

Multiphase Pumping contributes to reduce Emissions from Natural Gas production

How Twin Screw Multiphase Pumps can move oil and gas production to central processing, reducing facilities and potential emission escape points



Advantages with Multiphase Pumping



- ✓ Facility reduction: Using a single flow multiphase line moving the comingled well flow to centralized processing, eliminating separators, compressors, stock tanks, etc. Reducing CAPEX & OPEX and adding revenue from gas production
- ✓ HSE impact: Eliminating flaring and venting of associated gas. Reducing overall CO2 emissions. Reduced facility footprint and operator personnel. Potential methane escape points minimized. Less road traffic and fewer accidents from reduced trucking
- ✓ Draw down/Boosting: Lowering FBHP for better well inflow. Production acceleration. Increased and extended total hydrocarbon recovery. Delay well abandonment
- ✓ Flow Assurance: Mitigate hydrate formation. Combatting heavy oil/water emulsions and wax issues
- ✓ Liquid logging /Wet gas: Assisting blow down of liquid logged wells through increased tubing velocity by reducing FWHP pressure.

The Headlines...

BUSINESS // ENERGY

Permian methane emissions back on the rise after small dip

BUSINESS

‘Sustainably Fracked’: Shale Producers Seek a Green Label for Their Natural Gas

Under pressure over climate change, shale companies borrow an idea from the food industry as they look to differentiate the fuel they produce

OPINION

American Petroleum Institute: We can meet demand as well as cut carbon dioxide emissions

R. Dean Foreman, Opinion contributor Published 7:31 p.m. ET Aug. 27, 2019

❖ **N.D.C.C. § 38-08-06.4 specifies that at least 75% of produced gas must be captured via:**

1. Pipeline
2. On-site power generation
3. Various forms of liquids extraction with specific efficiency requirements

❖ **Rules are tightening over time**

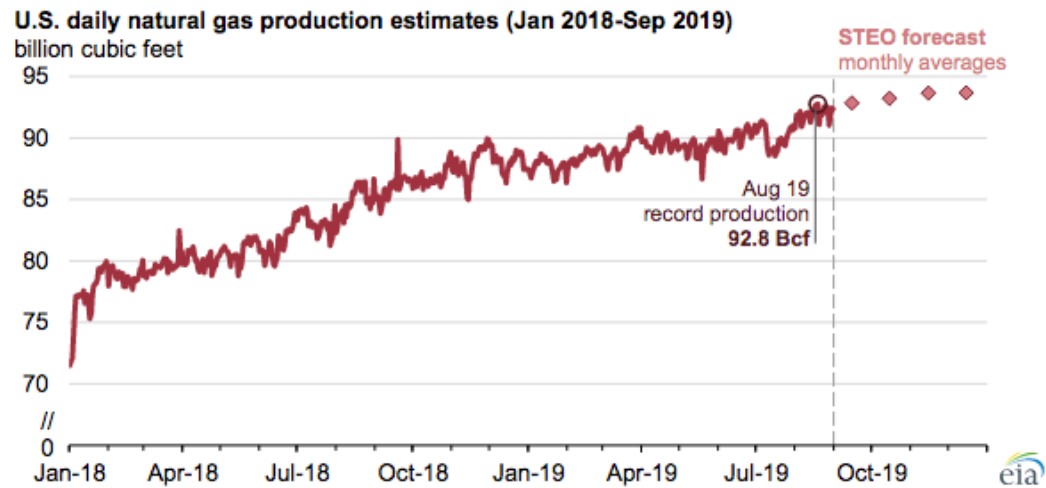
- In addition to overarching gas capture rules for all wells, NDIC Order 24665 increases gas capture requirements for infill wells in the Bakken / Three Forks Pool
- Progressively increased gas capture requirements from 74% in 2014 to 88% currently
- Scheduled to rise to 91% on November 1, 2020
- Dry gas “flaring loop hole” not in the spirit of the law, long-term viability in question

❖ **Failure to meet these limits results in well being choked back to 100 Bopd**

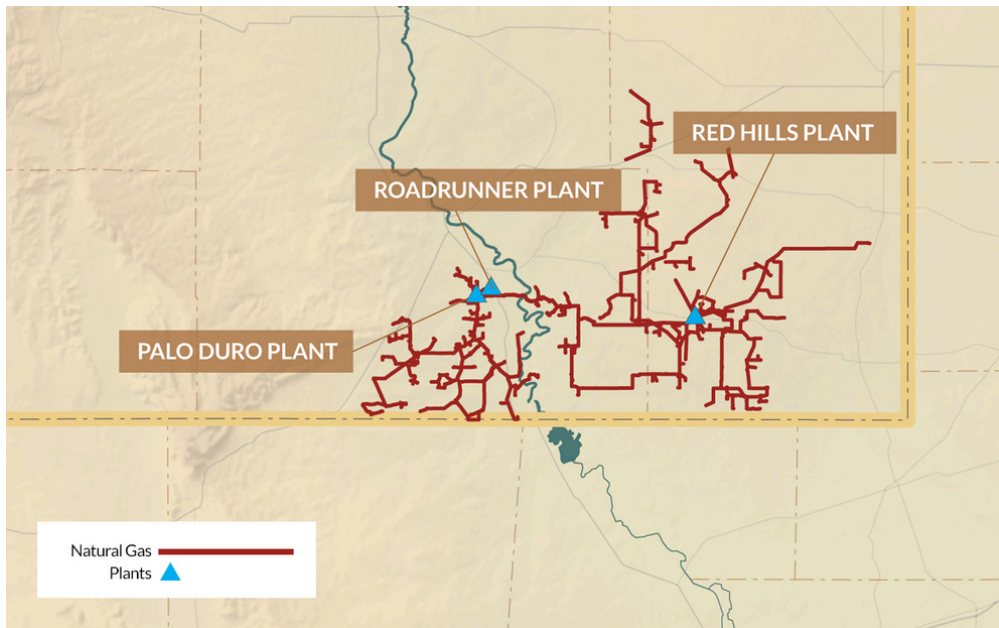
- 200 Bopd if 60% of gas capture requirement is met

❖ **Special royalty and tax penalties also imposed for producers failing to meet gas capture rules**

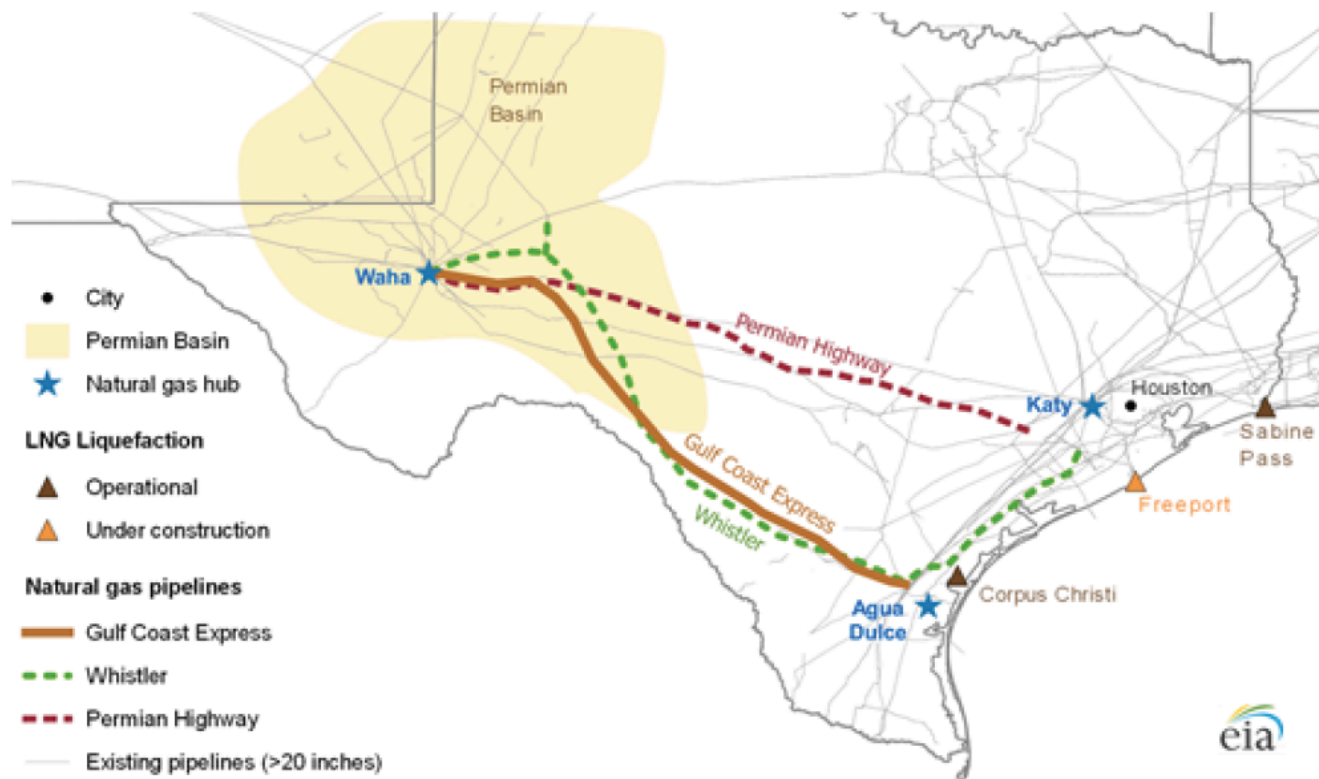
U.S. natural gas production reaches a new record despite low prices



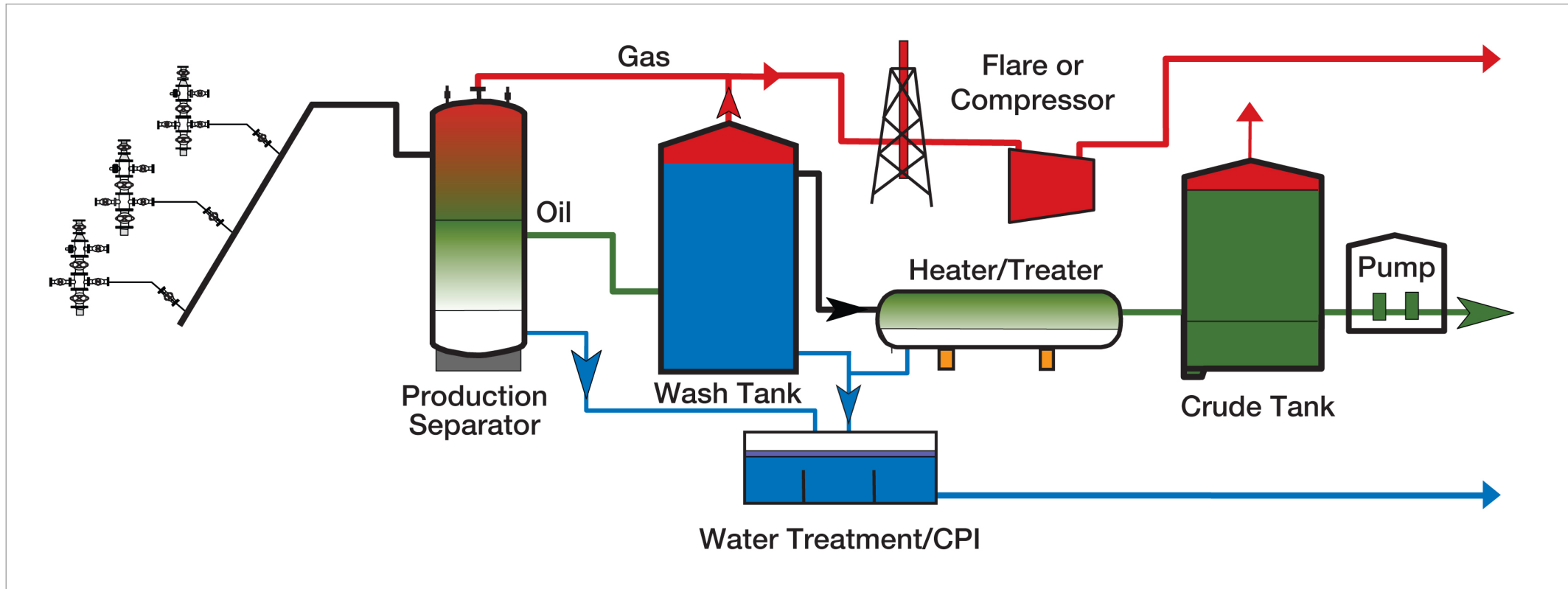
Source: U.S. Energy Information Administration, *Short-Term Energy Outlook*; IHS Markit



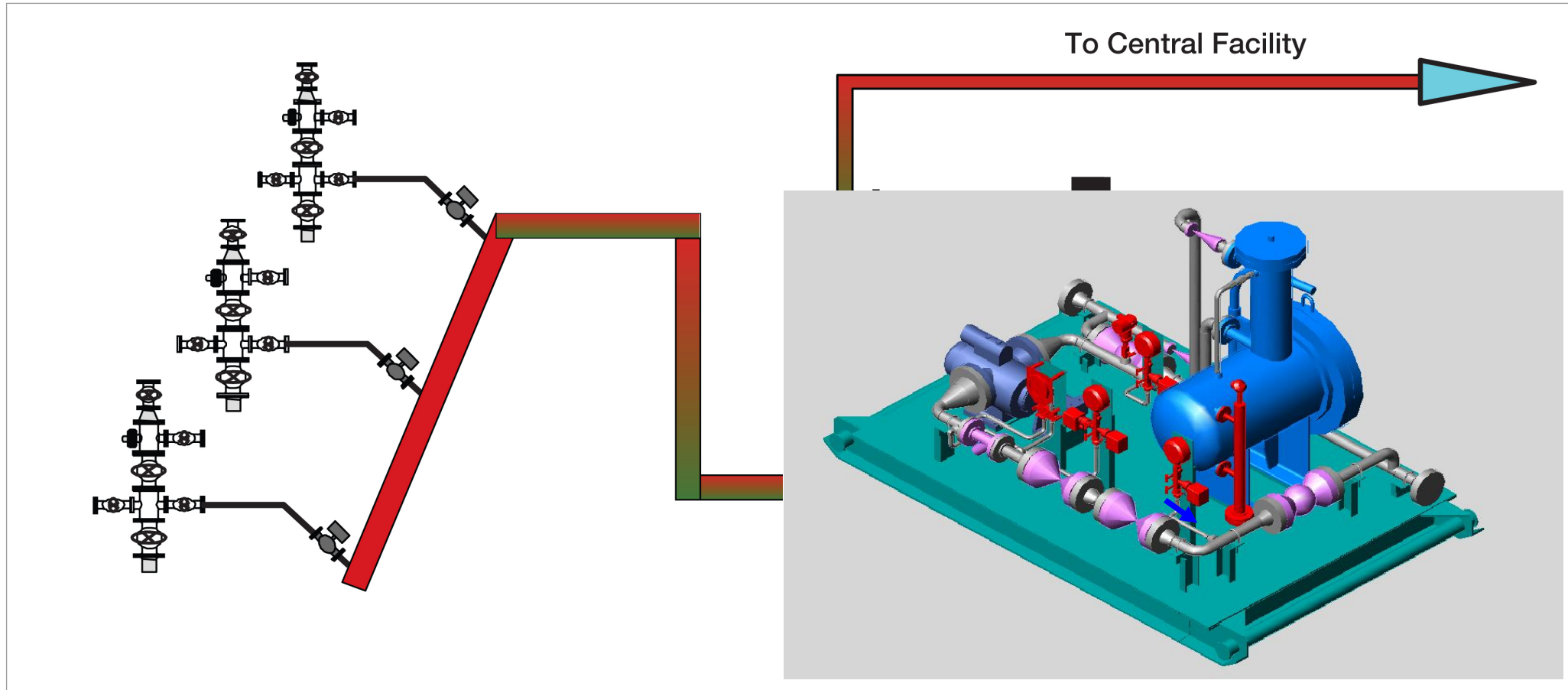
Good Times Coming!



Conventional Gathering Facility

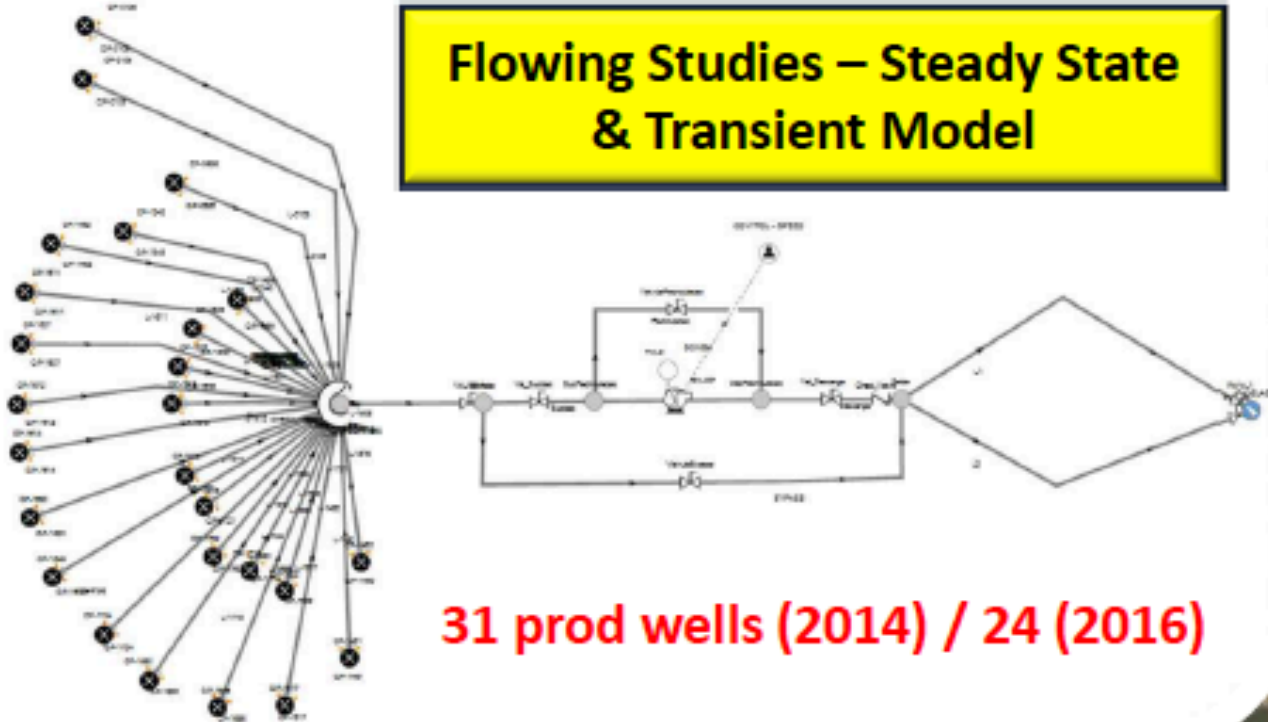


Gathering and Boosting with Multiphase Pumping



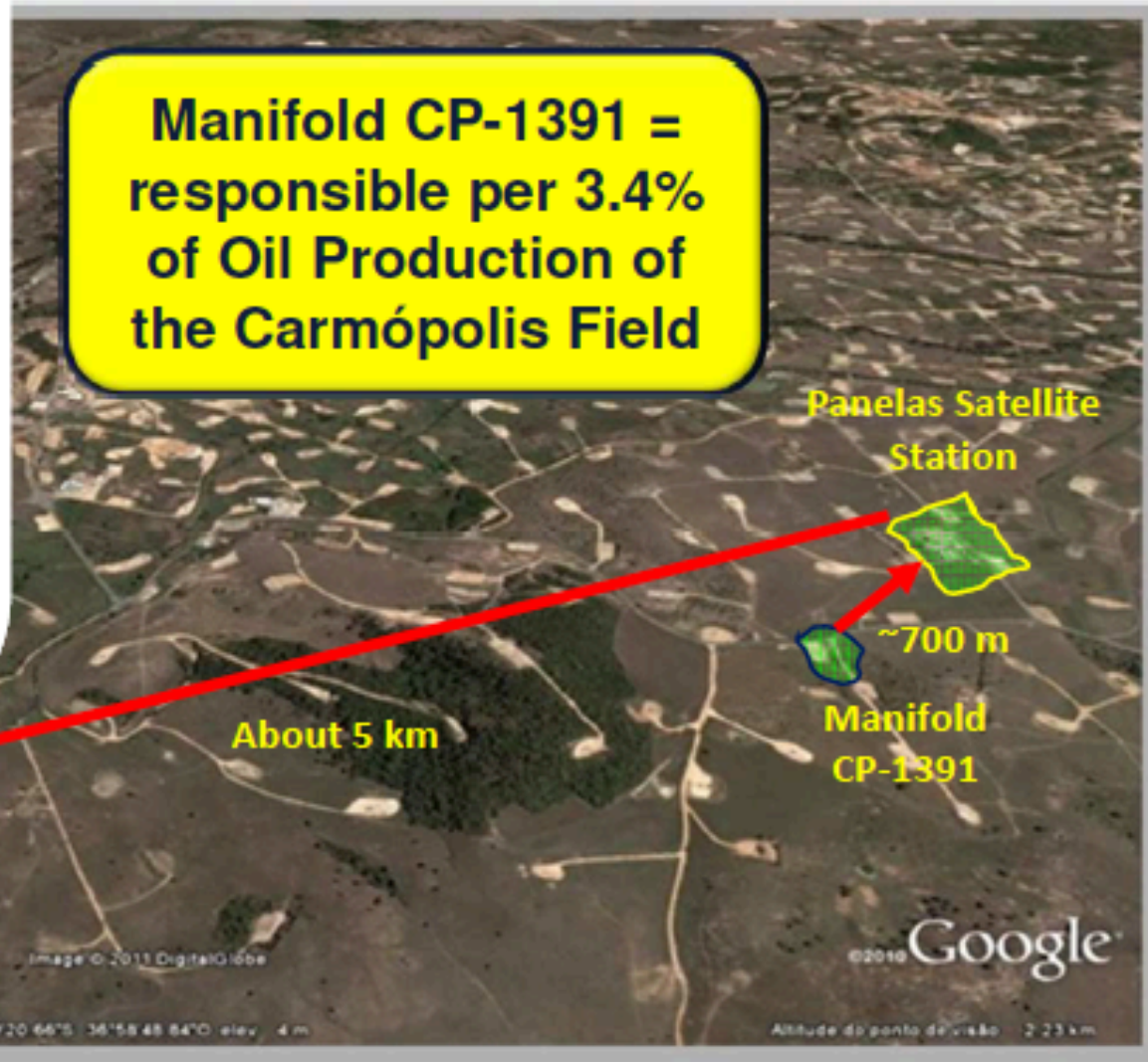
Well Testing and Boosting

Flowing Studies – Steady State & Transient Model

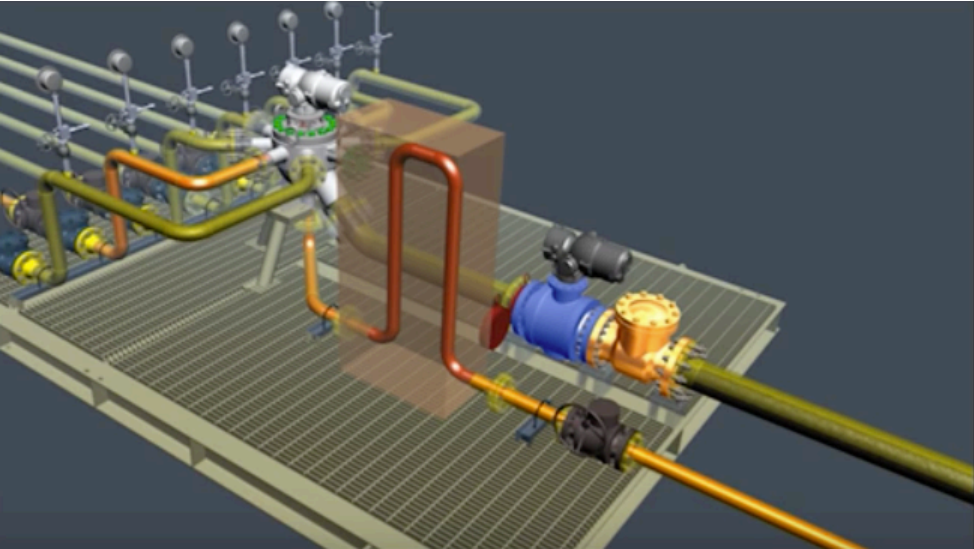


31 prod wells (2014) / 24 (2016)

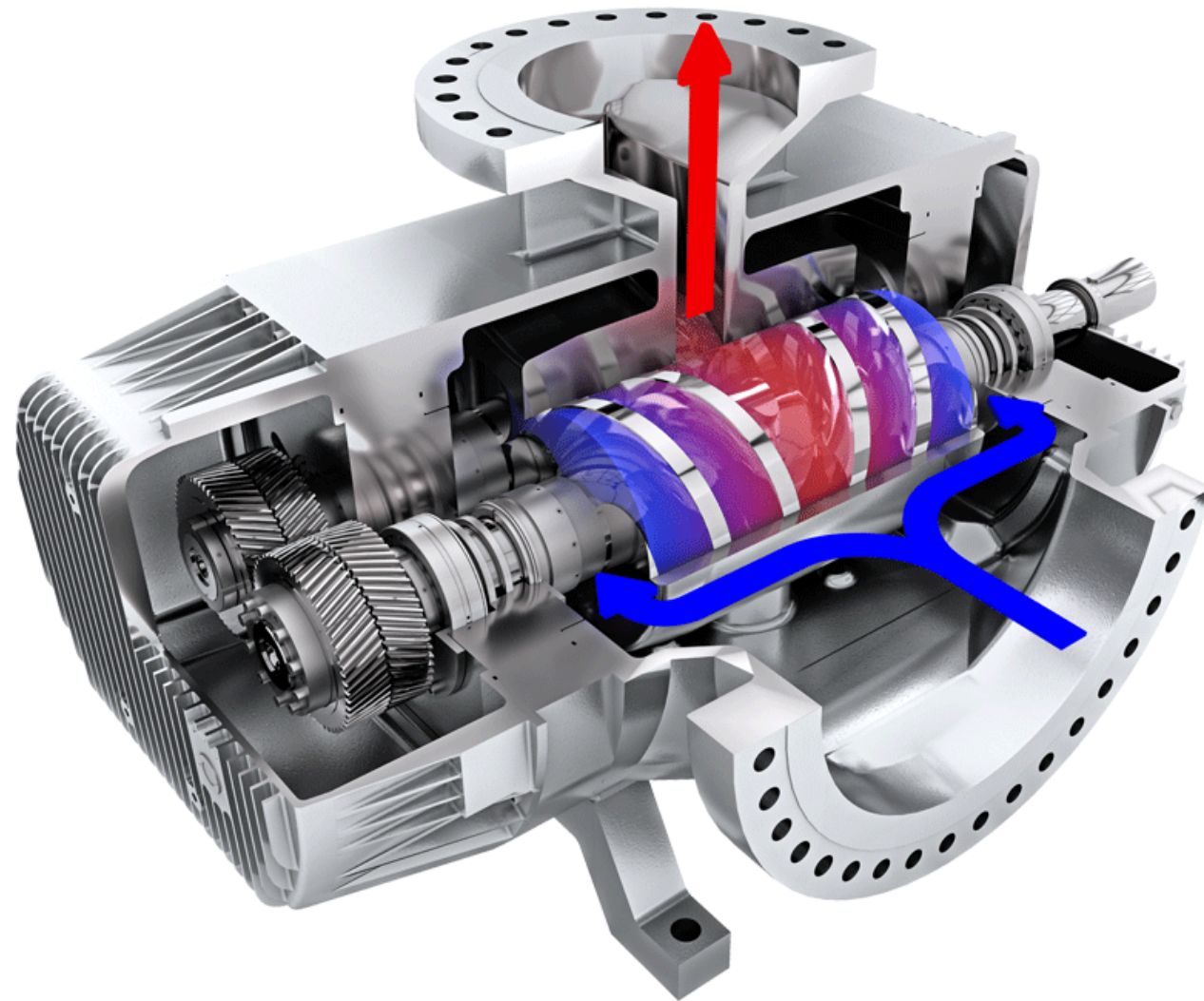
Manifold CP-1391 = responsible per 3.4% of Oil Production of the Carmópolis Field



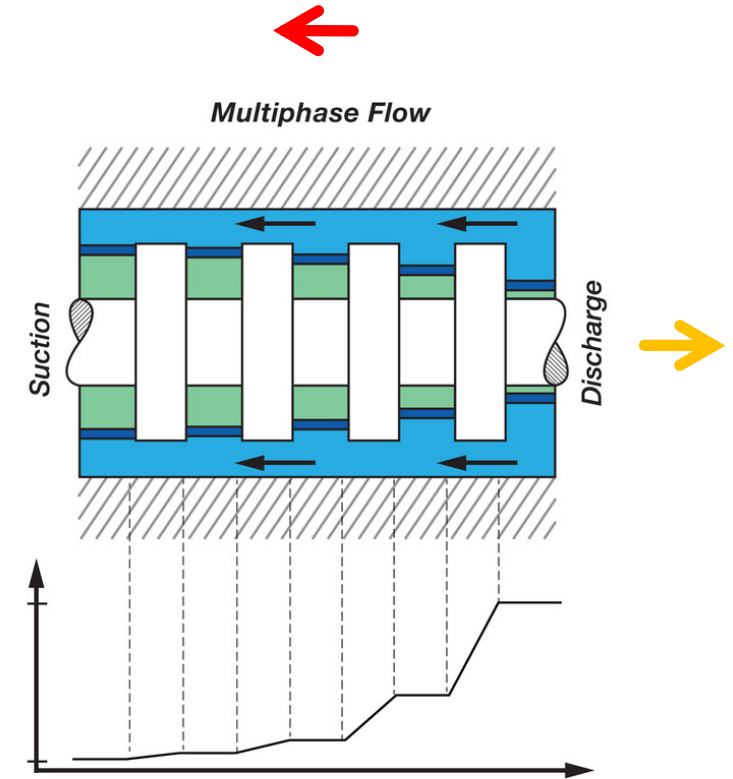
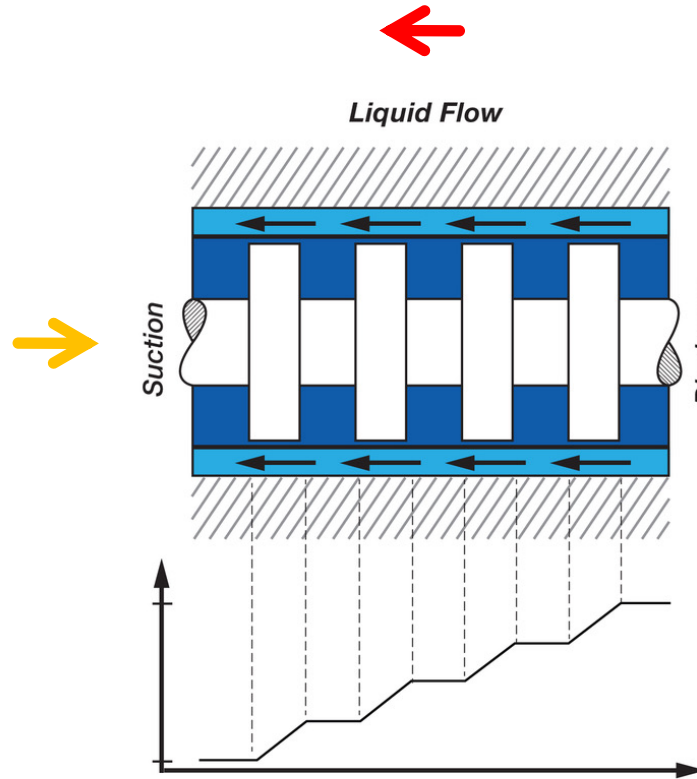
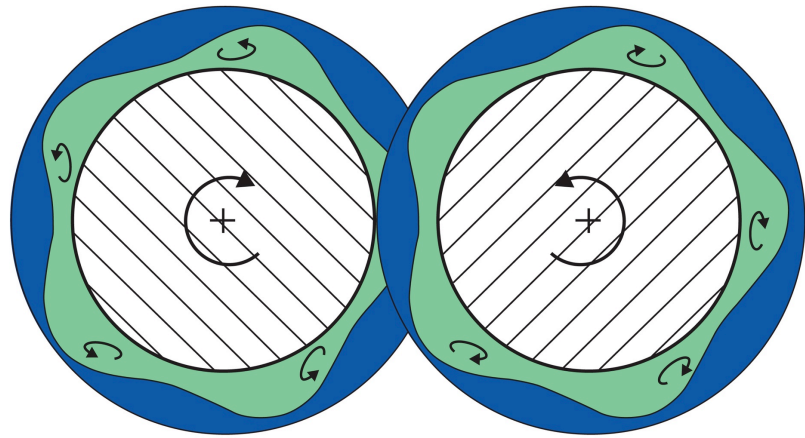
Gathering Lines, Multiphase Metering & Booster Pumps



Multiphase Pump



Liquid and Gas Phase Split

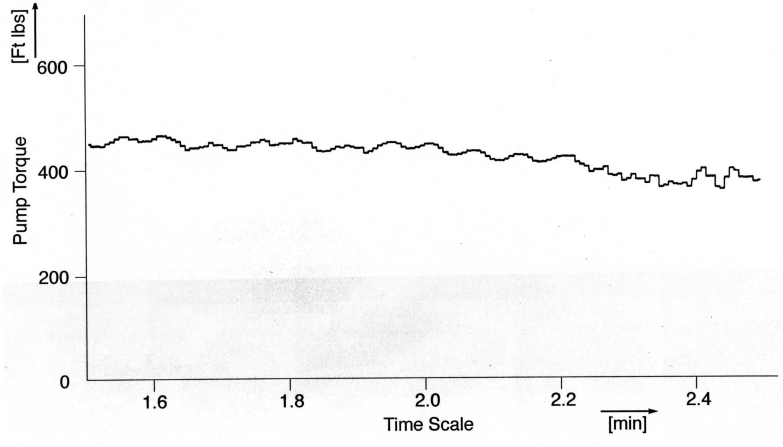
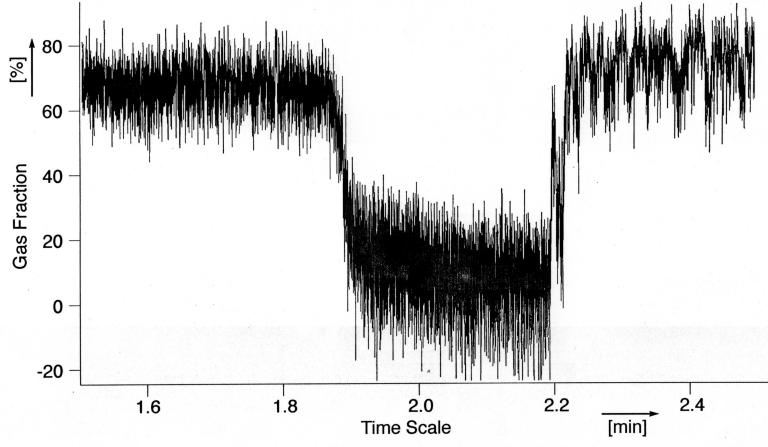
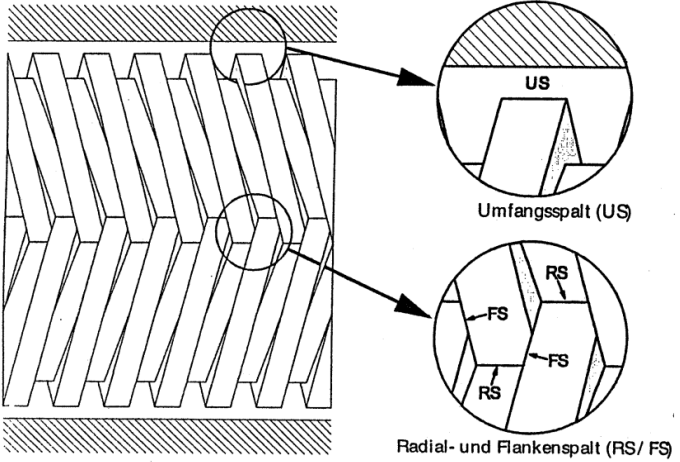


Pumping liquids

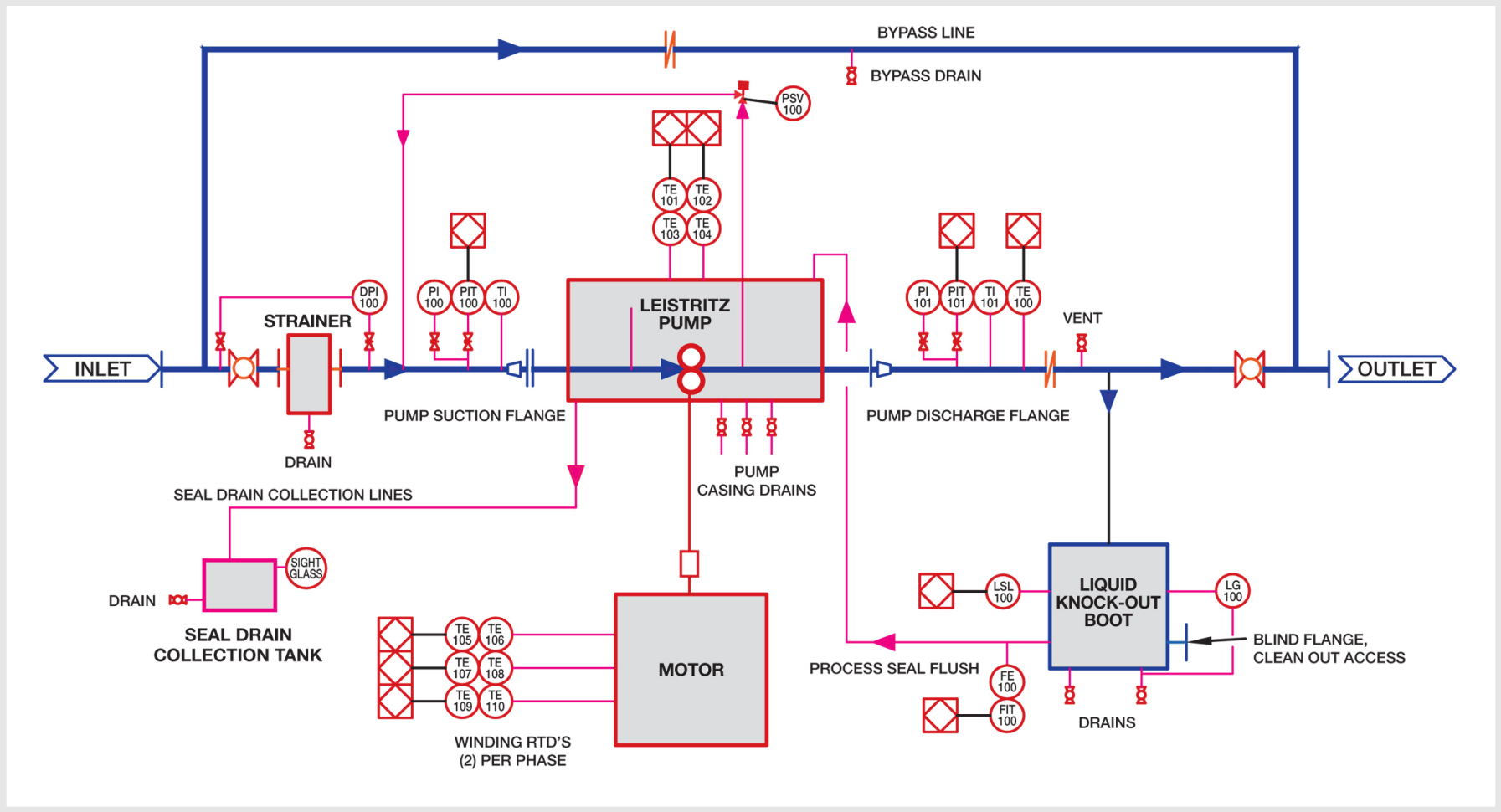
Compressing gas

-  Gas
-  Liquid
-  Slip (enlarged for illustration purposes only)

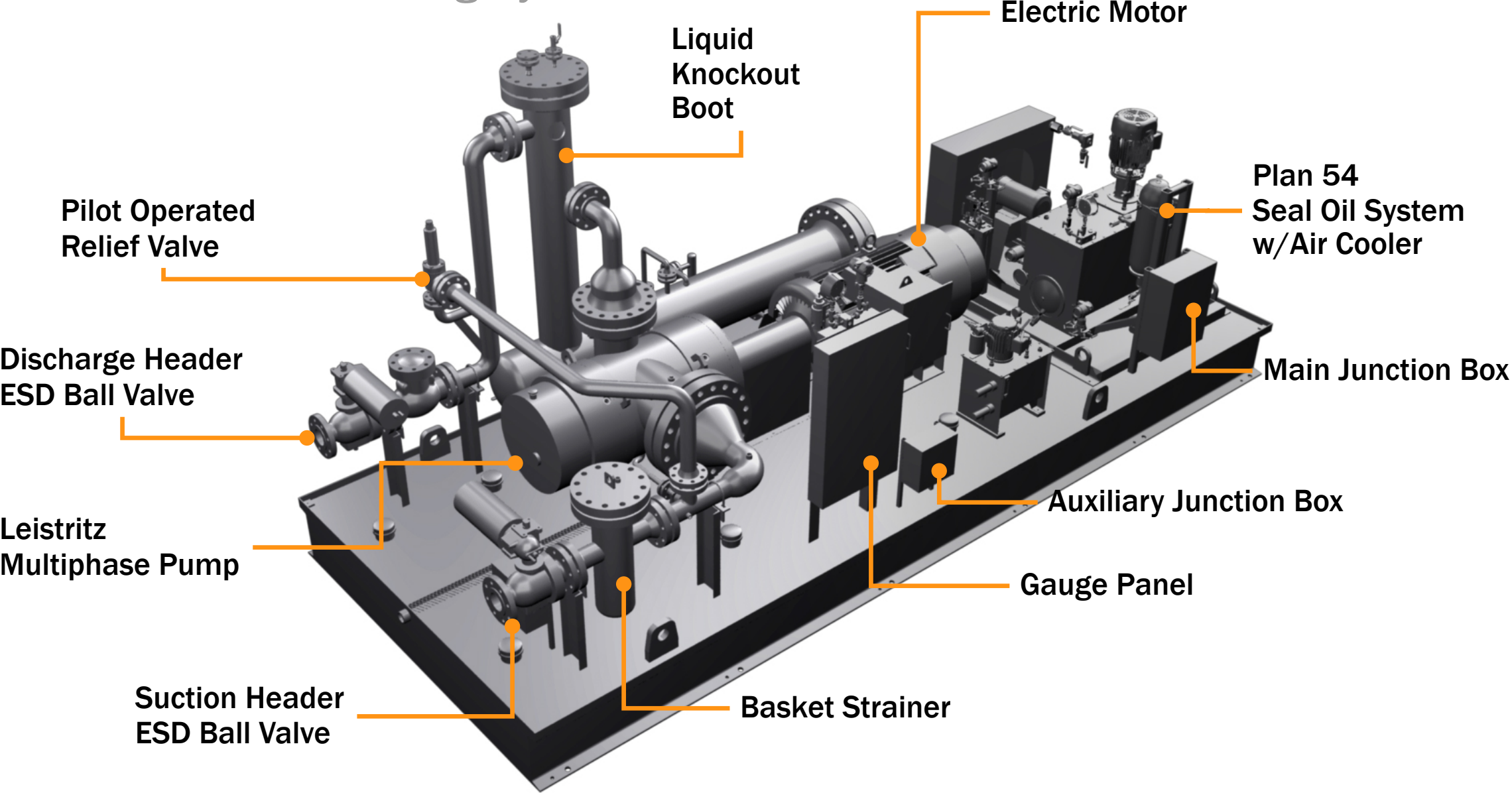
Multiphase Pumping Principles



Standard Multiphase Pump Package P&ID

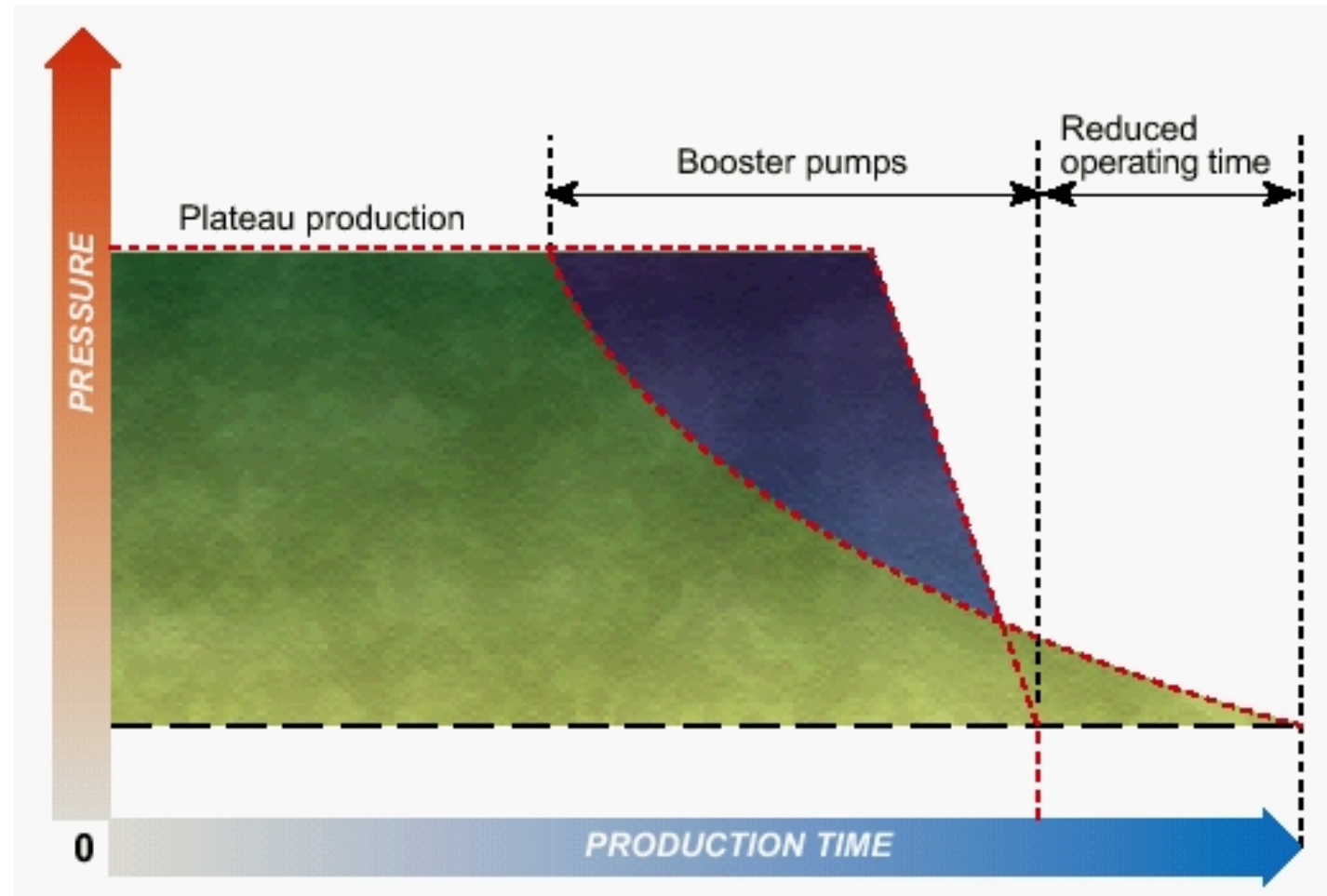


Typical Leistritz Gathering System



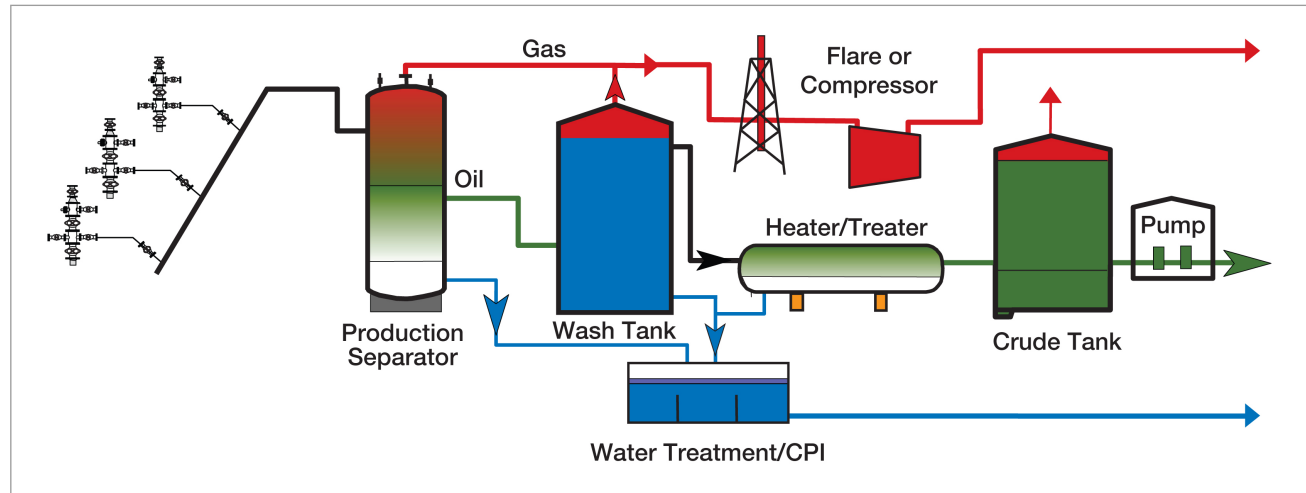
Other Advantages with Multiphase Pumping

Besides boosting well flow also enhances production from low pressure well and extends plateau production and total recovery by lowering flowing wellhead back pressure

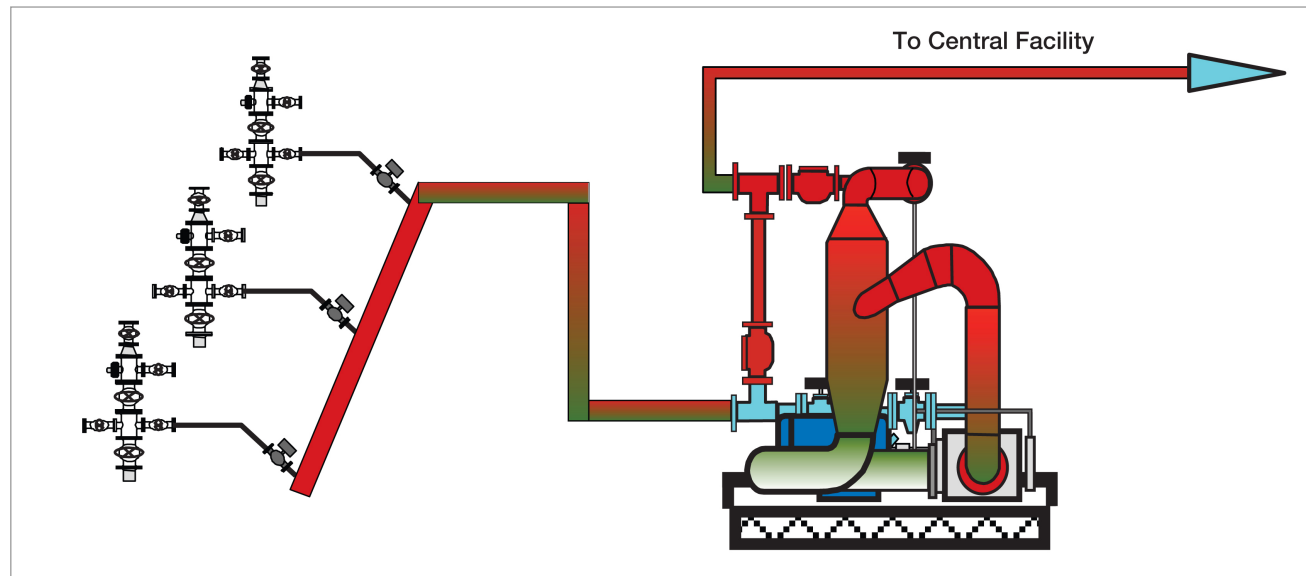


Added Benefits

Compared to conventional well pad production multiphase boosting improves production with transient and unstable flow regimes in horizontal wells as well as slugging and surging in surface flow lines.



Conventional Production



Multiphase Production

Example of Facility Reduction: Before MPP



Example of Facility Reduction: After MPP Installation



Small Gathering and Boosting System



Medium Sized Gathering and Boosting System

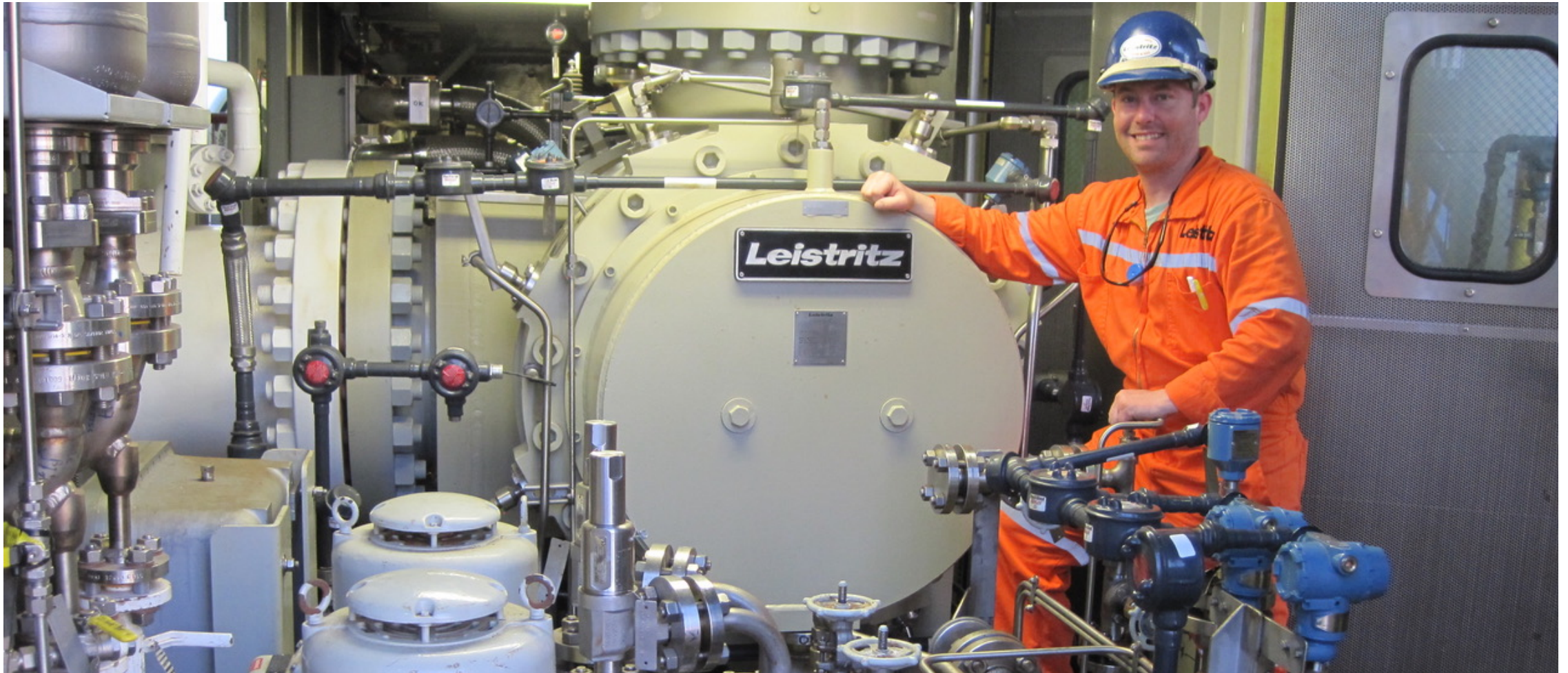


Portable Unit for De-Liquefying Gas Wells

Using multiphase pumps for blowing down liquid logged gas wells eliminate the need for a blow down tanks, venting or flaring. Liquids and gas is boosted together in the multiphase flow line back to processing.



Full Field Service, Commissioning & Technical Support





THANKS FOR YOUR ATTENTION.

