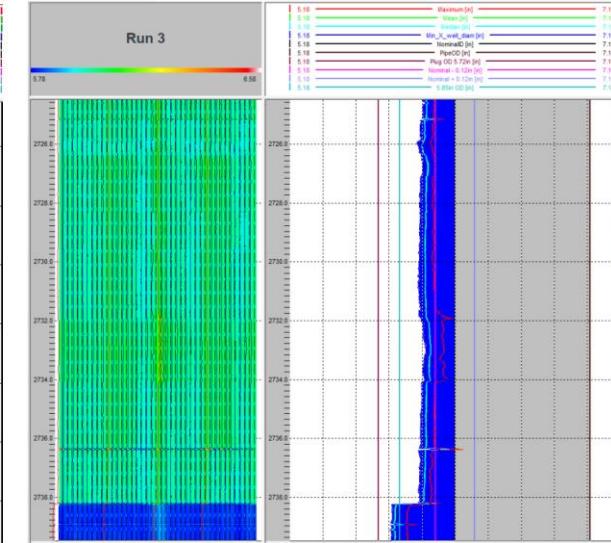
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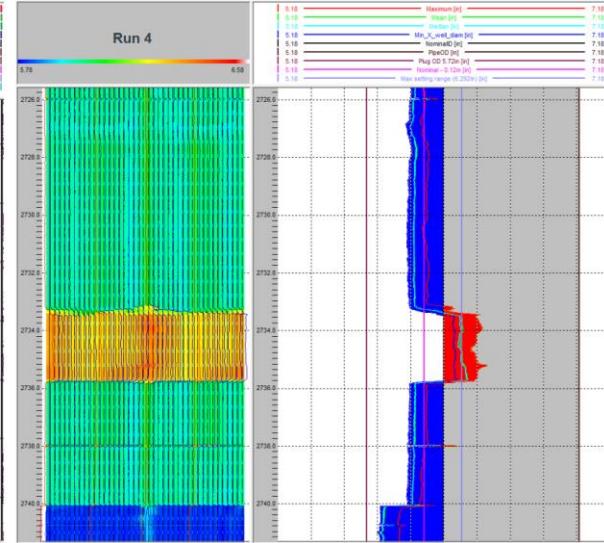
After existing tech. 1 run



After 1<sup>st</sup> run existing tech. 2



After 2<sup>nd</sup> & 3<sup>rd</sup> run existing tech. 2



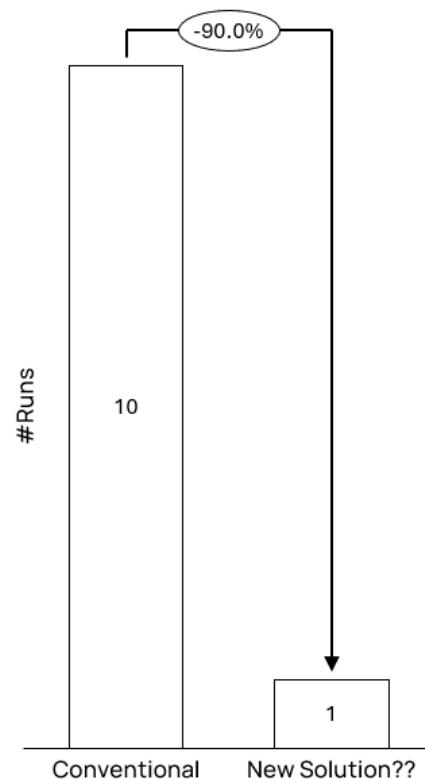
# The Idea

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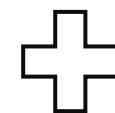
Can we complete the whole objectives in one run?



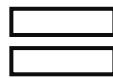
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# The Solution

We need a solution that could achieve multiple objectives in one run



**Expandable Bit**



# How It Works

We need a solution that could achieve multiple objectives in one run

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We need a solution that could achieve multiple objectives in one run

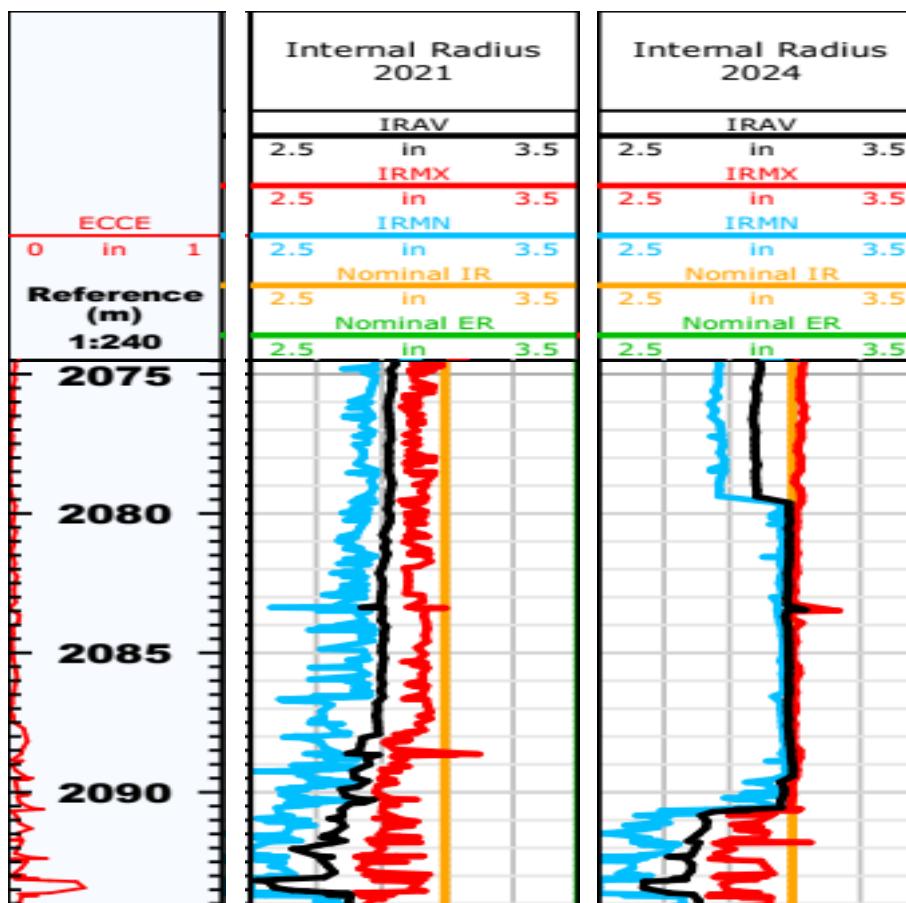
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# The First Job

Run for an operator in the North Sea to achieve the multiple objectives of milling restriction to allow conveyance of high expansion plug, and accurately clean scale up to drift ID in the setting area



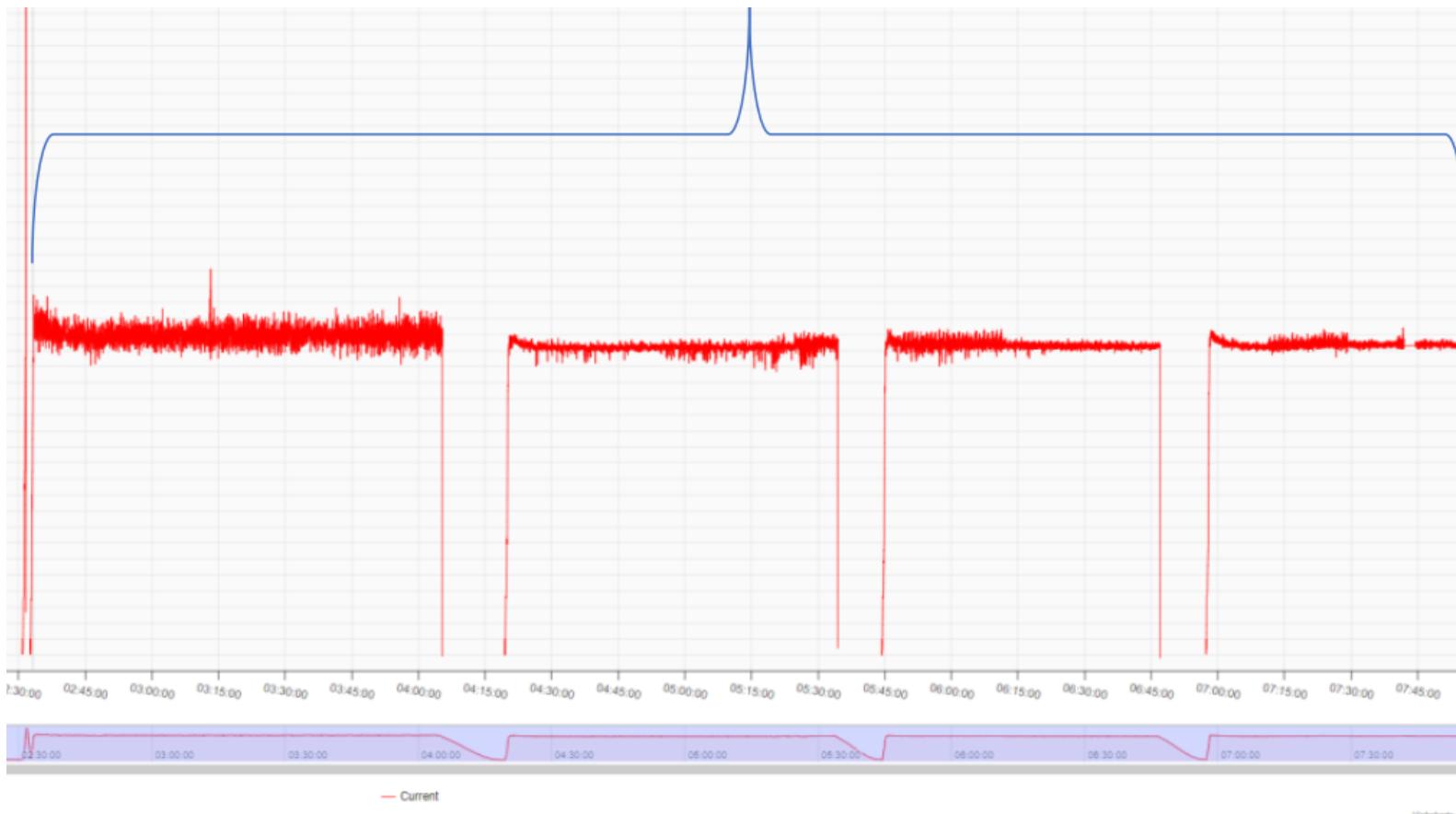
- 4.5in lead bit and 6.05in Expendable Bit
- Milled through various restrictions with lead bit
- Section milled plug setting area 10m Expandable Bit
- Post milling MFC showed successful scale removal
- High expansion plug was set and tested successfully



At least, 3 runs saved!

# The First Job

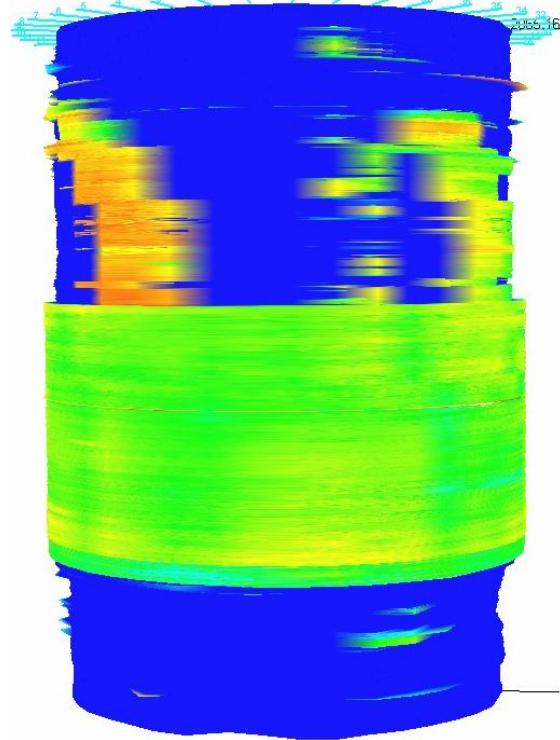
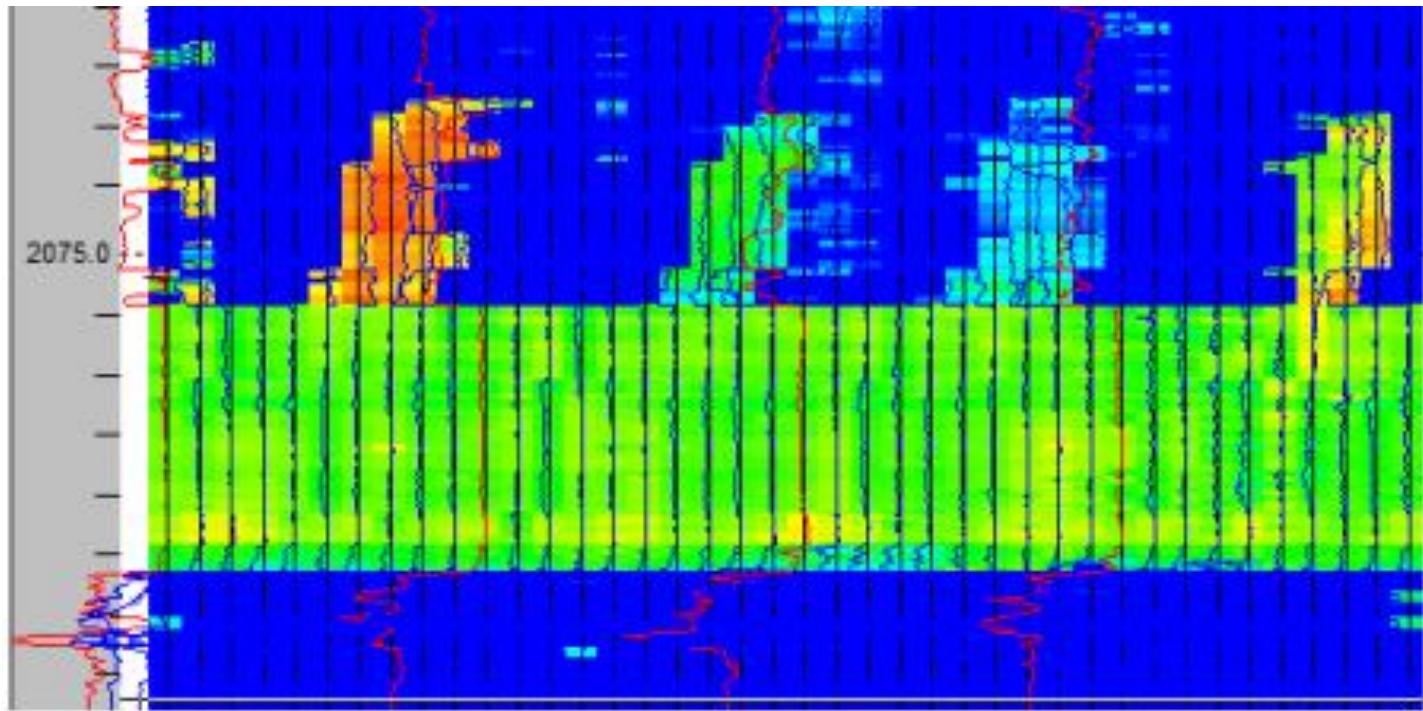
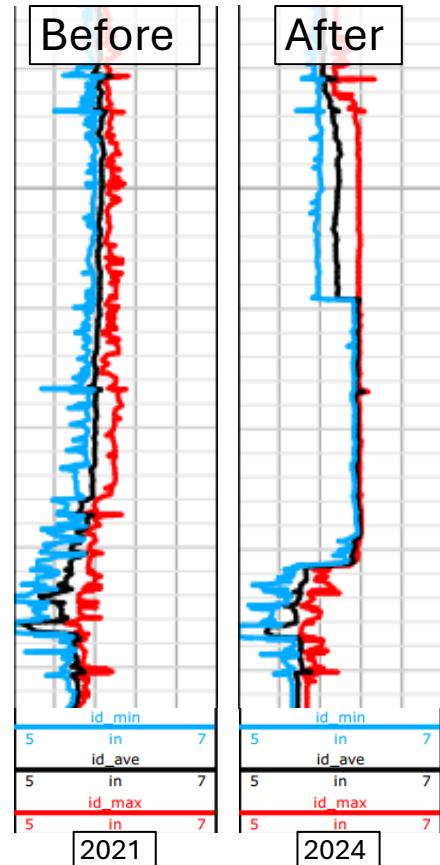
Run for an operator in the North Sea to achieve the multiple objectives of milling restriction to allow conveyance of high expansion plug, and accurately clean scale up to drift ID in the setting area



- 4 Milling pass with Expandable bit
- High milling activity on the first pass
- Subsequent passes shows less milling activity
- Indicates a completion of the scale removal

# The First Job

Run for an operator in the North Sea to achieve the multiple objectives of milling restriction to allow conveyance of high expansion plug, and accurately clean scale up to drift ID in the setting area



# Case Story: Saving The Day!

Rush mobilization required to set a plug below a CMU sleeve for Pre P&A purposes. It was encountered scale above and at the plug setting area. Explosive removal was run multiple times without success.

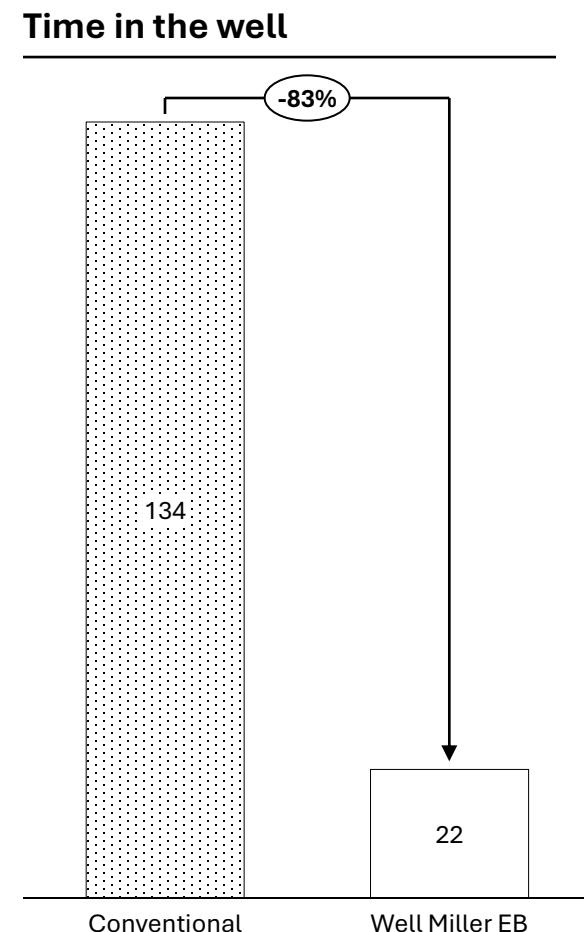
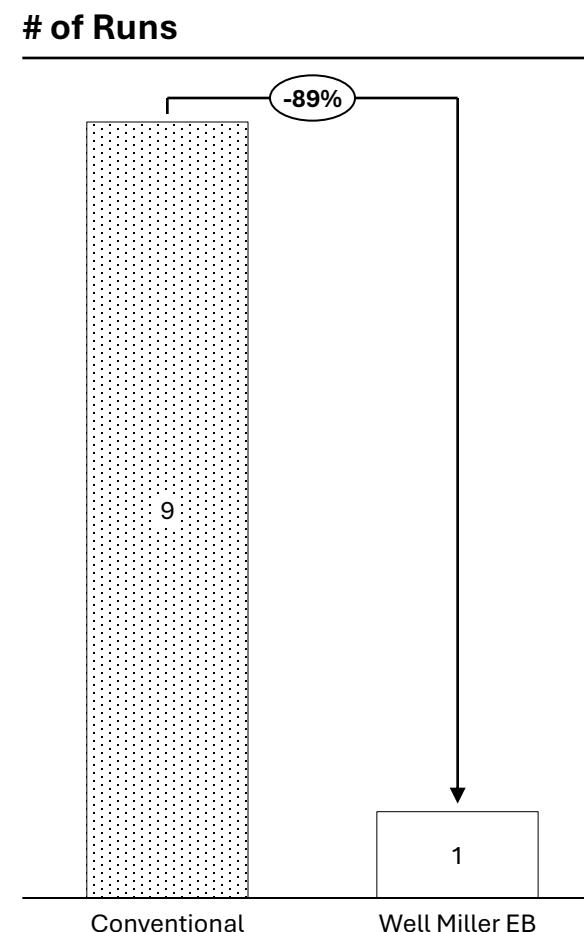
Before mobilized :

- 3 MFC runs
- 3 stringshot runs
- 3 milling runs

Operation Success:

- One run combo to clear scale debris path
- Expandable arms scale cleaning in plug area

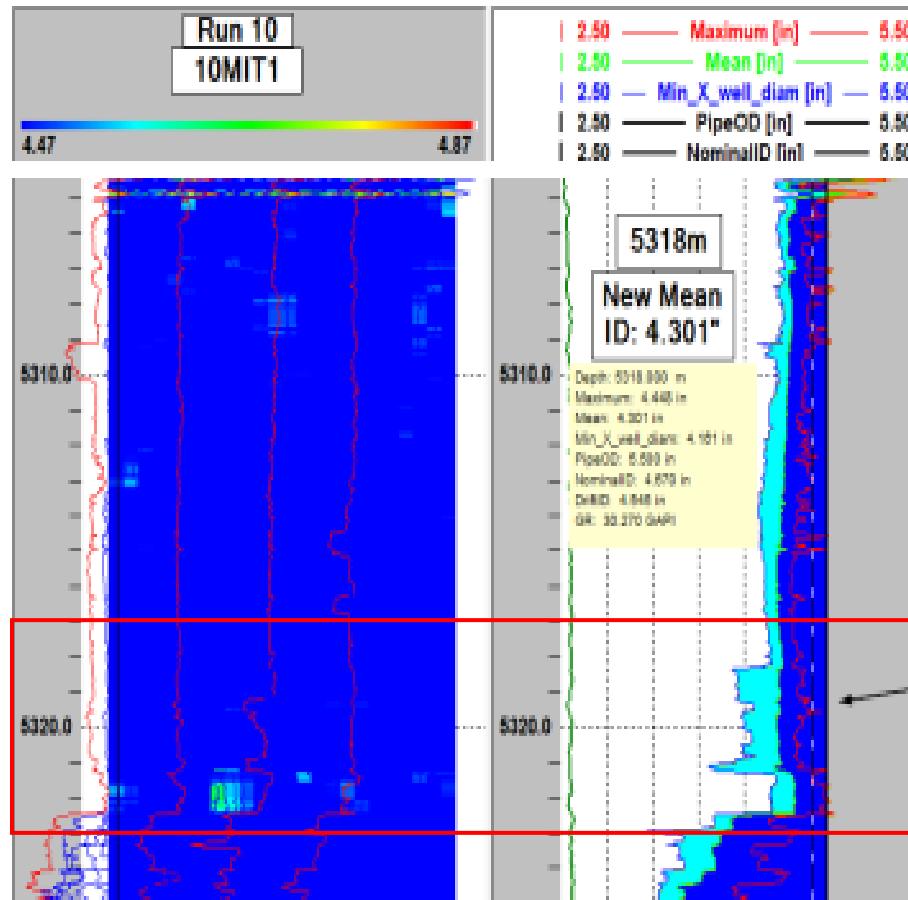
Well Miller EB could have potentially saved more than 100 hours in the well



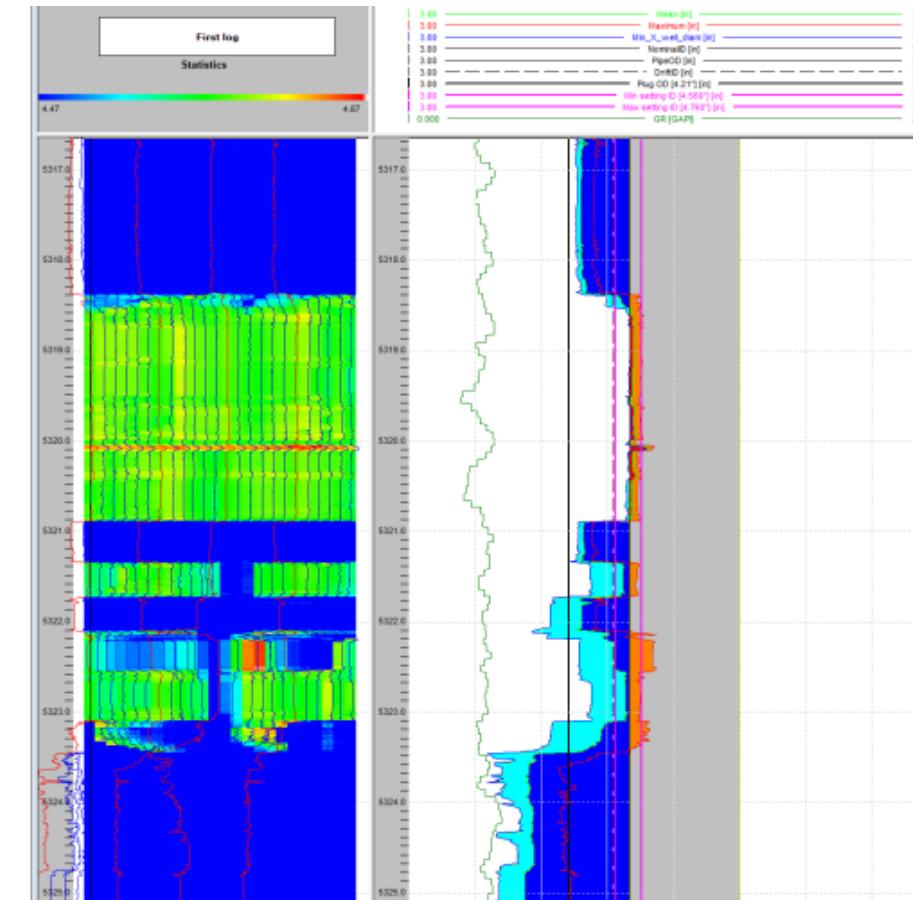
# Case Story: Results From Operation

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## Caliper Results Before

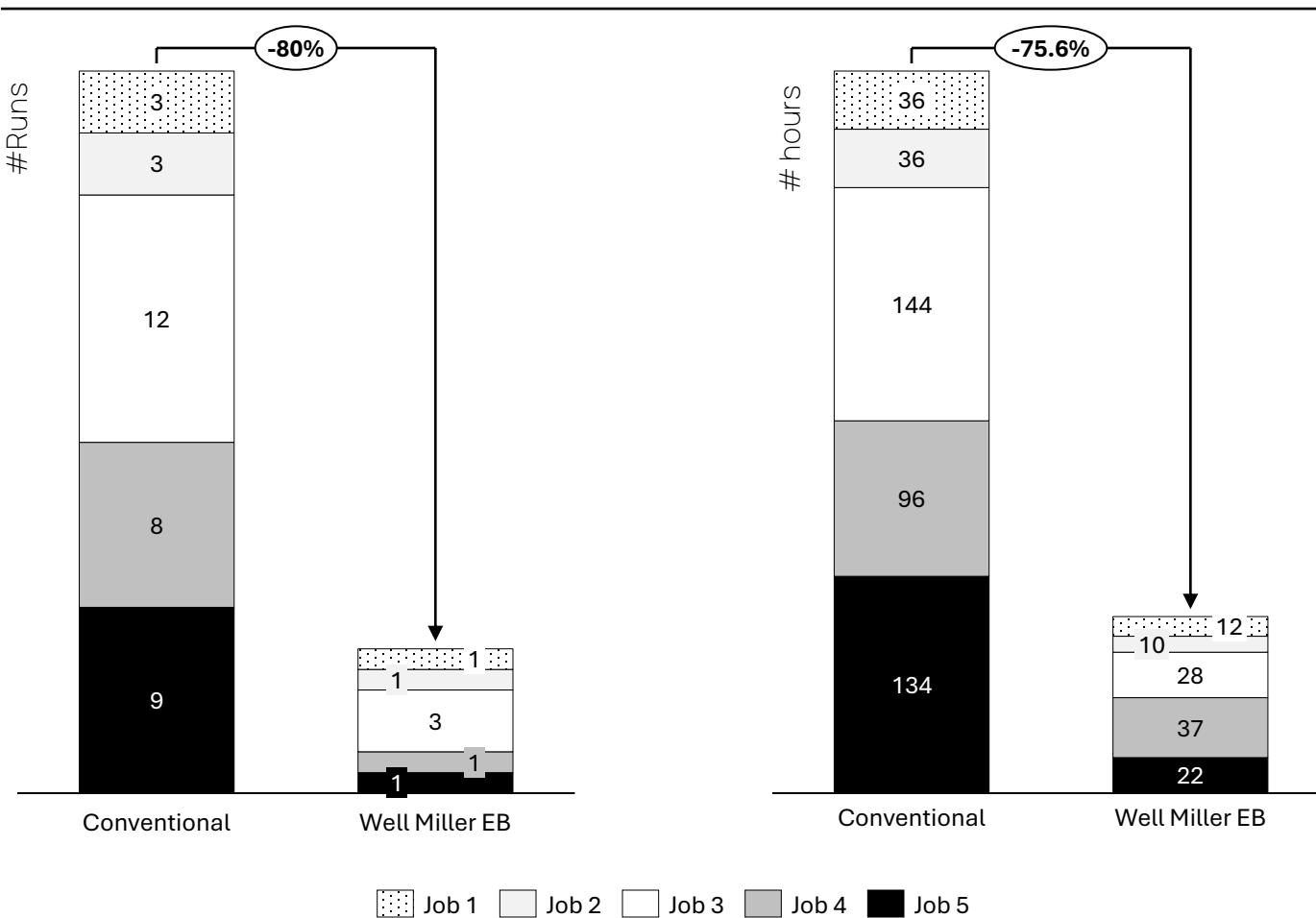


## Caliper Results After



# Value Creation

5 successful jobs been performed leading to reduced number of runs per job and rig time savings



More than 330 hrs. saved in 5 operation

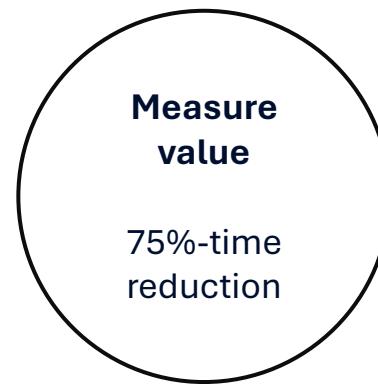
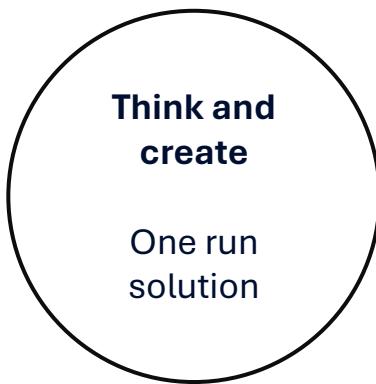
Average time saving is 66 hrs. per job

Less Cost

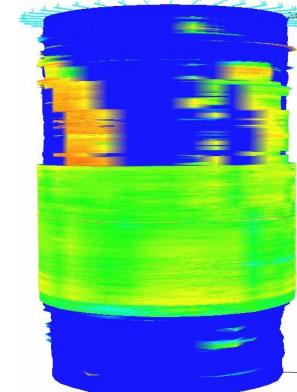
Less Exposure

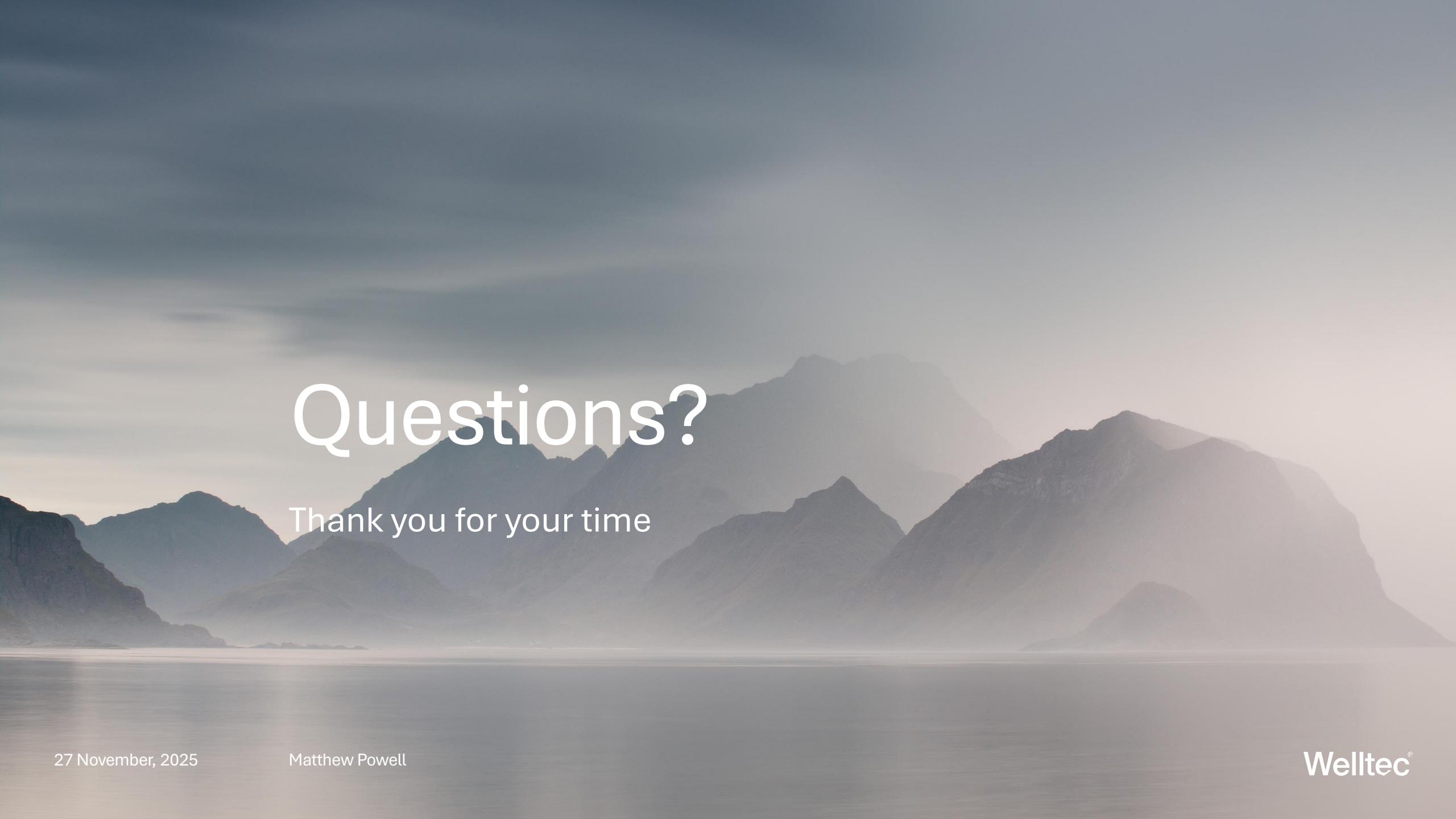
# Recap

Technology is key to achieving effective solution for our challenges while reducing cost and exposure



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A wide-angle photograph of a mountainous landscape. In the foreground, there is a body of water with a slight reflection. The middle ground is dominated by several large, rugged mountains, their peaks partially obscured by a thick layer of low-hanging mist or fog. The sky above is a mix of dark, heavy clouds and lighter, more diffused light, suggesting either dawn or dusk. The overall atmosphere is serene and somewhat mysterious.

# Questions?

Thank you for your time