Simplified View of the Thermodynamics of NGLs

Ty Leisure

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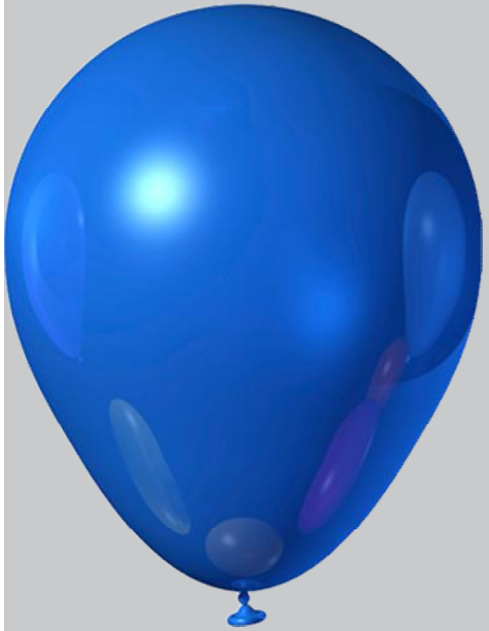
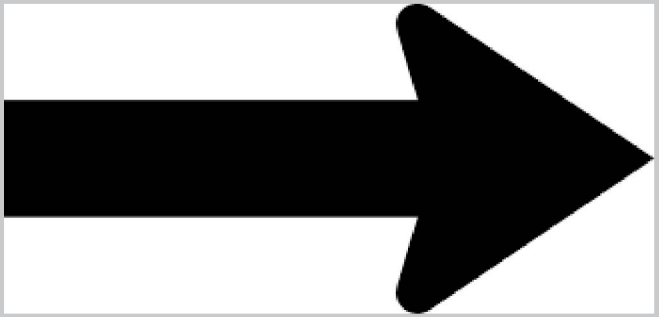
Basics





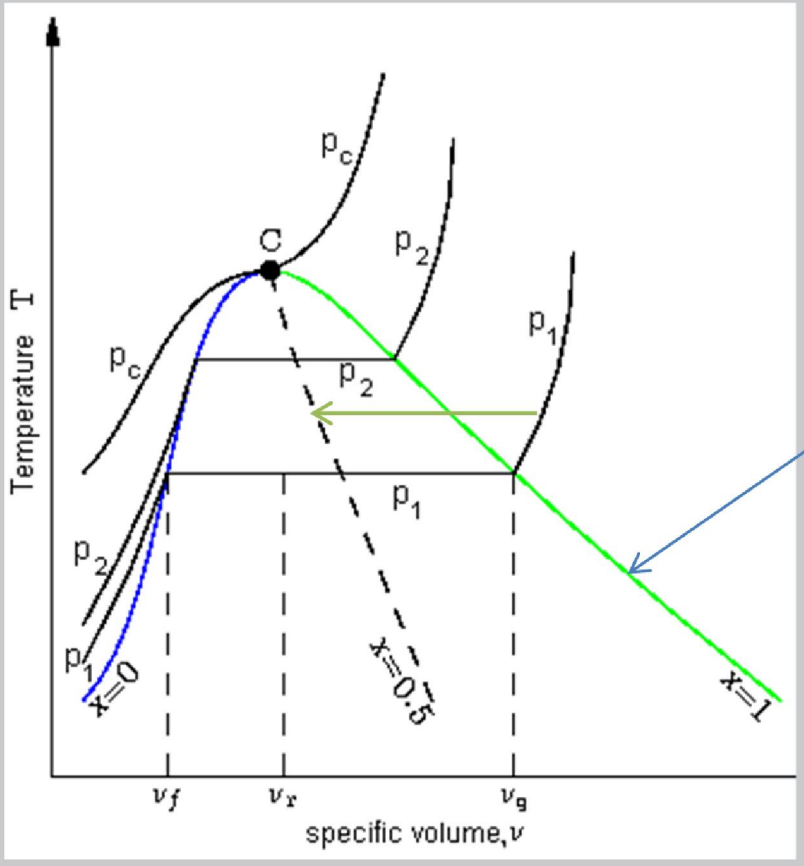
What is it?

- Condensation-
  - Is a change of form from a gaseous state to a liquid state

First Method

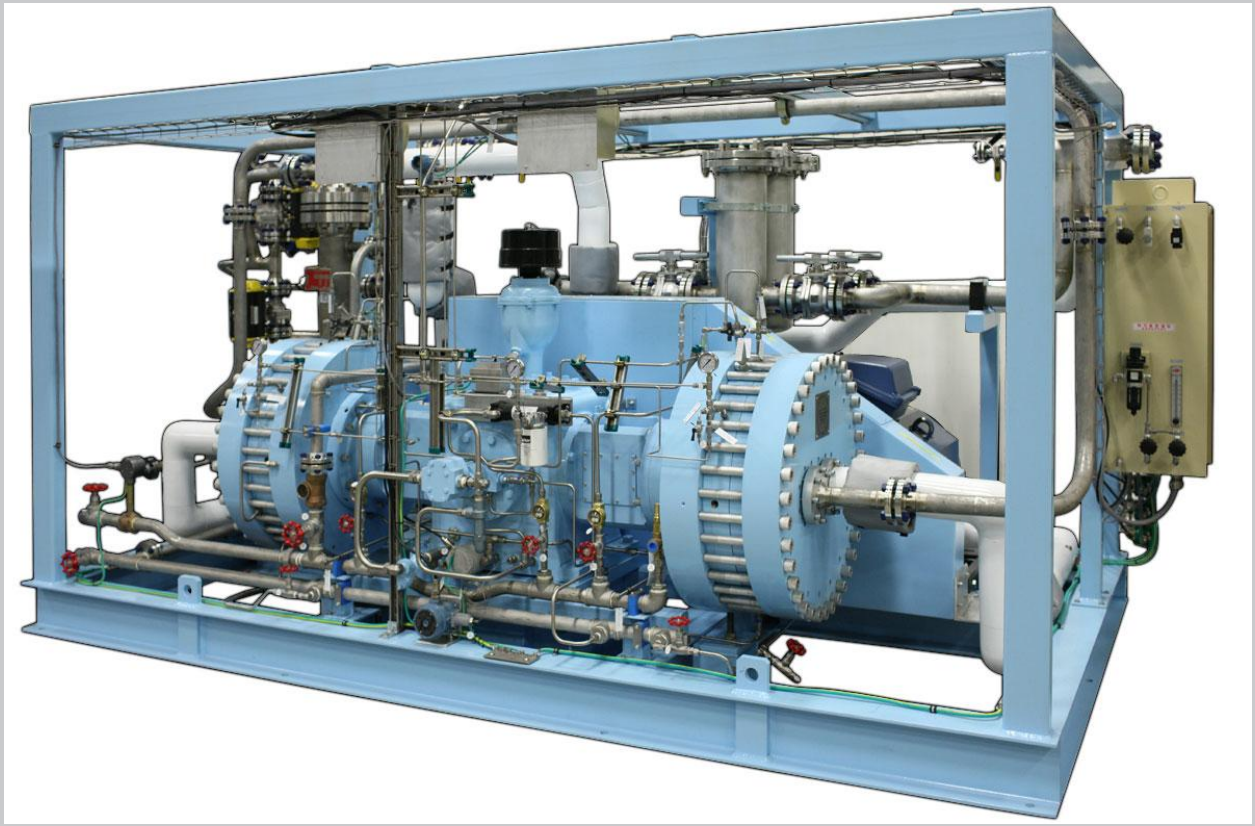
- Raise the pressure and keep temperature constant

VLE Diagram



Sat vapor line

Compressors



There is a problem

- TOO MUCH HEAT!!!

Heat Exchangers

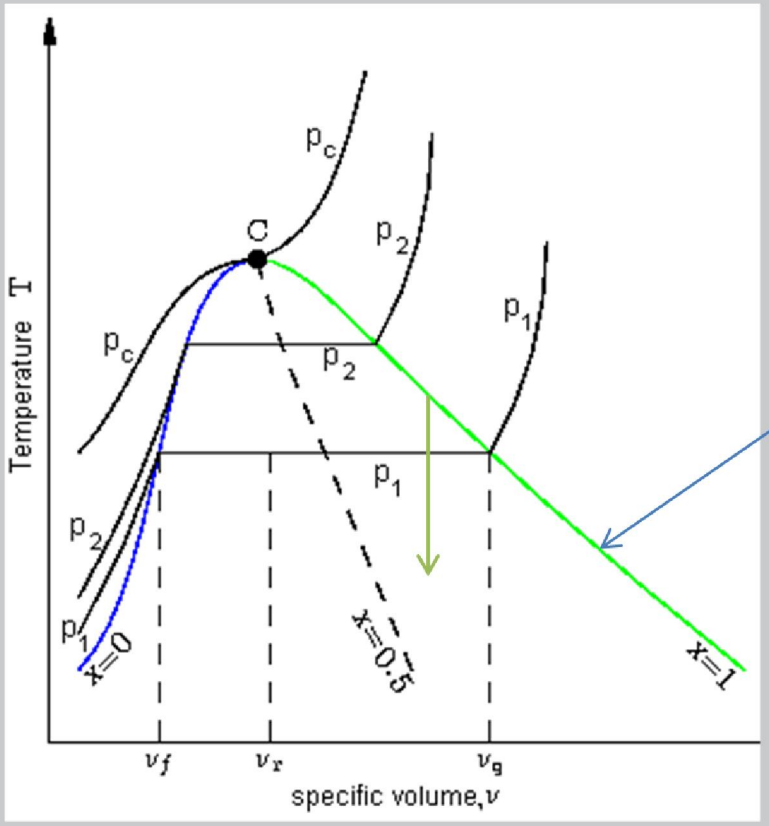
Compressors + Heat Exchangers

- Compressors raises pressure and temperature
- Heat Exchangers remove heat
- Readily available
- Takes up a large portion of space

The Second Method

- Lowering the temperature and keep pressure constant

VLE Diagram



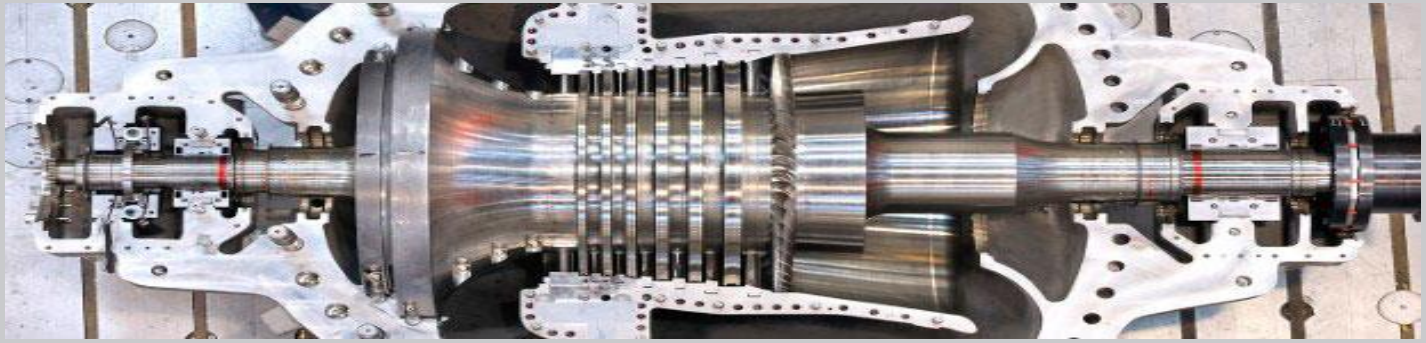
Sat vapor line

Refrigeration

Refrigeration

- Similar to domestic refrigerators
  - Hot air → Compressor → Refrigerant → Gas → Repeat
- Relatively expensive

Turbine Expanders



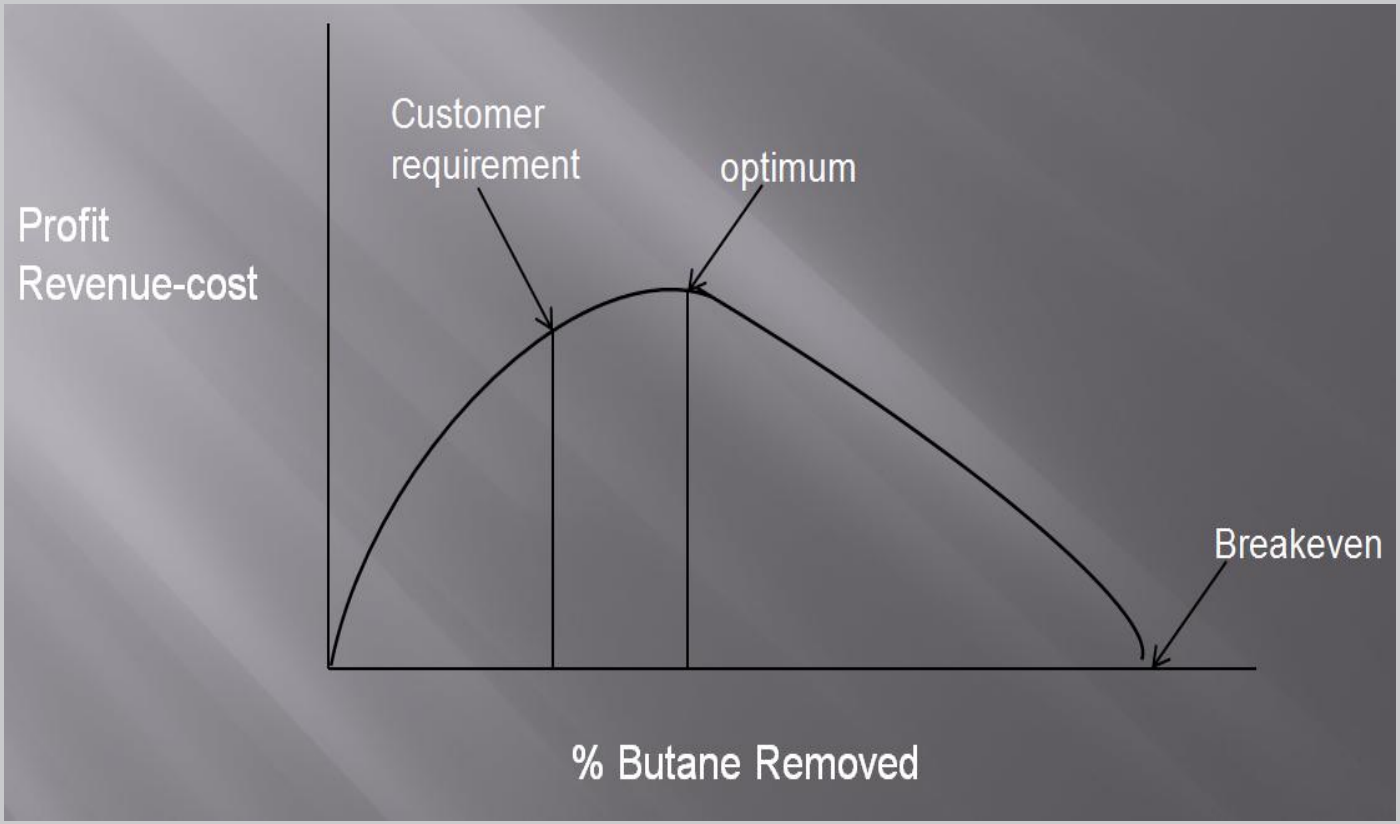
Turbine Expanders

- Mechanical Energy → Kinetic Energy → Potential Energy → Kinetic Energy → Mechanical Energy
  - Wow!
- Work can be 100% recoverable
  - Less cost

Turbine Expanders

- Temperature drop function of pressure drop
- Ethane!

Economics


Customer
requirement
optimum
Profit
Revenue-cost
Breakeven
% Butane Removed

Summary

- ↑ Pressure, Temperature constant
  - Compressors + Heat Exchangers
- ↓ Temperature, Pressure constant
  - Refrigeration and Turbine Expanders

Final Thoughts

- Turbine Expanders → Ethane
- Refrigeration → Cost down, efficient liquid recovery
- Compressors + Heat Exchangers → In every chemical plant. Bulky

Questions?