

A Low Cost Deepwater Gas Development Solution using Subsea Dehydration

Richard Moore

SubCool Technologies Pty Ltd

Ian Long

INTECSEA, WorleyParsons Group

A Hybrid Concept

Many Deepwater Gas fields are uneconomic and remain stranded. Current solutions are challenged.

Both traditional Surface and FLNG solutions result in 'mega-facilities', with high CAPEX, high OPEX, manning and HSE / heli-ops challenges.

'Subsea solutions' also have technical challenges including distance limits.

A revolutionary new concept achieves lower cost by processing the gas and associated liquids at the fundamentally most efficient location. This concept is not surface, not subsea, but a genuine 'hybrid'.

This innovative concept uses proven components, offering straight forward technical qualification and deployment.

Dehydration – A Key Unit Operation

Dehydration is a core onshore / surface unit operation that allows hydrocarbons to be transported long distances to market, at lowest possible cost, using water dry pipelines.

Cooling and a first stage separation are also key unit operations to remove water, ensuring the subsequent dehydration is efficient.

Alternatives prior to Subsea Processing

When the industry commenced subsea production, subsea processing operations were not available. Instead solutions such as chemical injection, insulation and heating have been used. While very successful over short distances and moderate water depths, these are challenged over longer distances and deeper waters.

The industry is now ready for subsea dehydration to lower the cost of deepwater gas.

Key Distinction between Gas and Liquids

There is a key distinction between processing liquids and processing gas, which, though innately clear, has not been widely considered, debated, nor published.

Liquids can be processed on the surface relatively efficiently. It is the high pressure surface gas systems that have a disproportionate impact on size, weight and cost of surface facilities.

Importantly, in countries like Brazil and West Africa, using an FPSO to produce liquids is not questioned. Processing liquids on an FPSO is clearly seen as more cost efficient than bringing the liquids to shore.

Process Engineering Fundamentals

Cold is required for gas processing and this is available on the seabed.

Heat is required for liquid separation and stabilisation. Low viscosities are a key enabler of droplet coalescence. This is most efficiently undertaken on the surface.

Figure 1 Scheme 1 - Hybrid Concept with low pressure FPSO including condensate storage and export

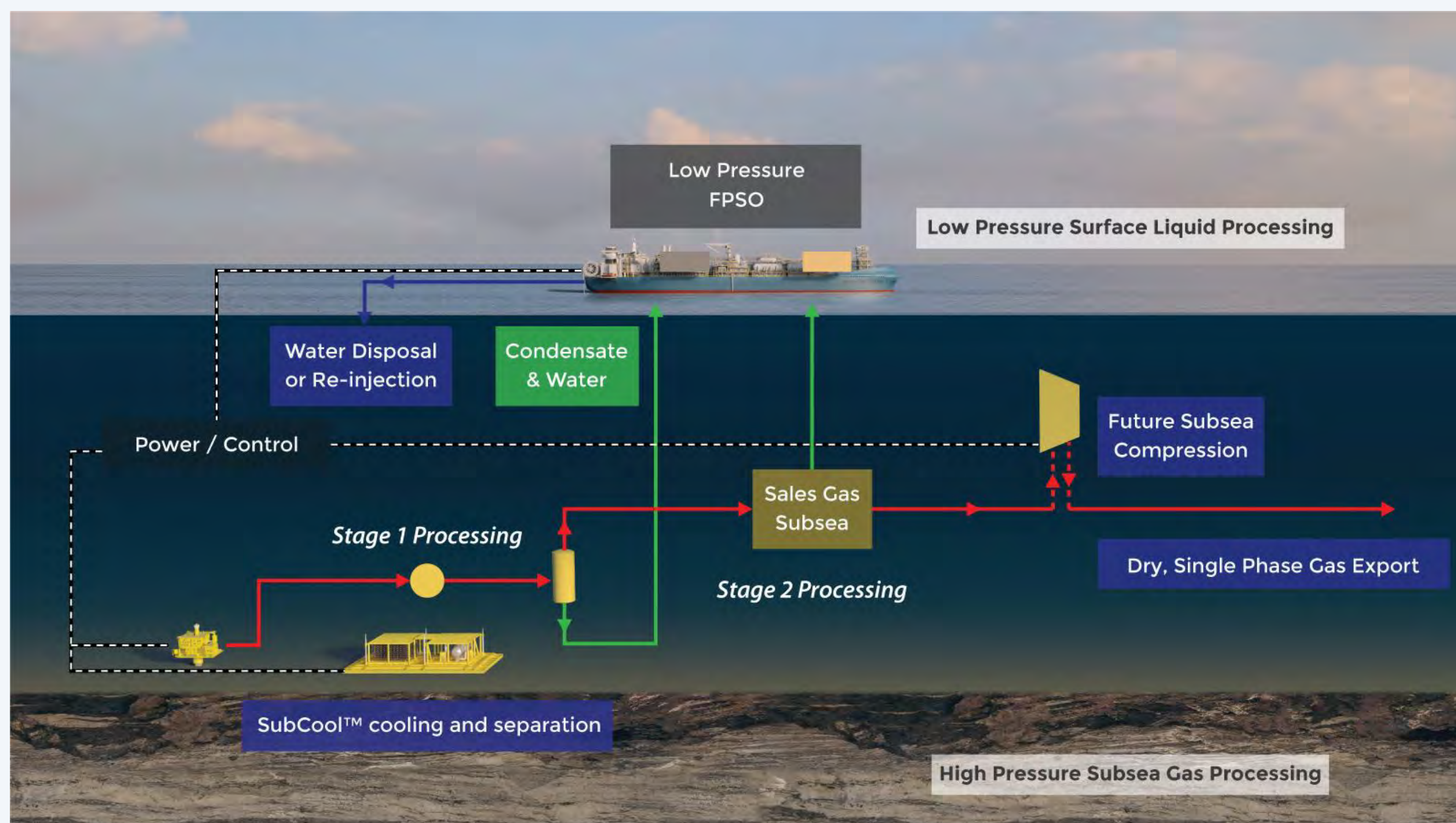


Figure 2 Scheme 2 - Hybrid Concept with low pressure Semi-Sub including condensate de-watering and re-injection

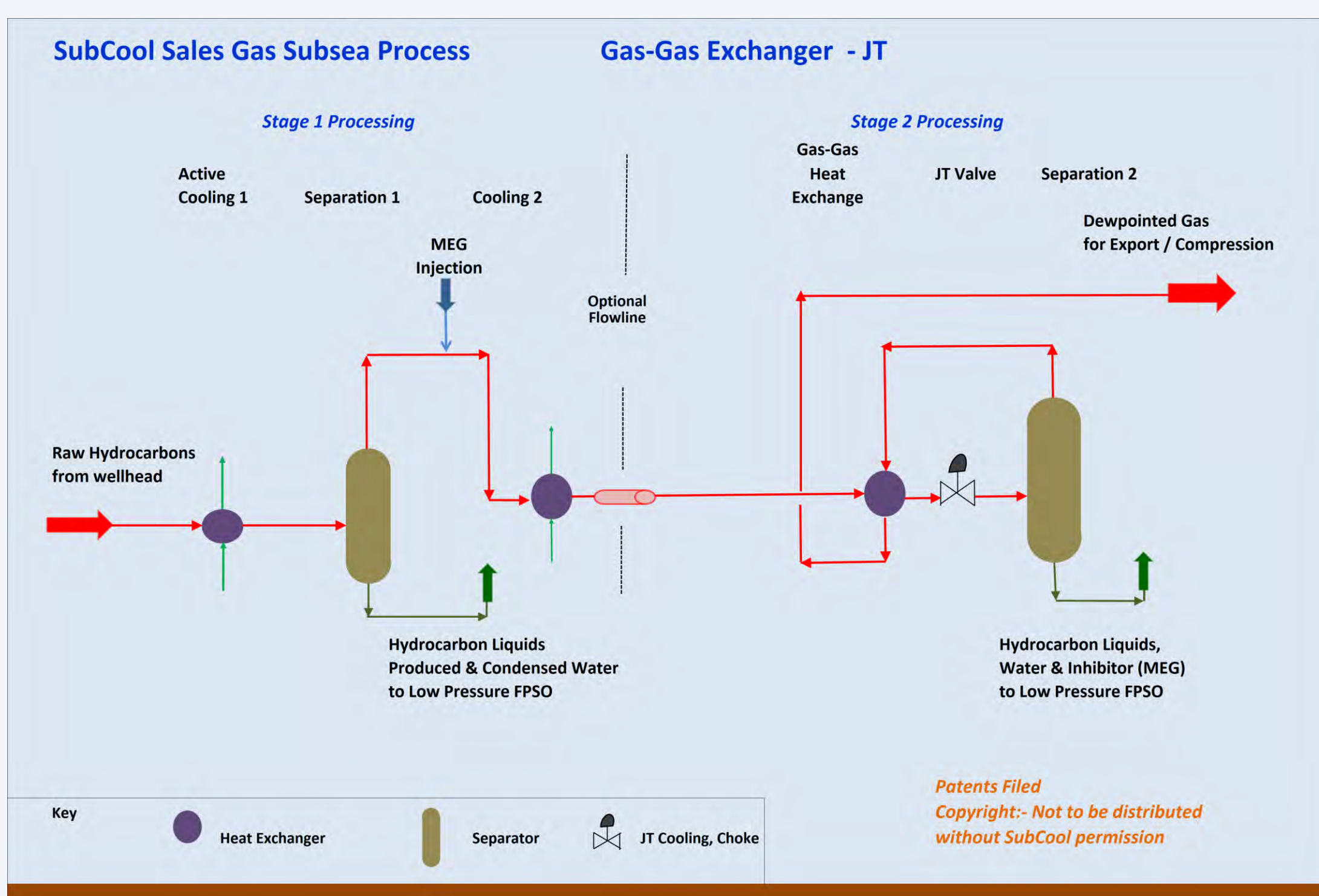
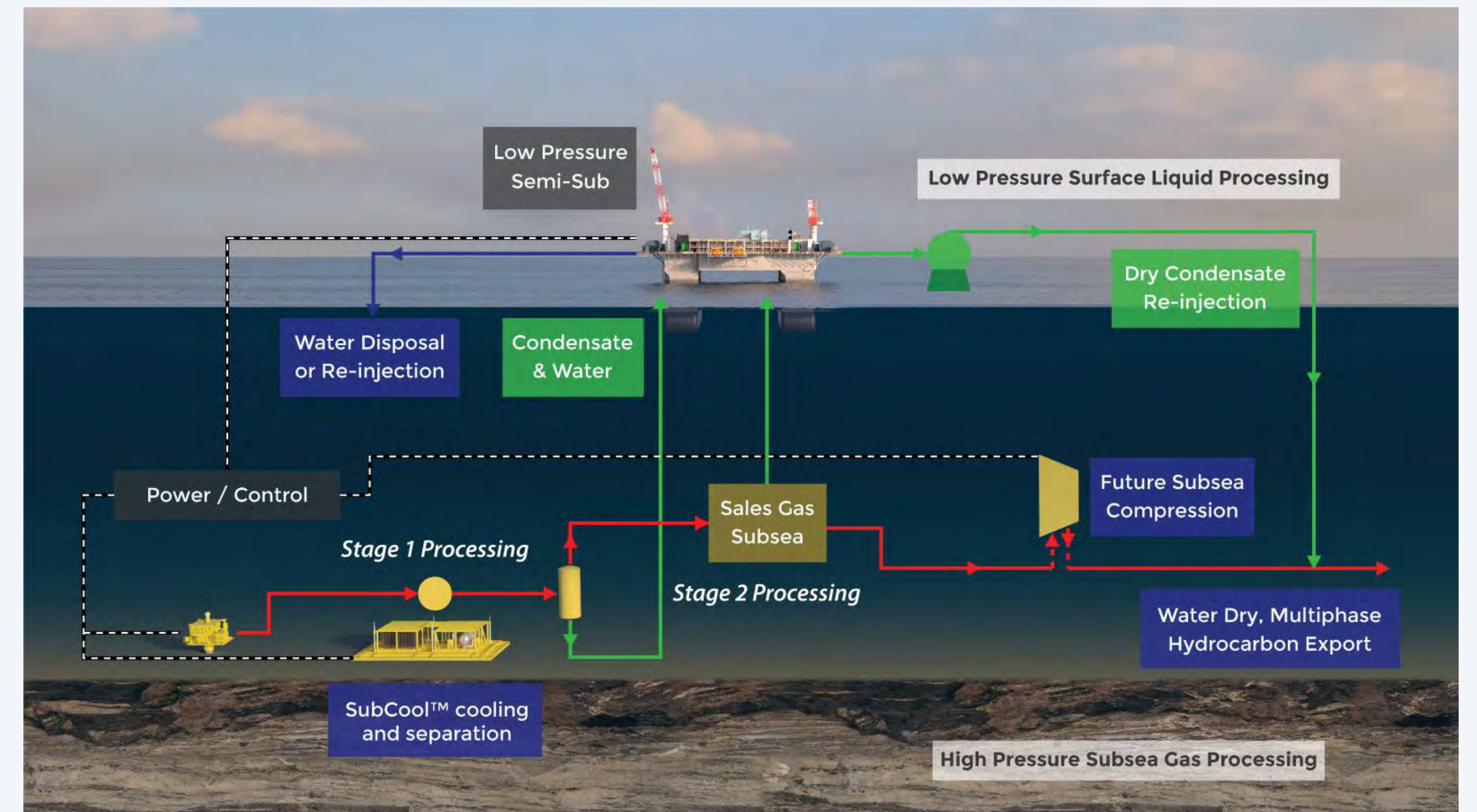


Figure 3 Subsea Dehydration Process

Subsea Dehydration Process

First Stage

Active Cooling and Separation removes produced water and the major fraction (>80%) of condensed water. Cooling is stopped above hydrate and wax temperatures, prior to 1st Stage Separation. Glycol is added post 1st stage separation prior to further cooling.

Second Stage

A gas-gas heat exchanger is a key equipment item to efficiently lower temperatures using JT cooling. High pressure processing allows dehydration for a minimal temperature drop.

An innovative and novel application of onshore proven technology

Simple and Robust – essential for subsea application

Summary

- A new solution has been identified to develop deepwater gas fields, more efficiently and for lower CAPEX and OPEX costs.
- This revolutionary solution is a 'Hybrid Concept'. It is not subsea, not surface, but a truly unique and optimal combination.
- The hybrid concept is based on fully processing the high pressure gas subsea, including subsea dehydration. The 'cold' available on the seafloor assists efficient high pressure subsea gas processing.
- The concept incorporates a compact, surface facility for liquids processing. Provision of heat allows the low pressure liquids to be efficiently processed on the surface. The surface facility also simplifies power and control for future subsea compression and provides virtually unlimited distance capability.
- All components are proven and require a minimum of technical development
- Safety is improved with a significantly reduced permanent offshore workforce required

NOTES / ACKNOWLEDGEMENTS

Note the process and concepts described herein are the subject of filed patents. All rights are retained by the developing company, SubCool Technologies Pty Ltd.

The support of INTECSEA, WorleyParsons Group, is acknowledged, as technology development partner for SubCool Technologies Pty Ltd.