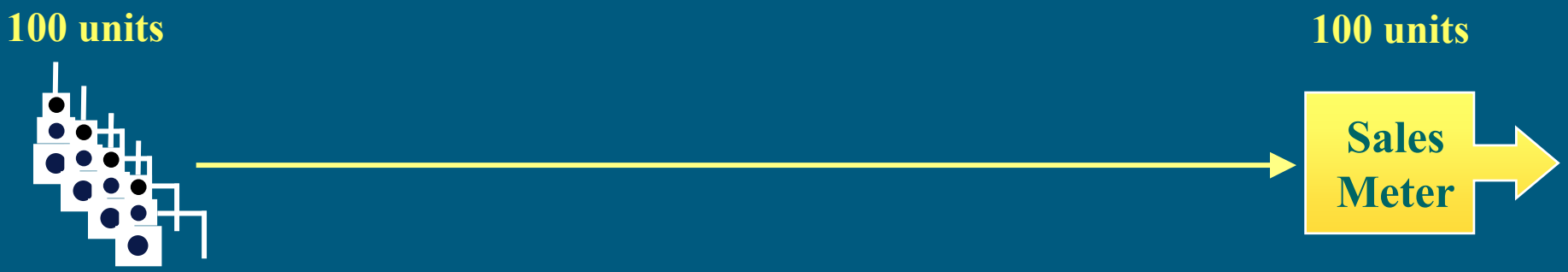
Process Optimization Review

PRO - OP

June 6, 2006

PRO-OP Concept

- How can we get as much product, produced at the wellhead, to the sales meter?



- **PRO-OP** – a systematic approach to increase production efficiencies and profitability through evaluating process components whereby methane emissions are reduced on a cost effective basis.

Pro – Op…….the big picture

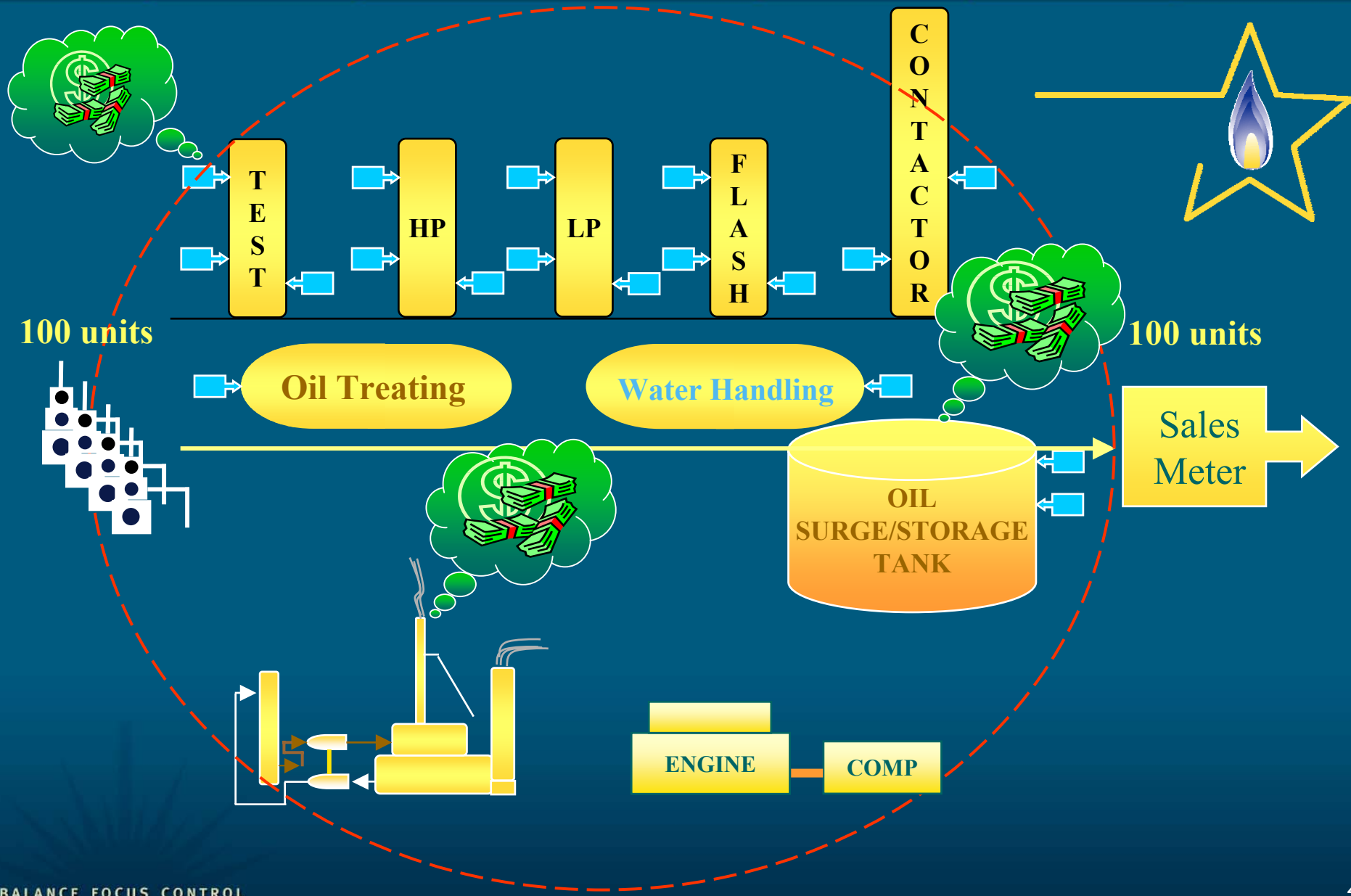
Build in optimization on the front end

Drilling | **Completion** | **Stimulation** | **Production** | **Work over**

- Modification / Repairs
- Ongoing Facility Evaluations

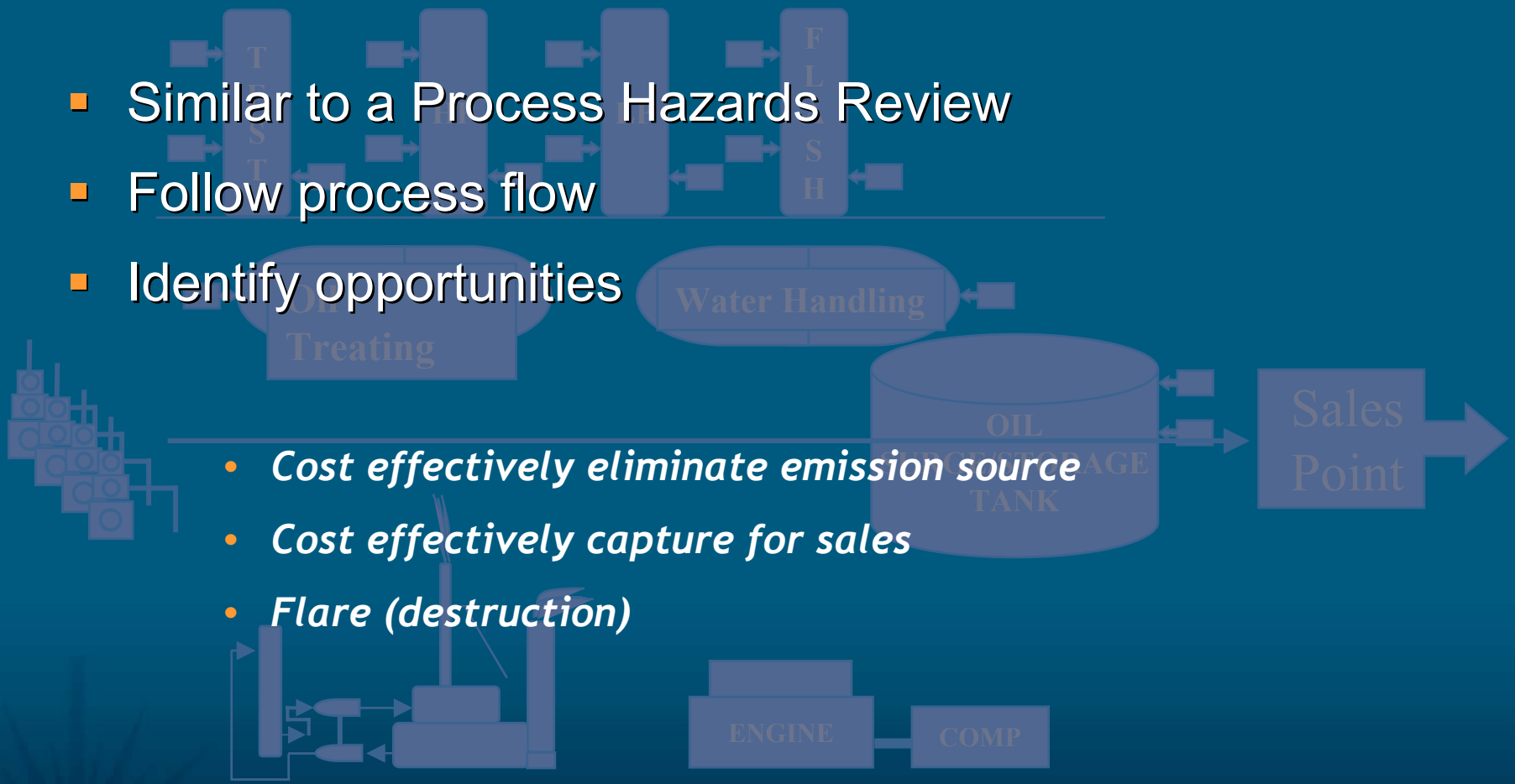
Pro–Op

Process Optimization Review



Process

- Similar to a Process Hazards Review
- Follow process flow
- Identify opportunities



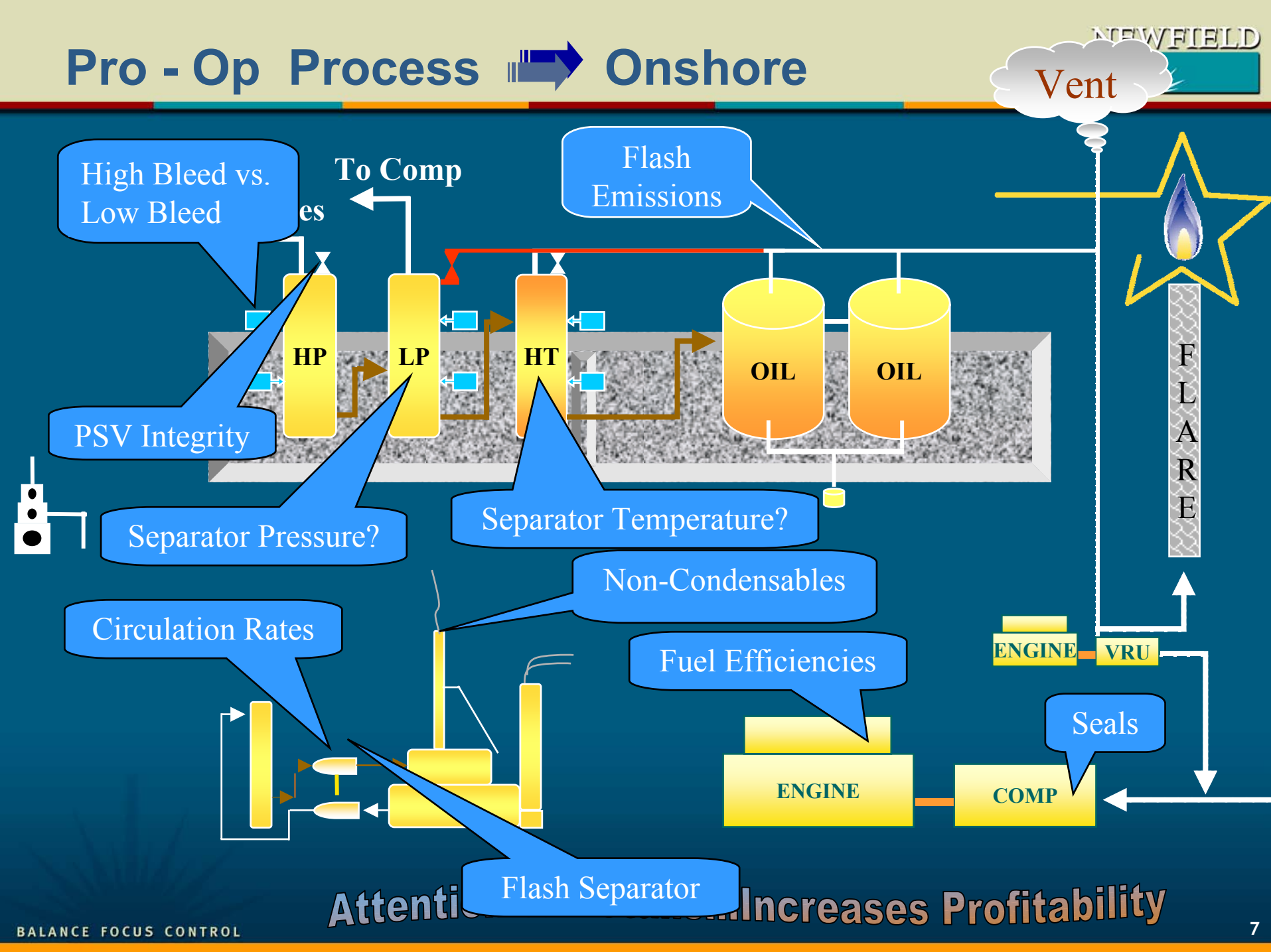
- *Cost effectively eliminate emission source*
- *Cost effectively capture for sales*
- *Flare (destruction)*

Optimization Techniques

Table 1- List of major optimization techniques for oil and gas production operations

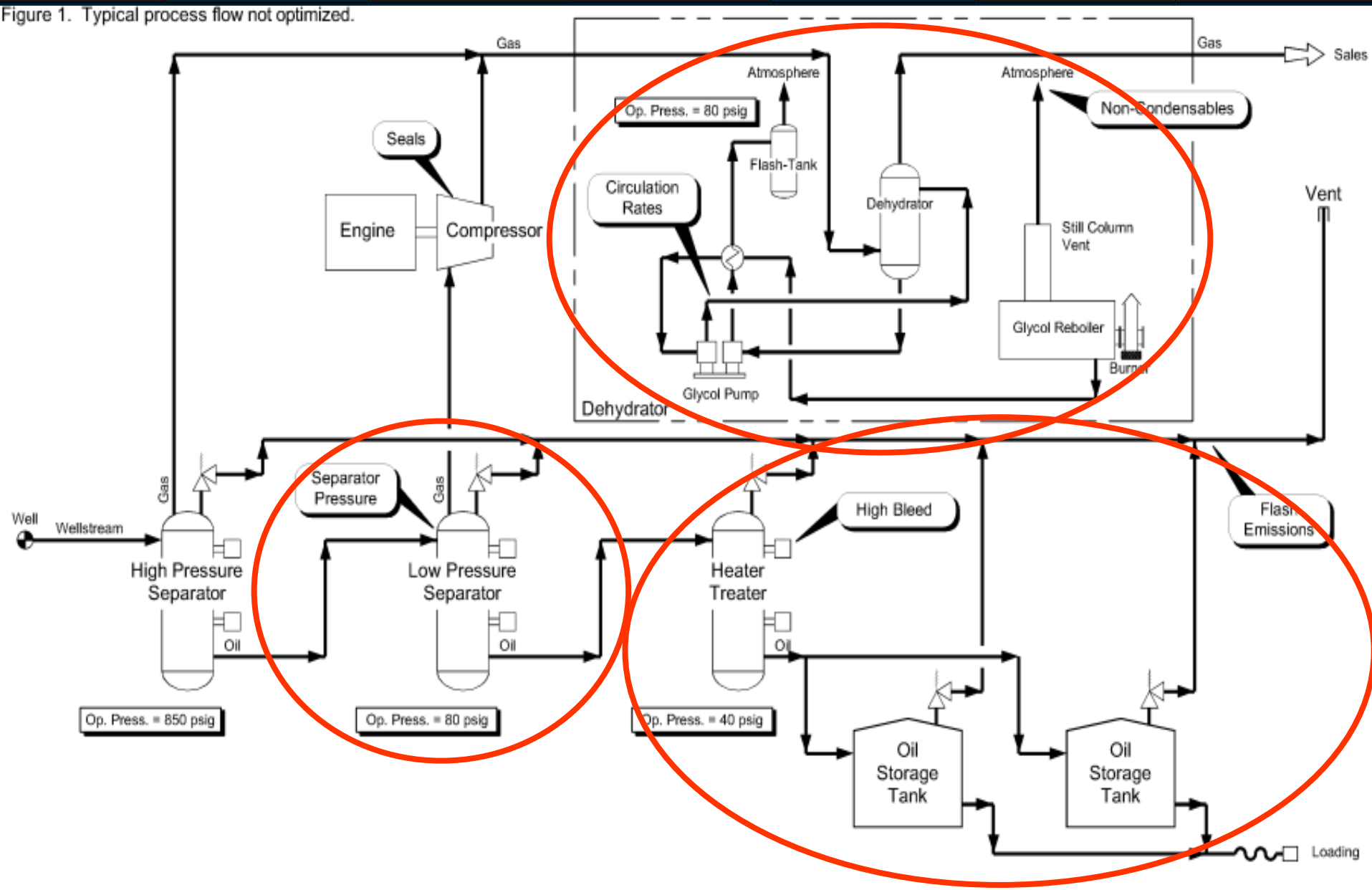
Process	Optimization Technique to Reduce Venting Emissions
Pneumatics	1. Use low bleed pneumatics versus high bleed pneumatics 2. Use compressed air
Pressure Relief System	1. Repair or replace leaking relief system components
Production Separators	1. Reduce operating pressure of separators just upstream of storage tanks 2. Route flash gas to compressor for sales
Glycol Dehydration Units Still Column Vent	1. Install condenser, flare or vapor recovery system 2. Optimize glycol circulation rates
Glycol Dehydration Unit Flash Tanks	1. Route gas to fuel system 2. Install vapor recovery system or route compressor 3. Burn gas in flare
Flare and Vent Systems	1. Repair components leaking into vent system 2. Install vapor recovery to recover routine natural gas venting
Internal Combustion Engines	1. Maximize fuel efficiency with controls
Reciprocating Compressors	1. Replace worn compressor rod packing rings and rods
Centrifugal Compressors	1. Replace wet seals with dry seals in centrifugal compressors
Crude Oil Storage Tank	1. Install vapor recovery system to recover vent gases

Pro - Op Process ➡ Onshore



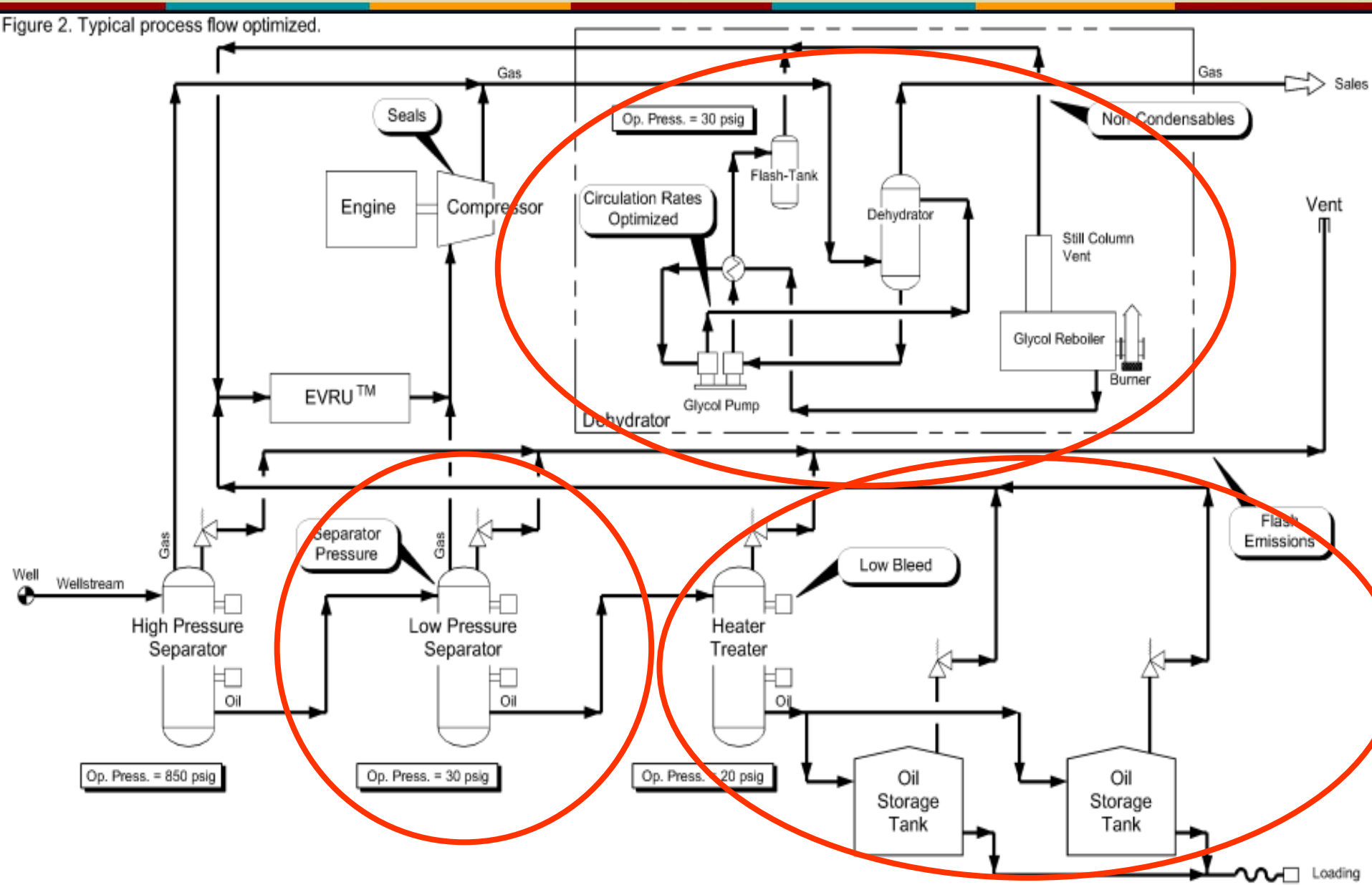
Non – Optimized Facility

Figure 1. Typical process flow not optimized.



Optimization Techniques

Figure 2. Typical process flow optimized.



ATTENTION TO DETAILS EQUALS INCREASED PROFITABILITY

Before and After Optimization

Table 3- Vent gas emissions and value before and after optimization

Process	Optimization Technique	Gas Recovered (MMBTU/Yr) [A]	Optimization Costs First Year[B] ($)	Recovered Product Value[C] ($/year)	First Year Optimization Savings/Costs [D] ($)
Pneumatics	Low bleed natural gas pneumatics controllers	1,900	-2,200	9,500	11,700
Glycol Dehydration Unit	Vent gas from still column and flash tank recovered by EVRU™	50		3,850	
Glycol Dehydration Unit	Flash tank gas routed to vapor recovery system	1,100	120,000	5,500	62,850
Heater Treater Flash	Vapor recovery by EVRU™	19,200		96,000	
Oil Storage Tanks	Vapor recovery by EVRU™	15,500		77,500	
	Totals:	37,750	117,800	192,350	74,550

Optimization Techniques

Table 4-Total Vent gas and methane emissions before and after optimization

Process	Optimization Technique	Natural Gas Vented Not Optimized (MMSCF/yr)	Natural Gas Recovered by Optimization (MMSCF/yr)	Methane Only Emissions Not Optimized (MMSCF/yr)	Methane Recovered by Optimization (MMSCF/yr)
Pneumatics[E]	Low bleed natural gas pneumatics controllers	2	1.9	1.9	1.8
Glycol Dehydration Unit[E]	Vent gas from still column and flash tank recovered by EVRU™	1.2	1.2	1.1	1.1
Heater Treater Flash Gas[F]	Vapor recovery by EVRU™	8.4	8.4	5	5
Crude Oil Storage Tanks[G]	Vapor recovery by EVRU™	6.8	6.8	1.7	1.7
	Totals:	18.4	18.3	9.7	9.6

Conclusion

- Use PRO-OP on new facility designs
- Prepare optimization template
- Prepare and conduct field training
- Use PRO-Op on existing facilities
- Increase Profitability and report methane reductions to EPA Natural Gas Star Program