National Subsea Research Initiative

The case for stand alone facilities

NSRI – the focal point for Research and Development for the UK subsea industry

Dr. Gordon Drummond

2017

www.nsri.co.uk

Who we are

A ‘not for profit’, industry led, expertly guided organisation

To enhance the UK’s position as the leading technology provider for the subsea industry

The technology arm of Subsea UK

What we do

Subsea Industry Sectors

Oil & Gas

Defence

Wave and Tidal

Ocean Science

Mining

Offshore Wind

Economics study : Size of Prize

Assumption $60/ bbl

Methodology
Economic viability measure determined from operators profitability discount index, post tax (discounted at 10%) > 0.3;

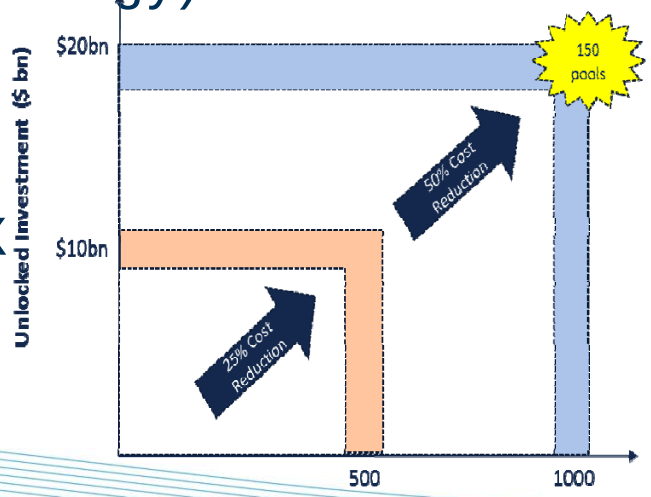
- Production profiles of small pools drawn from DECC and averaged
- Industry norms used to determine CAPEX; OPEX and Decom costs
- Deterministic and probabilistic approaches taken

Economics study : Size of Prize

Results

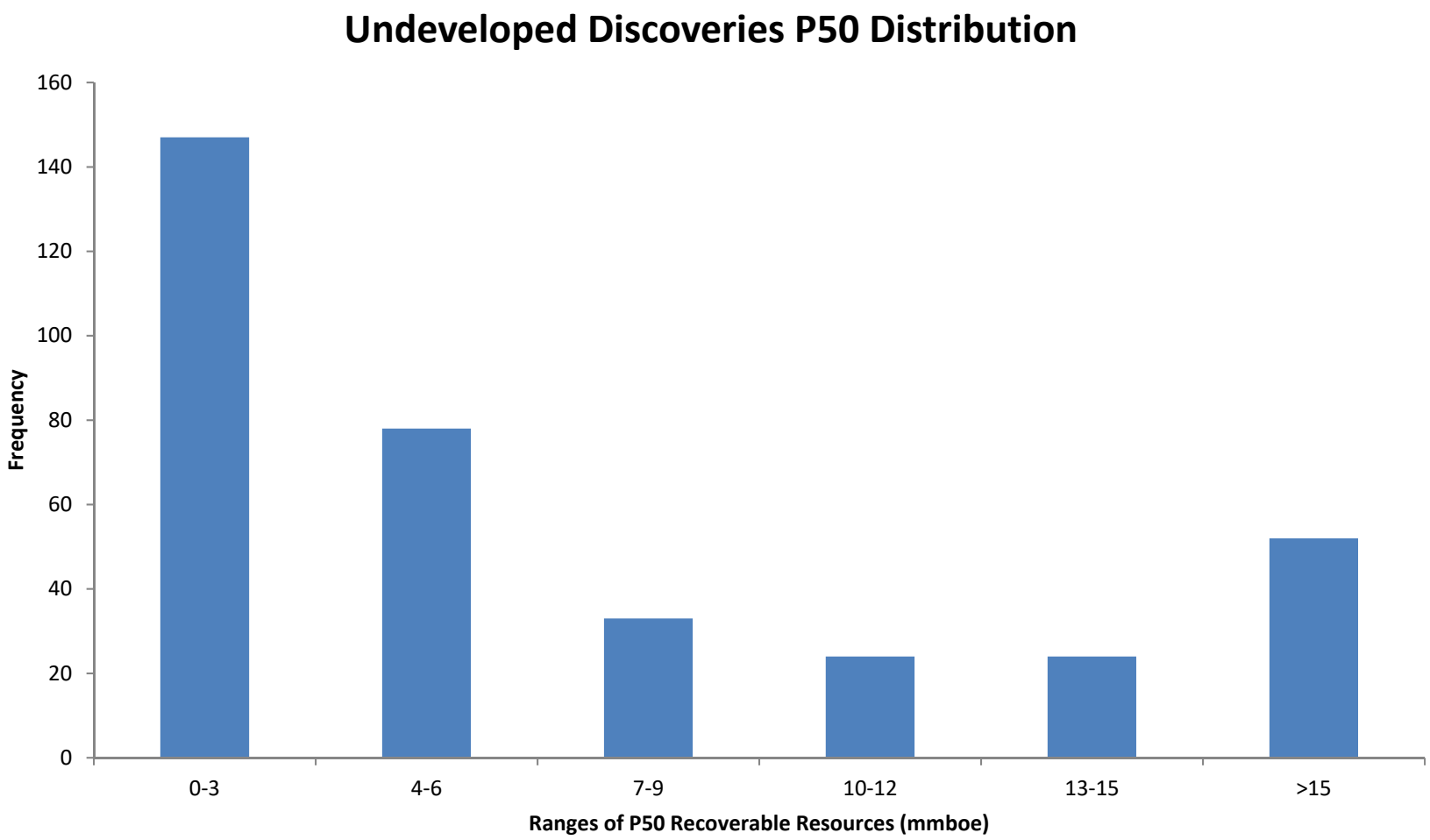
- The smallest size of pool that becomes economic is 11.MBoe. (existing technology)
- If a cost (C&O) reduction of 25% can be achieved, all things remaining constant, that become 9.1MBoe. (new technology, efficiency measures)
- For a cost reduction of 50% then that becomes 5.8MBoe. (disruptive technology)

This corresponds to opening up approximately 150 of the pools, $19Billion of CAPEX & $16Billion of OPEX and recovers 1.06Billion barrels.



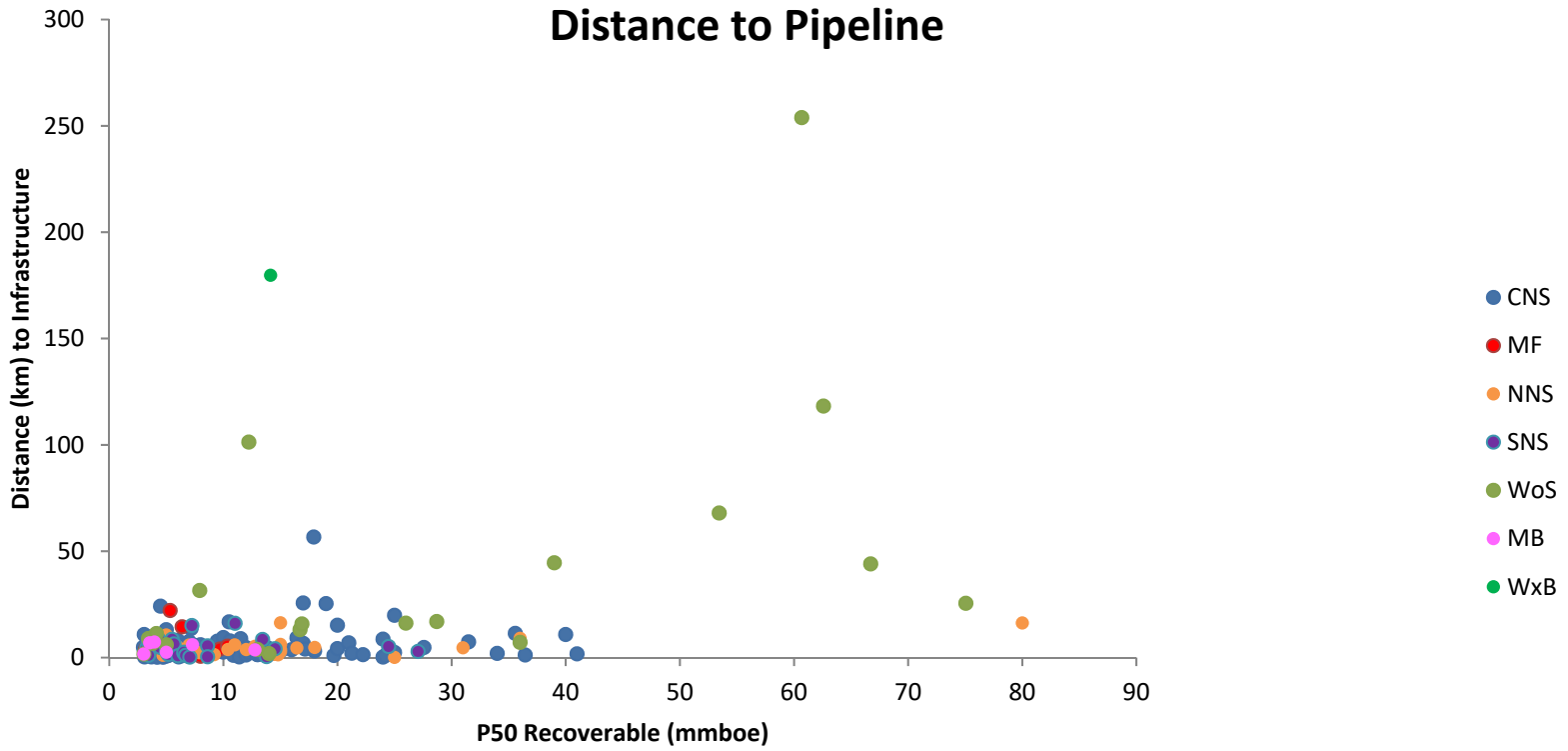
Oil & Gas Authority

2015 DATA



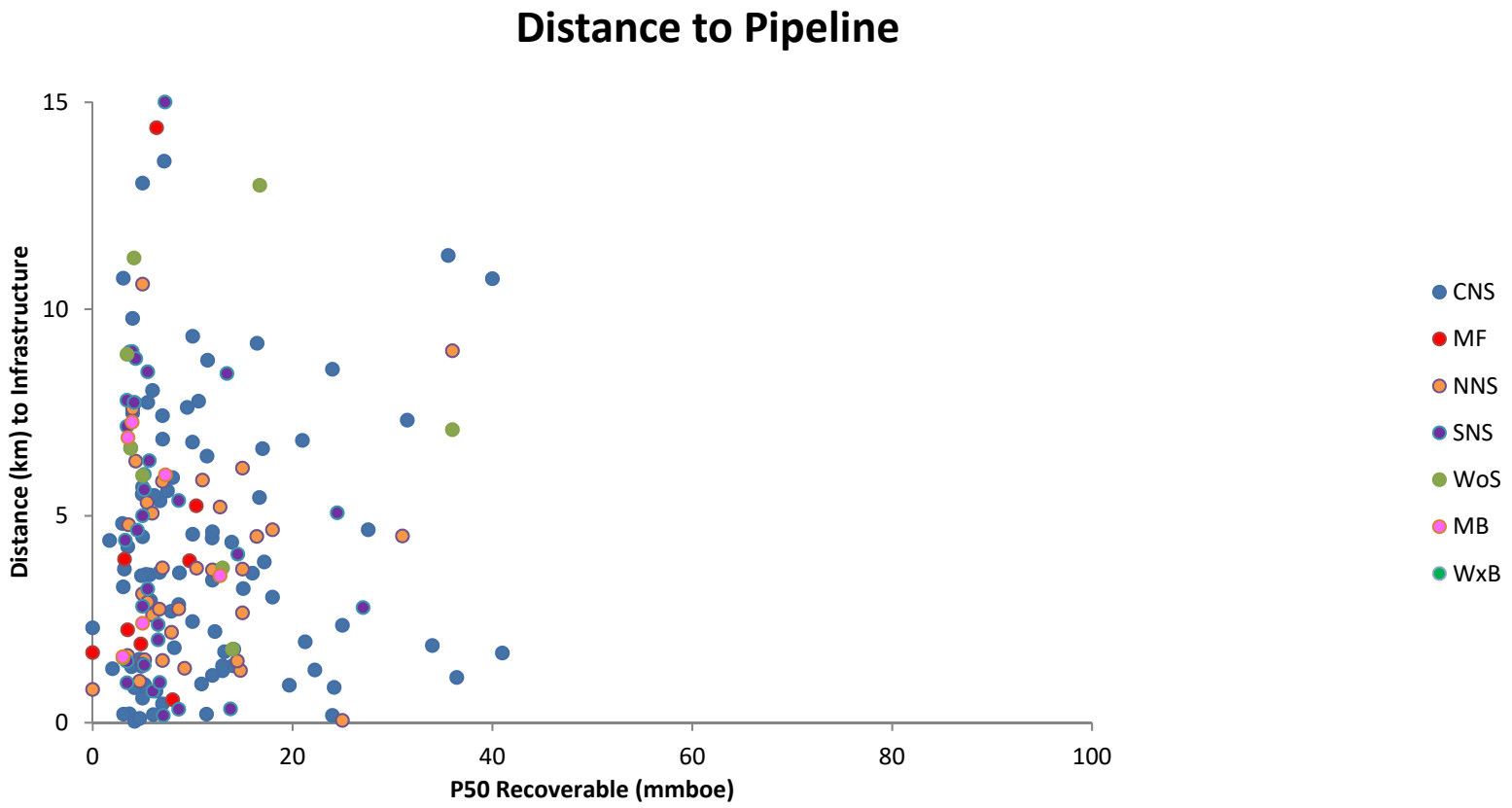
Oil & Gas Authority

Pipeline



Oil & Gas Authority

Pipeline – Focused Graph

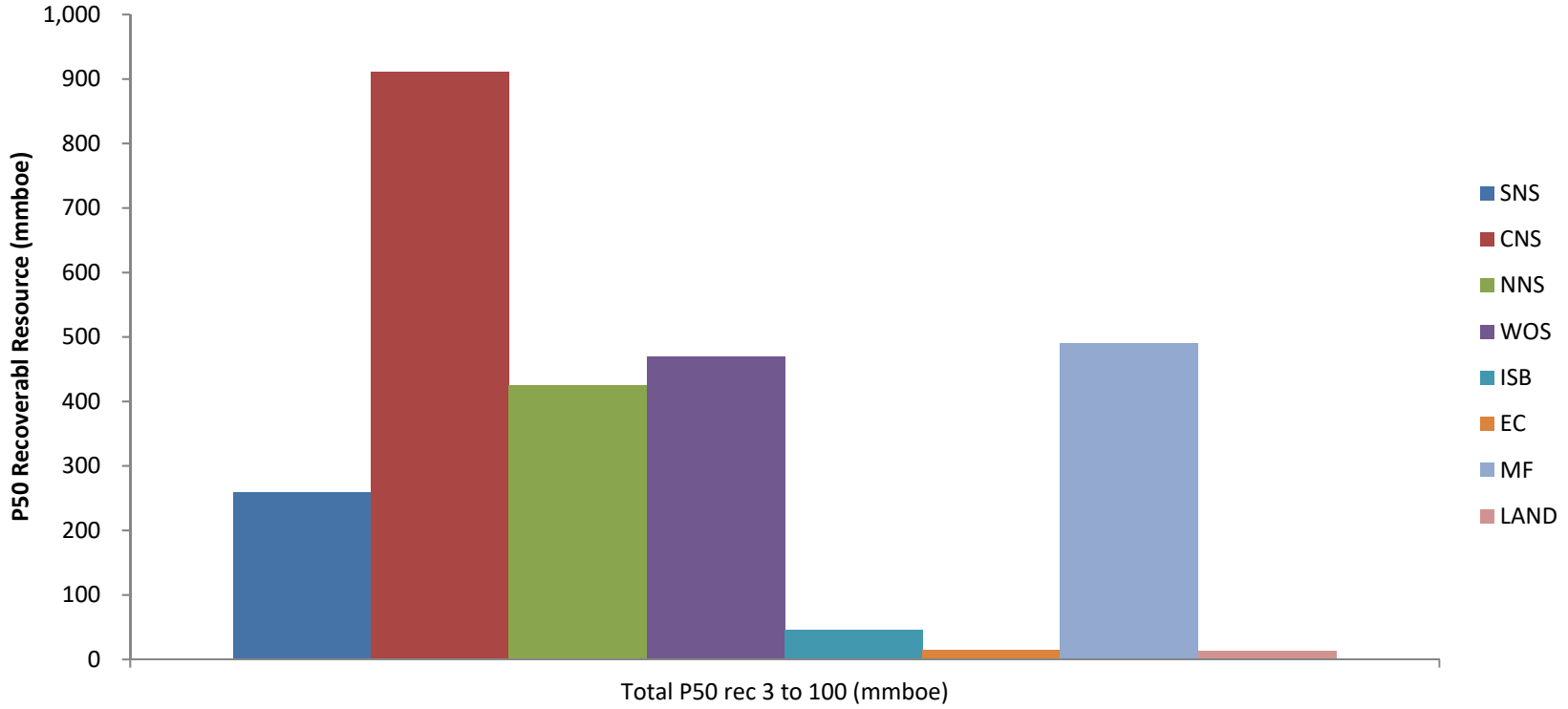


Oil & Gas Authority

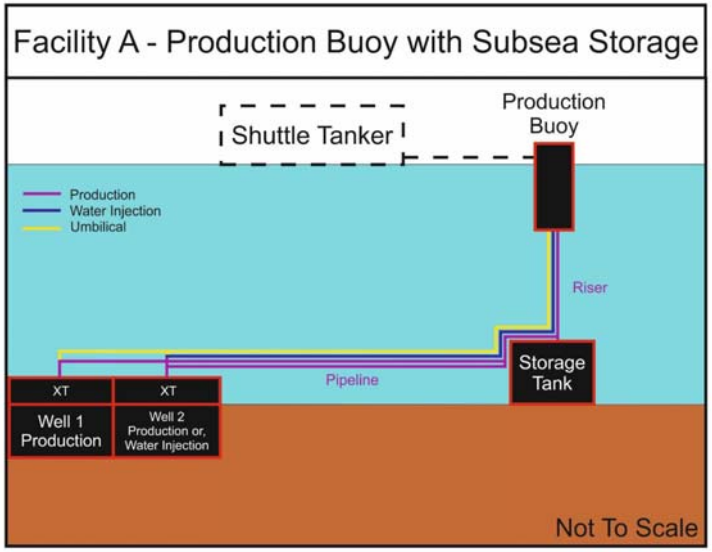
Beacon is included in EC

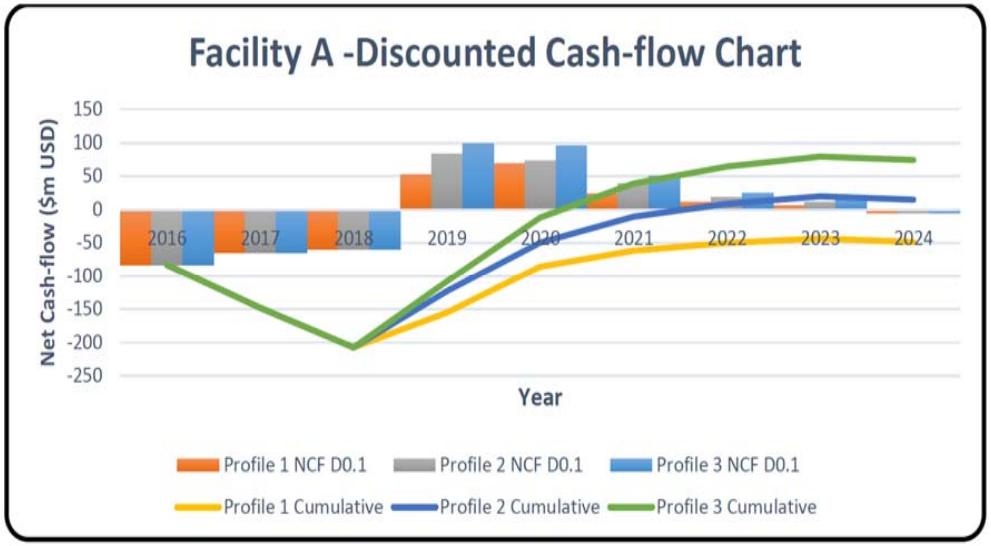
Resources by area: Changing small pools to pools..

Total P50 (3 to 100mmboe) recoverable by Area



Solutions





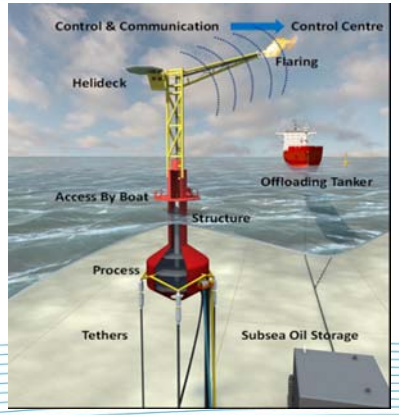
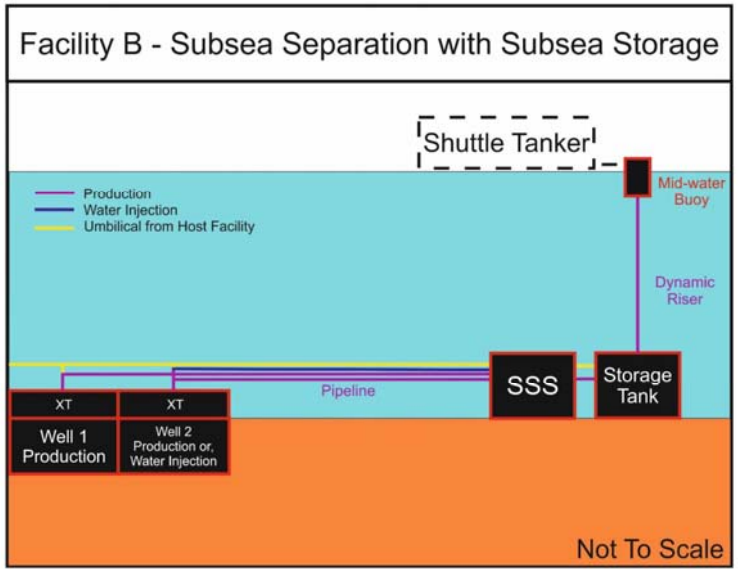
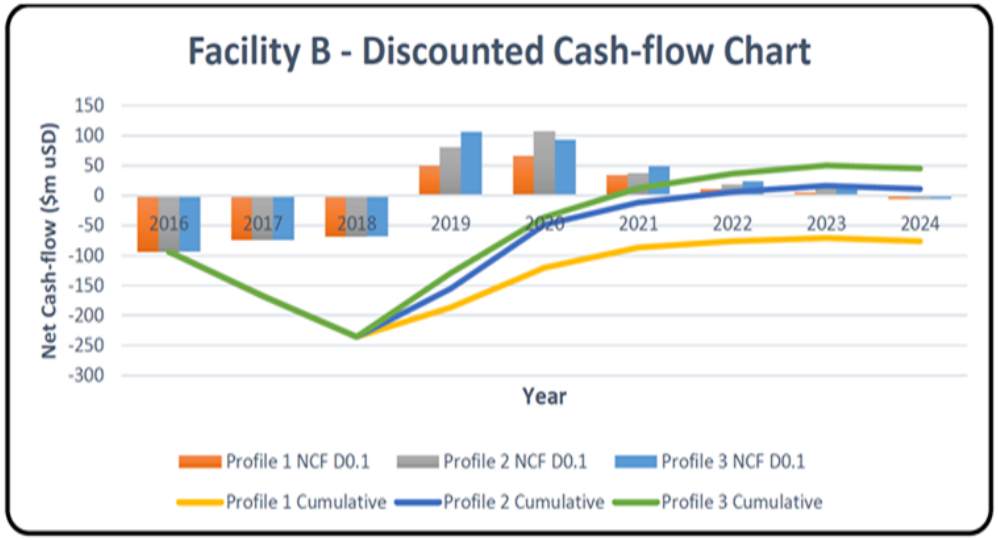


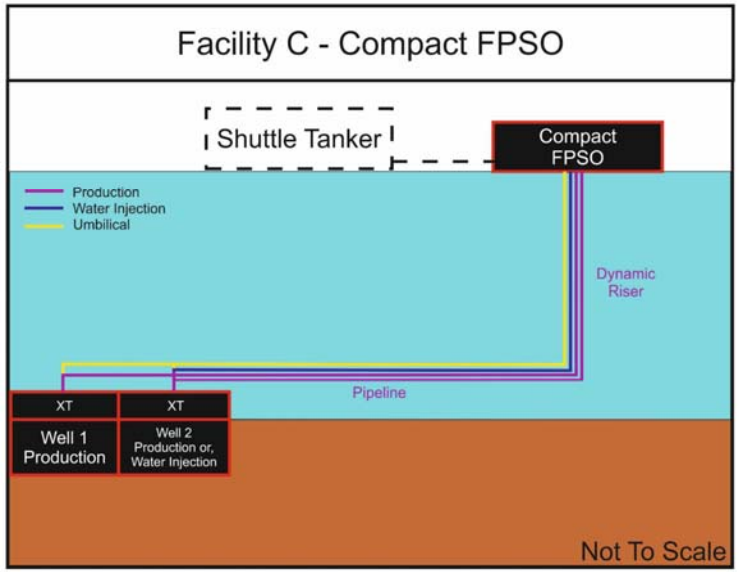
Image courtesy Enegi Oil

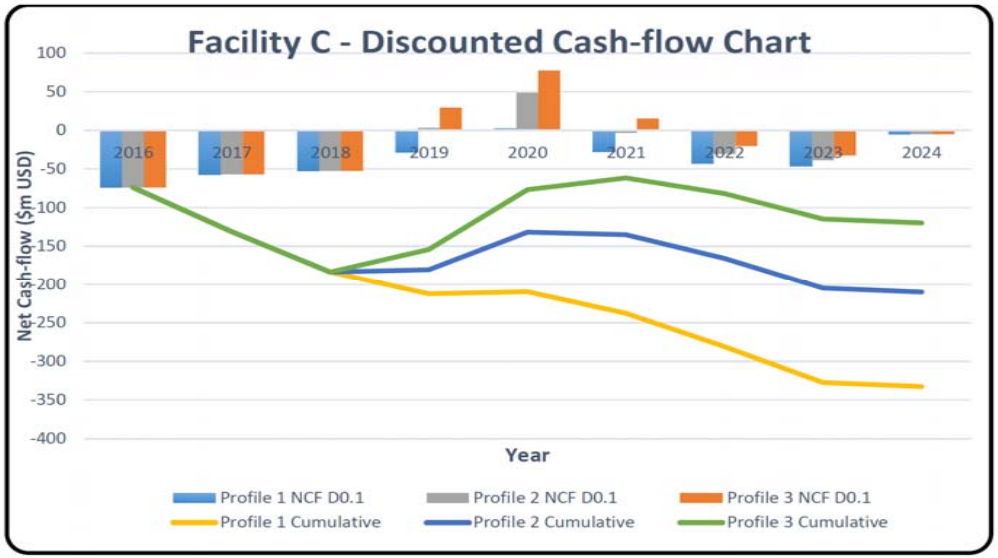
Solutions


Facility B - Subsea Separation with Subsea Storage
Shuttle Tanker
Mid-water Buoy
Production
Water Injection
Umbilical from Host Facility
Dynamic Riser
Pipeline
SSS
Storage Tank
XT
XT
Well 1 Production
Well 2 Production or, Water Injection
Not To Scale


Facility B - Discounted Cash-flow Chart
Net Cash-flow ($m uSD)
150
100
50
0
-50
-100
-150
-200
-250
-300
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year
Profile 1 NCF D0.1
Profile 2 NCF D0.1
Profile 3 NCF D0.1
Profile 1 Cumulative
Profile 2 Cumulative
Profile 3 Cumulative

Solutions


Facility C - Compact FPSO
Shuttle Tanker
Compact FPSO
Production
Water Injection
Umbilical
Dynamic Riser
Pipeline
XT
XT
Well 1 Production
Well 2 Production or, Water Injection
Not To Scale


Facility C - Discounted Cash-flow Chart
100
50
0
-50
-100
-150
-200
-250
-300
-350
-400
Net Cash-flow ($m USD)
2016
2017
2018
2019
2020
2021
2022
2023
2024
Year
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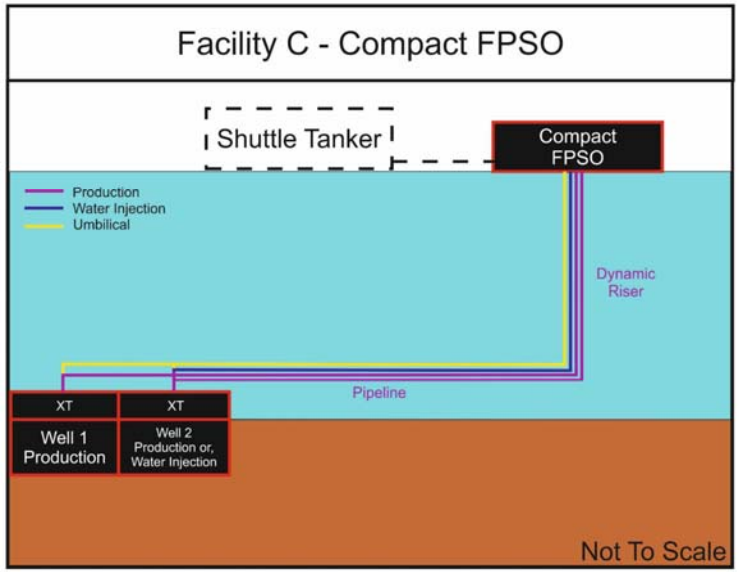
Profile 2 NCF D0.1
Profile 3 NCF D0.1
Profile 1 Cumulative
Profile 2 Cumulative
Profile 3 Cumulative

Solutions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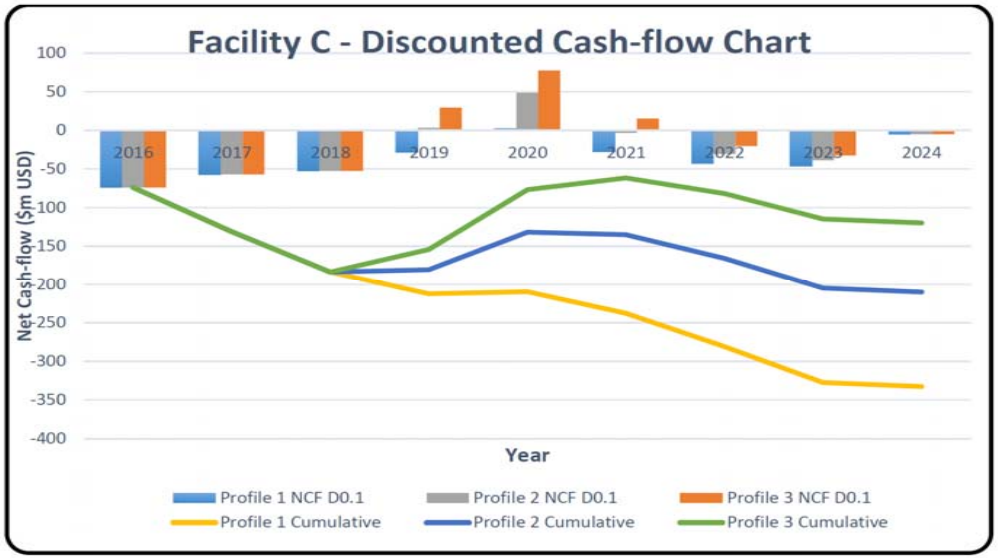
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Profile 2 NCF D0.1
Profile 3 NCF D0.1
Profile 1 Cumulative
Profile 2 Cumulative
Profile 3 Cumulative

Conclusion - Solutions

Facility A = Production buoy
Facility B = Subsea factory -lite
Facility C = Compact FPSO
Profile 1 = 5.8 MBoe
Profile 2 = 9.1 MBoe
Profile 3 = 11.8 Mboe

Conclusion = Facility A & B economic at MEFS of 11.8 & 9.1 MBoe

PFD for Oil production system

PFD for Oil production system

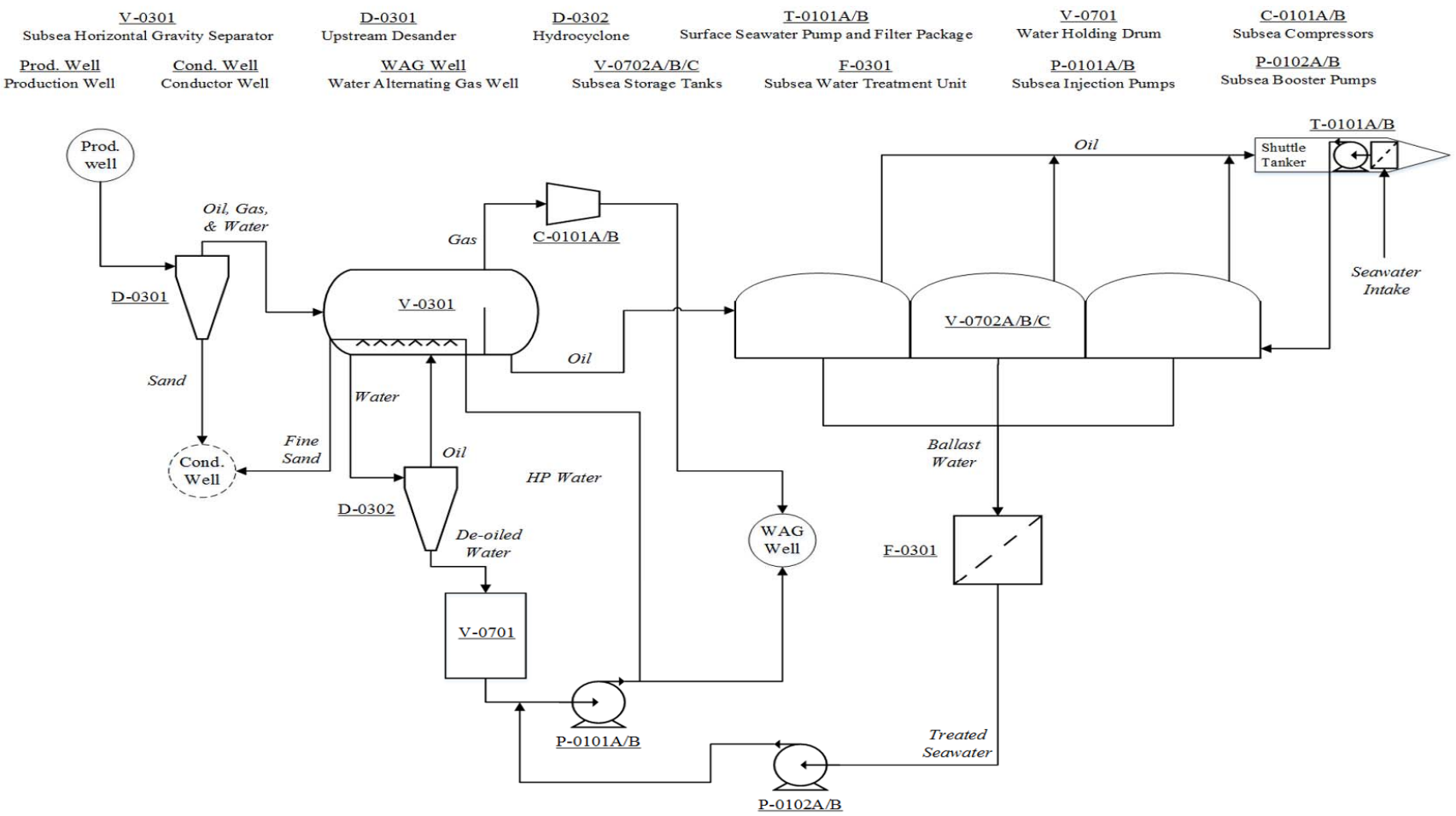


Figure 25 - Process flow diagram for revised process configuration of subsea production system.

GustoMSC Production jack ups

Image courtesy GustoMSC

Conclusive Remarks

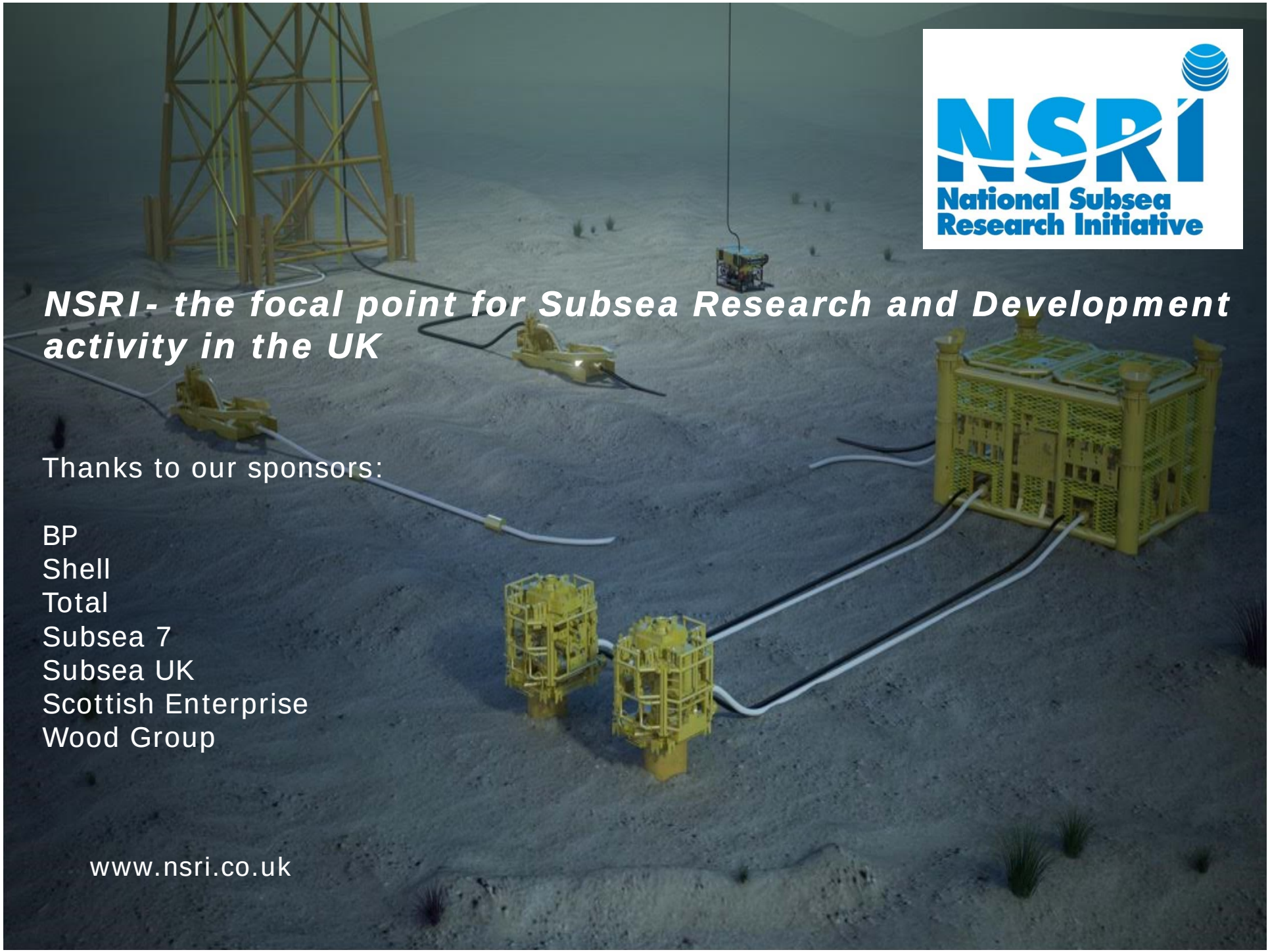
Very Coarse economics

- *Oil price $50 /bbl*
- *Lifting costs (best case) $15/bbl*
- *Pre tax profit margin say 25%*

  50 – (0.25 x 50) – 15 = $22.5/bbl

- *Capex for development of*

Pool size	$
10mmBoe	225 million
25mmBoe	563 million
50mmBoe	1,125 million



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