

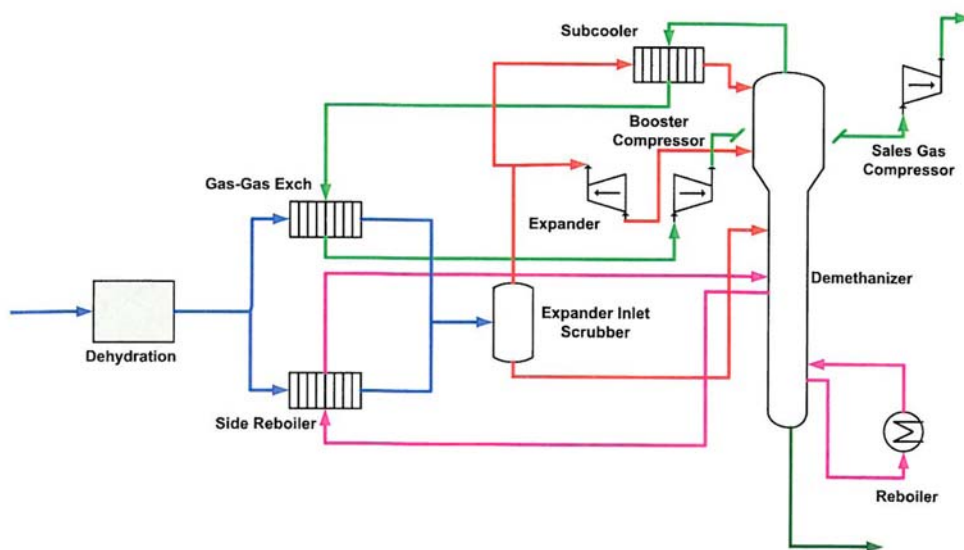
# FINAL

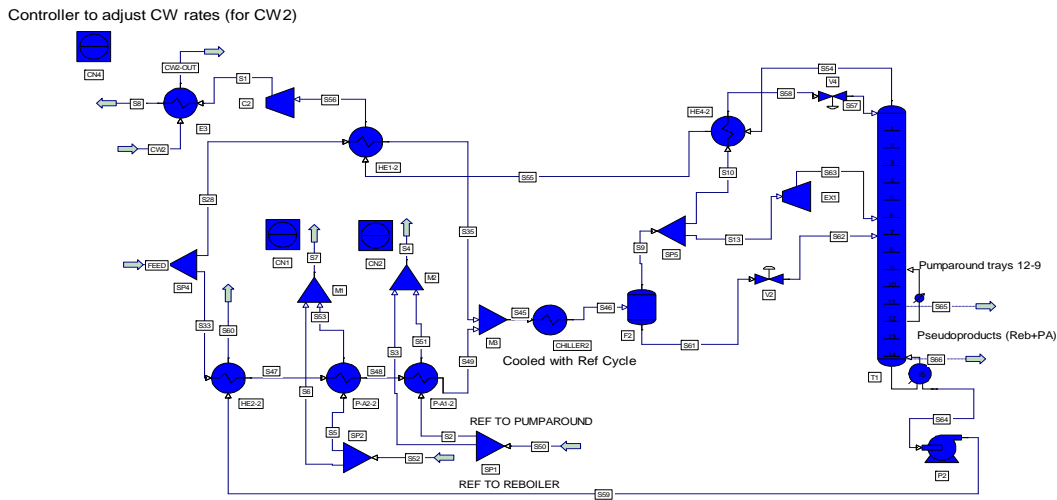
CHE 4253

## Design of a Gas Plant

Natural gas contains several hydrocarbons, mainly methane, but also C<sub>2</sub>, C<sub>3</sub>, C<sub>4</sub> and C<sub>5</sub>+ in addition to water, CO<sub>2</sub>, H<sub>2</sub>S and Nitrogen as main impurities.

C<sub>2</sub>+ components have more economical value than methane, so it is economical to separate them. The separation takes place in a unit called Recovery Expander Plant (see figure for **ONE** version of this plant; there are others; Pro II has two plant simulations in the applications library called G5\_Expander Plant. A simulation of a real existing plant is also shown below and will be provided). The column bottom is C<sub>2</sub>+, which is further separated into other constituents.





Consider a natural gas that has the following composition: C1=92%, C2=3%, C3=1.5%, C4=0.3%, C5+=0.1%, He 0.1%, 3% CO<sub>2</sub>. The gas is taken from a well and contains water, which simply removes water condensate at the source and then is treated to remove water and CO<sub>2</sub> until standards are met. Assume that your plant is planned is to be located near a new pipeline that will operate at 900 psia in Oklahoma. The pipeline is planned to have a nominal capacity of 200 Million Cubic feet per day, but will operate in the range of 75-100% capacity.

#### Tasks:

- 1) Determine basic flowsheet and operating conditions and column parameters (pressures, temperatures, number of trays, feed tray, etc) so that the optimum amount of C<sub>2</sub>+ is removed. At this stage, the HEN study may be omitted, but C<sub>2</sub>+ separation levels needs to be discussed.
- 2) Synthesize the HEN.
- 3) Simulate the complete flowsheet.
- 4) Provide Major Equipment specification sheets.
- 5) Provide Lay out of equipment.
- 6) Provide Pumps, piping and valve (including safety valves) specifications.
- 7) Provide a PID diagram. Make sure HAZOP studies are include.
- 8) Provide Total Capital Investment, Operating costs and profit.

- **Oral Reports (using ppt) on the state of all 8 tasks (graded): Weeks of Nov 4, Nov 18, Dec 2. Limited to Tue and Thu 1:30-3 pm, and Friday 2-4 pm. All students MUST be present and ALL must participate in the discussion.**

- Final project to be delivered orally the week of finals.
- Five (5) students maximum per group.
- For the first meeting this week, be prepared to provide ideas for task 1.