[Open]

Sustainable Sand Management Control and Solutions - Balancing Performance, Costs, and Environment

20–21 AUGUST 2024 | KUALA LUMPUR, MALAYSIA

Fit for Purpose Well Completion Design and Innovative Sand Control Solution: Cost Reduction Strategies for Project Economic Viability

M Shamir A Rahim, Zaidi Awang@Mohamed, Nurul Iffah M Garib

PETRONAS CARIGALI SDN. BHD.

[Open]

Outline

01 **Problem Statement**
Field with Sand Production History

02 **Project Background**
Project Economic Flow

03 **Completion Re-strategize**
Lower Completion Evolution

04 **Innovative Sand Control Solutions**
Converting CAPEX to OPEX

05 **Value Creation**
Cost Reduction Flow

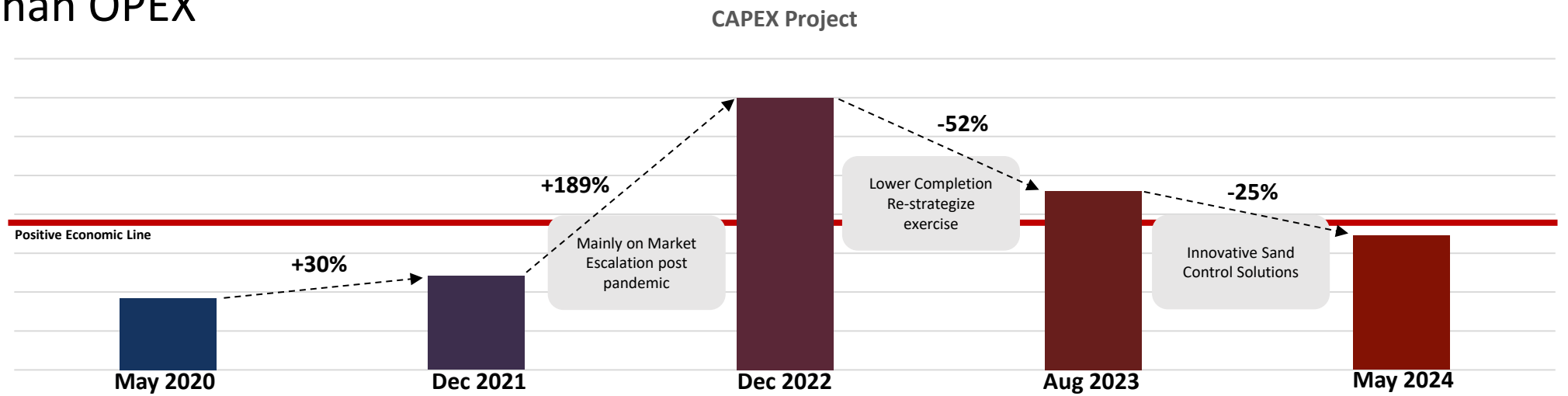
06 **Conclusion**
Lesson Learnt & Way Forward

Problem Statement

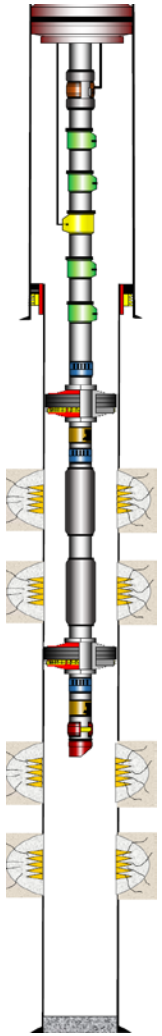
- Transition type of sand with medium to high fine content (20 – 46%)
  - Existing wells from the fields completed with no downhole sand control
- Well integrity issues due to sand production
  - Tubing Leak
  - Erosion marks at nozzle orifice & chipped flow collars at production choke
- Existing facility was not design with sand management capability
  - Sand accumulation inside vessels during cleaning has reached up to 400L
  - Crude Oil Transfer Pump strainers clogged with sand
  - Sand accumulation inside Crude Oil Tanks at FSO
- Due to this, downhole sand control is required with provision of surface sand management

Project Background

- Based on company internal guidelines on the sand prediction analysis and particle size distribution, it is recommended to complete wells with screenless frac pack with resin consolidation
- Balancing between the technical needs and the project economics rationality is a challenge.
- Project Economics analysis showing the economic is more sensitive to CAPEX than OPEX



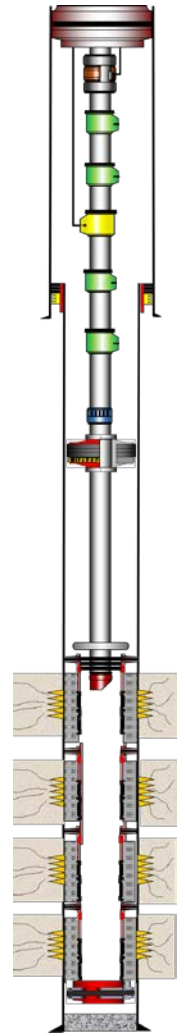
Completion Re-strategize



Screenless Frac Pack with Resin Consolidation

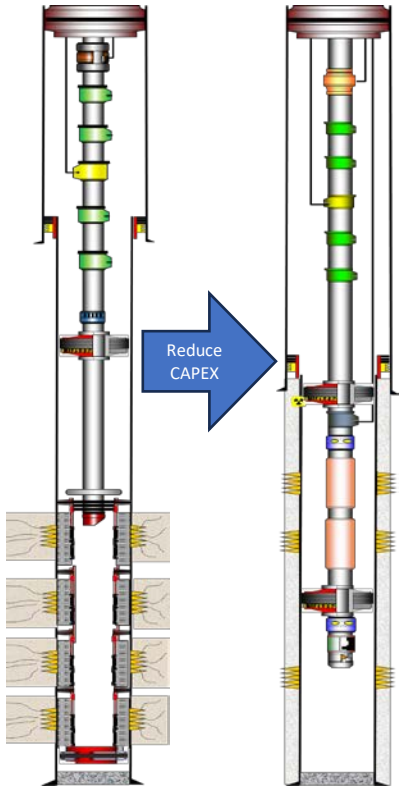
Cased Hole Frac Pack with Screen

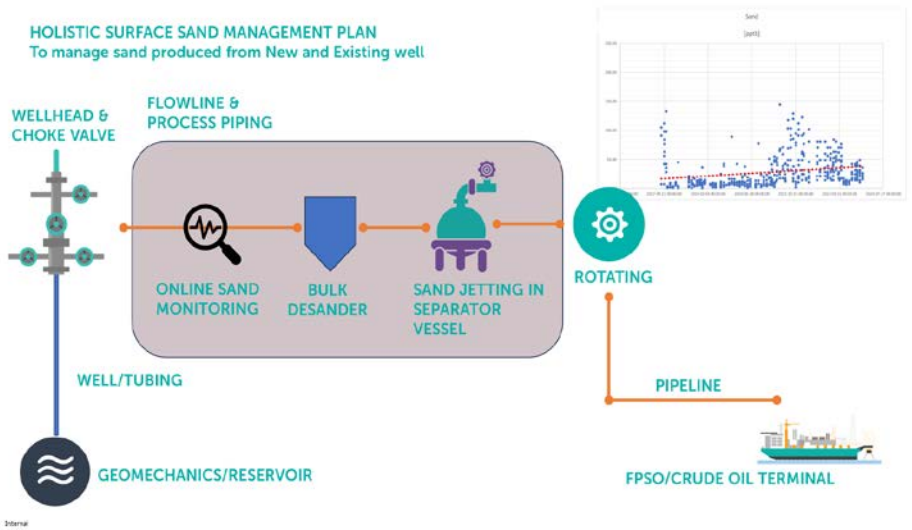
Internal Guidelines	Technical Challenges	Operational Challenges	Commercial Challenges
Based on internal guidelines, it is recommended to complete the well with Screenless Frac Pack with Resin Consolidation	Coal presence within/between sands – potential increment of treatment zone 3 – 5 zones/well Varies permeability (50 – 150 mD) will impact resin injection at matrix condition & No proven performance for long well life (resin performance longevity)	Do not offer flexibility during operation ie. to change FP to HRWP or extension pack in the case of any uncertainties of the OWC/GOC in the formation – Lesson learnt from operation in nearby field	Screenless Frac Pack with resin treatment timing is 4 – 5 days/zone while only 1 – 2 days/zone for Frac Pack with Screen (single trip multizone treatment). Saved ~10% well cost



Innovative Sand Control Solutions

- **Overcoming high well cost (CAPEX) via surface sand management**





Methodology

- Screening criteria to identify potential selective well C&P
- Establish sand prediction using scenario methods
- Erosion rate assessment using Sand Erosion & Transport (SET) and predicting time to failure (TTF) piping replacement
- Cost Benefit Analysis CAPEX vs OPEX
- Strengthen surface sand management

Workflow/Decision Tree

Start

Criteria for Selective C&P:
- Low WC
- Low GOR/Gas rate

WC < 50% and/or Gas rate < 2MMscfd

No → Base: Remain FP

Yes → Erosion evaluation via SET <0.1mm/y

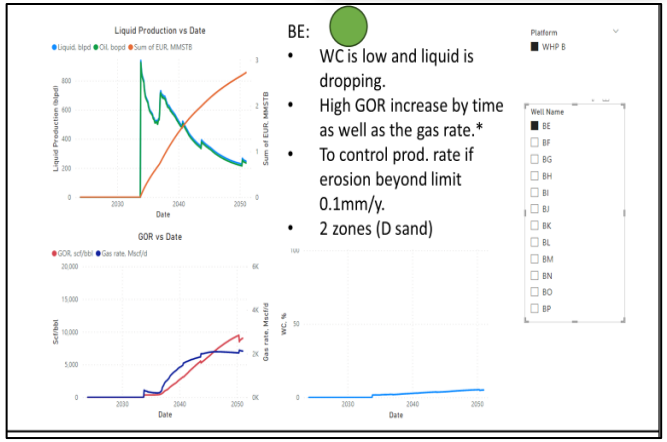
No → C&P Option 1: Control production rate by producing below erosion limit

Impacted Production curtailment

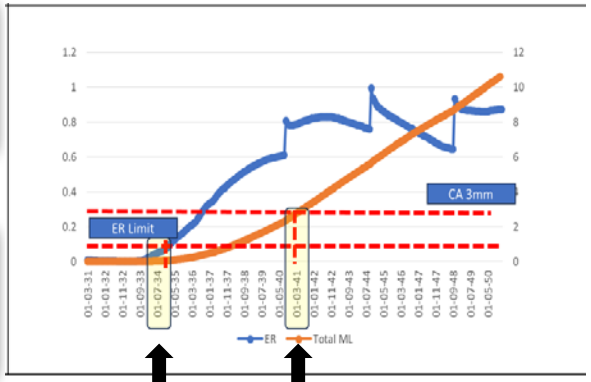
No → C&P Option 2: Install ERTTSS

Incurred OPEX lifecycle cost for ERTTSS-SC replacement

Yes → Qualified for C&P



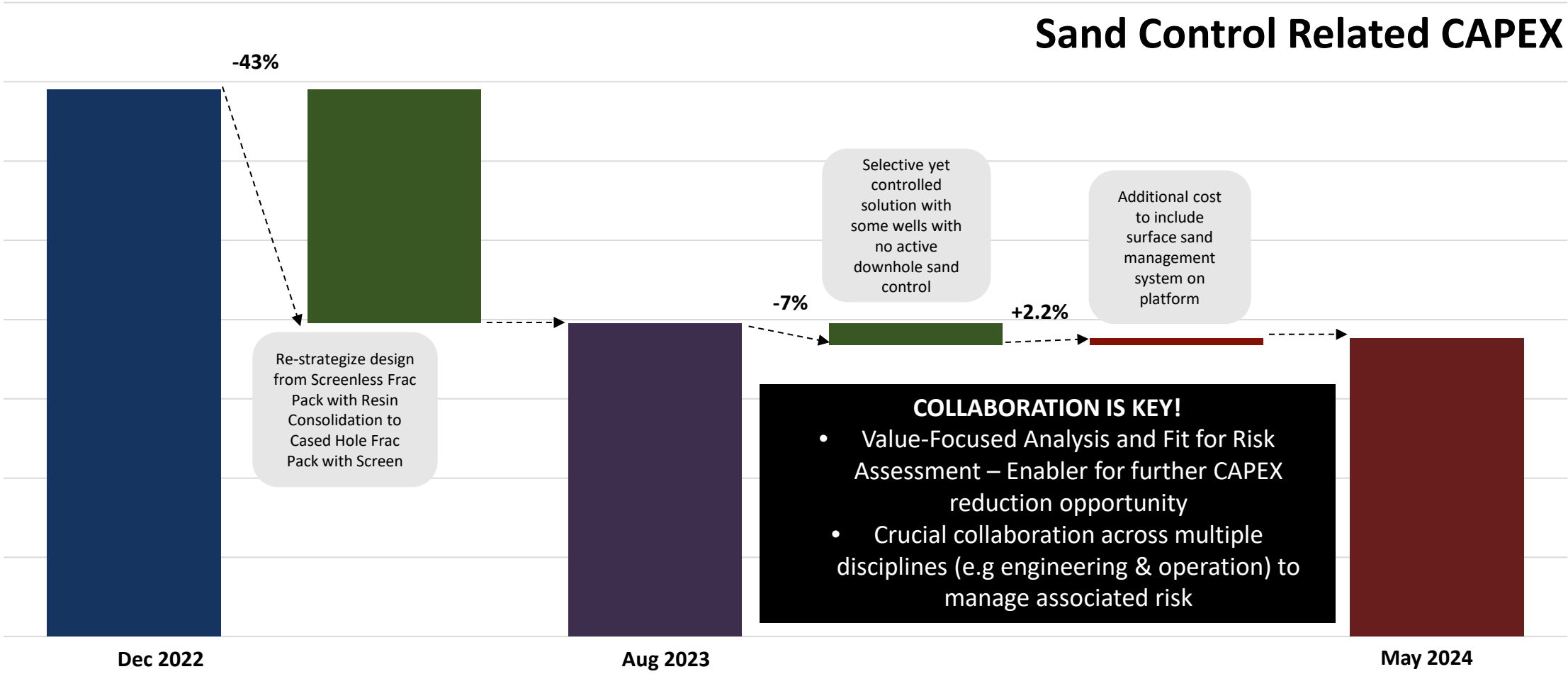
BE:
- WC is low and liquid is dropping.
- High GOR increase by time as well as the gas rate.*
- To control prod. rate if erosion beyond limit 0.1mm/y.
- 2 zones (D sand)



->Decision to control production or install ERTTSS

->Indicator of TTF (piping replacement) for NFA case

Value creation



Conclusions

- Understanding of formation (coal existence)& Operational limitation, lesson learned from previous application and utilizing the fit for purpose technology helped optimize the well cost.
- Value-Focused Analysis and Fit for Risk Assessment serve as enablers for identifying further opportunities to reduce CAPEX.
- Crucial collaboration across multiple disciplines, such as engineering and operations, is essential for effectively managing sand-related risks and transitioning from a CAPEX to an OPEX-oriented philosophy
- Techno-commercial judgement and evaluation are essential to move the project.

[Open]

Thank You