Overview of Gas Plant Processing (*Overview Sistem Pemrosesan Gas*)

Teknologi Pemrosesan Gas (TKK 564)

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Instructor's Background

- BEng. (1995): Universitas Diponegoro
- Meng. (2000): Institut Teknologi Bandung
- PhD. (2006): Universiti Teknologi Malaysia

- Specialization:
  - Catalyst Design for Energy Conversion
  - Process Design for Energy Conversion
  - Combustion Engineering
  - Computational Fluid Dynamic (CFD)

Course Syllabus: (Part 1)

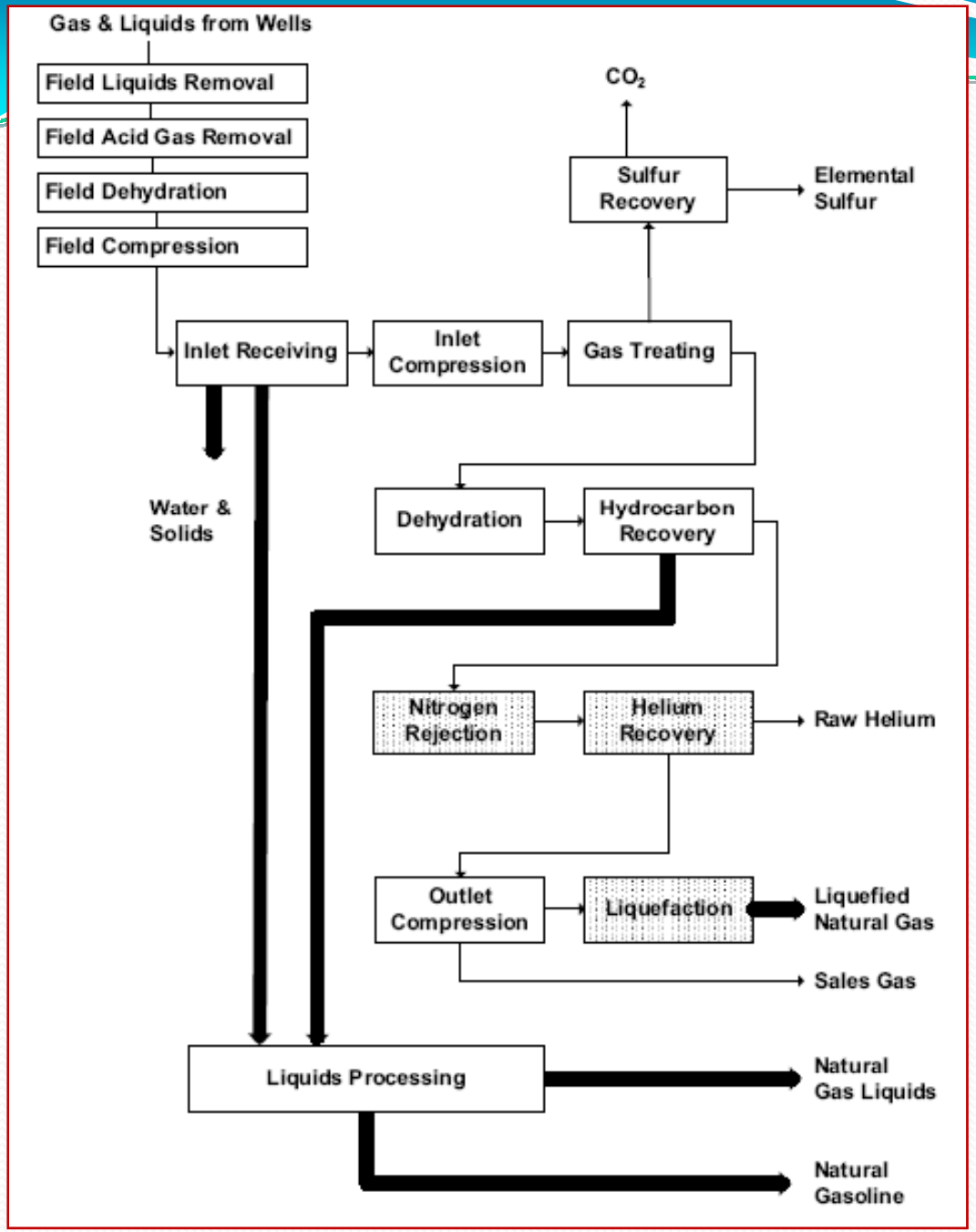
1. Definitions of Natural Gas, Gas Reservoir, Gas Drilling, and Gas production (*Pengertian gas alam, gas reservoir, gas drilling, dan produksi gas*)
2. **Overview of Gas Plant Processing (*Overview Sistem Pemrosesan Gas*)**
3. Gas Field Operations and Inlet Receiving (*Operasi Lapangan Gas dan Penerimaan Inlet*)
4. Gas Compression System (*Sistem Kompresi Gas*)
5. Gas Treating (*Pengolahan Gas*)
6. Gas Dehydration (*Dehidrasi Gas*)
7. First Assignment
8. *Ujian Tengah Semester*

ROLES OF GAS PLANTS

- **Dehydration of gas to reduce corrosion and to prevent gas hydrate formation**. These plants commonly are found on offshore platforms, where associated gas is separated from oil and dehydrated. Depending upon pipeline infrastructure, the gas may be recombined with the oil before it is put into a pipeline to shore.
- **Associated oil stabilization**. The produced gas is reinjected into the formation to enhance oil recovery.
- **Carbon dioxide or nitrogen recovery for enhanced oil recovery (EOR)**. These plants separate natural gas from the CO_2 or N_2; the natural gas is marketed and the CO_2 or N_2 are reinjected into formations. In N_2 projects, an air plant may be constructed on site to provide additional N_2 at the beginning of the project.

- **Upgrading subquality gas**. To make the gas marketable, the undesired diluents N_2, H_2S, and CO_2 are removed. Of the three components, N_2 is the most difficult to remove because it requires cryogenic processing when large volumes are processed.
- **Helium recovery**. Few plants are dedicated primarily to helium recovery. Therefore, this facility is typically an addition to a gas plant. Natural gas is the primary source of helium.
- **Liquefaction**. Some gas plants are dedicated to the production of hydrocarbon liquids and a natural gas stream to make liquefied natural gas (LNG). These plants are in locations with large gas reserves and no pipelines to market.

Gas Plant Processing



Field Operations and Inlet Receiving

- All plants have field operations and a network of pipelines that feed the raw natural gas and liquids into the plant.
- Field operations may include dehydration, CO_2 and H_2S removal, and compression. These processes are discussed more below.
- Unless the gas is completely free of any liquids, once it enters the plant, the gas and liquids go into inlet receiving, where the initial gas–liquid separation is made.
- Condensed water, hydrocarbon liquids, and solids are removed.
- Water and solids are processed for disposal, and the hydrocarbon liquids go on to liquids processing

Inlet Compression

- Most plants have inlet compression, but compression requirements vary.
- High pressure is critical, as it drives the cryogenic-liquids recovery process.
- For inlet pressures of around 1,000 psi (70 bar) or higher, only gas coming from the liquids processing step needs compression.
- However, most onshore gas plants in the discusses compression. The same types of compressors are used for field and outlet compression.

Gas Treating

- Most plants have a gas treating step to remove the acid gases H_2S and CO_2, along with other sulfur impurities.
- Most plants use water-based absorbents to remove the impurities, but other solvents and processes are used.
- Next section explains various methods for removal of these components.

Dehydration

- Nearly all plants utilize a dehydration step because the gas that leaves the gas treating step is usually water saturated.
- Even if no water-based gas treating is required, most gas streams contain too much water to meet pipeline specifications or to enter the cryogenic section of the plant.
- Field operations sometimes dry the gas to avoid gas hydrate formation as well as to reduce corrosion.
- Next Section provides details on the commonly used dehydration processes

Hydrocarbons Recovery

- Any plant that processes natural gas to produce hydrocarbon liquids (NGL) or LNG utilizes a hydrocarbon recovery step.
- This step usually involves cryogenic separation to recover the ethane and heavier hydrocarbons.
- Hydrocarbon recovery often plays an important role in field operations, where it is used for fuel gas conditioning and to alter gas condensation temperatures.

Nitrogen Rejection

- Although a less common process in the gas industry, nitrogen rejection will become more important as we shift to lower-quality gas feedstock.
- This process is typically cryogenic, although membrane and absorbent technology are becoming attractive

Helium Recovery

- Helium recovery is uncommon, unless the helium content is above 0.5 vol%.
- Treatment of other trace components, including BTEX (benzene, toluene, ethylbenzene, and xylenes) emissions and mercury is required.
- BTEX is primarily an environmental concern because of possible emissions from glycol dehydration units.
- Although at extremely low concentrations in the gas, elemental mercury can cause mechanical failure in aluminum heat exchangers.

Outlet Compression

- Most plants must compress the gas before it goes to the pipeline.
- The majority plants that have cryogenic hydrocarbon recovery use turboexpanders to provide refrigeration in the cryogenic section.
- Work generated in expansion is used to recompress the outlet gas.
- However, additional compression is usually required.
- Next Section discusses turboexpanders coupled with compressors, and stand-alone compressor

Liquid Processing

- Liquids processing occurs whenever NGL is a product.
- The processing required in the step depends upon the liquid content of the inlet gas and desired product
- Liquid processing involves: sweetening, drying and fractionating the liquid

Sulfur Recovery

- Any plant at which H2S removal is required, utilizes a sulfur-recovery process if venting the H2S will exceed environmental limits.
- The common recovery processes including tail gas cleanup

Important Support Components

- Utilities
- Process Control
- Safety System

Gas Plant Processing