- Oil and Gas Production
  - Upstream
    - Exploration and Drilling
      - Mud
        - Wellhead
        - Oil based
        - Water based
        - Synthetic
      - Well Completion
        - Installing the well casing
          - Depends of pressures and temperatures
          - Diameter of well (Size of drill bit)
          - Conductor casing
          - Types
            - Surface
            - Intermediate
            - Production
        - Completion
          - Open hole completions
          - Conventional perforated completion
          - Sand exclusion completions
          - Permanent completions
          - Multiple zone completions
          - Drain Hole completions
        - Installing the wellhead
        - Installing lifting equipment
        - Treating the formation
    - Production
      - Onshore
      - Offshore
        - Shallow Water Complex
        - Gravity Base
        - Compliant Towers
        - Floating Production
          - FPSO
          - Tension Leg Platform
          - Semi Submersible
          - SPAR
        - Subsea
    - Conventional Wells
      - Crude Oil with Gas
        - Artificial Lift required
        - Gas is called "associated gas"
      - Condensate wells
        - Natural Gas & Liquid Condensate (Ethane,Propane,Butane)
      - Natural Gas Wells
      - API - Measure of specific gravity (Higher = Less dense)
        - 40 - 45 API = High octane gasoline and diesel fuel
    - Reservoir Formations
      - Anticline
      - Fault
      - Salt Dome
    - Injection and Production Wells
    - Dry Completion and Subsea Completion
    - Wellheads
      - Components
        - Casing Head
        - Tubing Head
        - X-mas Tree
          - Horizontal or Vertical
            - Master, Wing and Choke valves on Horizontal axis for Horizontal X-mas trees
            - Horizontal X-mas trees used in Subsea Wells
          - Components
            - Master Gate Valve
            - Pressure guage
            - Wing valve
            - Swab valve
            - Choke
            - Check valves
      - Artificial Lift
        - Rod pumps
        - ESP - Electical Submerged Pump
        - Plunger Lift (For High GOR)
      - Well workover, Intervention and Stimulation
        - Work over - Major maintenance - replacement of tubing, new perforations, new gas lift mandrels
          - Through Tubing Workover
        - Intervention - Well work over without killing the well
          - Wireline Operations
        - Reservior Stimulation - Chemical Injection, Acid Treatment, Heating
          - ACID (HCL) - For calcereous reservoirs
            - Matrix Acidizing
            - Fracture Acidizing
          - Hydraulic Fracturing - Using propping agents - for eg,sand grains, aluminimum pellets
          - Explosive Fracturing
    - Storage, Metering and Exporting
      - Fiscal Metering
        - Liquids - Turbine meters, positive displacement and coriolis mass flow meters
        - Gas - Oriffice meters or Ultrasonic meters
      - Storage
        - Gas may be stored in underground mines or salt deposits
        - Offshore, oil is stored on storage tanks and transported
        - Onshore, fixed roof tanks are used for crude and floating roof for condensate
    - Gathering
      - Flowlines
      - Trunklines
      - Field Gathering System
        - Pig received and trap launcher
        - Production Header and Test Header
        - Test system
    - Mid-Stream Facilities
      - Raw Gas (processed as)
        - Natural Gas (Components)
          - Wet gas (< 85% methane)
          - Dry gas (<15 L of condensate / 1000 S meter cubed)
          - Sour gas (>5.7mg H2S per SCM)
          - Acid gas (CO2 at 20-40%)
          - Condensate (condensed out liquid during production)
        - Natural Gas Liquids
        - Liquefied Petroleum Gas
        - Liquefield Natural Gas
        - Compressed Natural Gas
      - Gas Plants (for treatment of Raw Gas)
        - Gas Sweetening / Acid Removal
          - Absorption (Amine absorption with absorber and reboiler)
          - Adsorption (Pressure swing, temperature swing or electric swing)
          - Cryogenic
          - Membrane
          - Sulfur Unit
          - Tail Gas Treatment
        - Dehydration (Pressure swing adsorption)
        - Mercury removal (Molecular sieves)
        - Nitrogen rejection (Cryogenic distillation)
        - NGL recovery and treatment (Cryogenic turbo expander and fractionating process)
        - Sales Gas (Specified by Volume, Calorific Value, Wobbe index, Methane number, Mercury, Dew point, H2S and sulfur content, Particles and additives
    - Refining
      - Fractional Distillation
        - LPG
        - Naphtha
        - Gasoline
        - Kerosene
        - Diesel Oil
        - White and Black Oils
        - Lubricating Oils
        - Fuel Oils
        - Bitumen
      - Upgrading and Advanced Processing
        - Atmospheric and Vacuum Distillation
        - Naphtha hydrotreating
        - Catalytic Reformer
        - Distillate Hydrotreater
        - Fluid Catalytic Crackers
        - Hydrocracker Unit
        - Visbreaking Units
        - Merox Units
        - Coking Units
        - Alkylatiion Units
        - Dimerization, Isomerization
        - Steam Reforming
          - Steam Methane Reformer
        - Amine Gas Treater - Claus Unit
      - Blending and Distribution
    - Unconventional Sources
      - Extra Heavy Crude
      - Tar Sands
      - Oil Shale
      - Shale Gas and Coal Bed Methane
      - Coal and Synthetic Fuels
      - Methane Hydrates
      - Biofuels
      - Hydrogen
  - Midstream
    - Gas Compression
    - Pipelines
    - LNG Liquefaction and Regassification
    - Refining
      - Separation of crude in distillation columns
    - Petrochemicals
      - Olefins
      - Aromatics
      - Synthesis Gas
  - Upstream
    - Wellheads
      - Dry completion
      - Subsea completion
    - Manifold and Gathering
    - Separation
    - Metering, Storage and Export
    - Utility Systems
  - Petrochemicals
    - Aromatics Petrochemicals
      - Xylene, Benzene and Toluene
    - Olefins
      - Ethylene, Propylene and Butadiene
    - Synthesis Gas
      - A mixture of Carbon Monoxide and Hydrogen
      - Produciton of Methanol or Ammonia
  - LNG
    - Liquefaction
      - Mixed Refrigerant Cycle
      - Cascade Cycle
    - Storage, Transport and Regasification
  - Pipelines
    - Pipeline Terminal - Pig Launcher and Receiver
    - Block Valve Stations
    - HIIPS
    - Leak Detection Systems
    - Pumps - For Liquid Pipelines
  - Manifolds and Gathering
    - Pipelines and Risers
    - Production, Injection and Test Manifolds
  - Separation
    - Test Separators and Well Tests
    - Production Separators (First Stage) - 3 to 5 MPa
      - Used to separate Oil, Gas and Water
      - Contains Slug Catchers (Slugs - Large gas bubbles or liquid plugs), Vortex Stabilizers(prevents vortexes in liquid), Demisters(removes liquid from Gas), Control and Shutdown Valves
    - Second Stage Separators - 1 MPa
      - Water content reduced to below 2%
    - Third Stage Separators - 100kPa
      - Flash Drum - Two Phase separation if mostly Oil
      - Knock-Out Drum - Two Phase separation if mostly Gas
    - Coalescer
      - Oil is heated in heat exchanges between the stages of separation
    - Electrostatic Desalter
      - Reduces water content to less than 0.1%
      - Removal of salts from Oil (Sodium, Calcium or Magnesium Chlorides)
    - Water Treatment (from Separators and Coalescer
      - Produced water discharged to sea < 40 mg/litre of Oil in Water as per OSPAR
      - Sand Cyclone - For sand removal
      - Hydrocyclone - For Oil removal
      - Water De-gassing Drum - Gas rises with oil droplets, oil sent to 3rd stage separator, Water discharged to sea
  - Gas Treatment
    - Heat Exchangers (To cool the Gas)
      - Plate Heat Exchangers
      - Tube and Shell Heat Exchangers
    - Scrubbers (To remove oil droplets from Gas)
      - Dehydration by absorption in triethylene glycol
        - Glycol reboilers are used to separate HC from Glycol and recover Glycol
  - Compressors
    - Reciprocating
      - Gas compression and high reservior pressure gas injection
      - 30 MW, 1800 RPM, 5 MPa
    - Screw
      - Natural Gas Gathering
      - 3000 RPM, 2.5 MPa
    - Axial Blade and Fin
      - LNG Plants - Air compressor and cooling compression
      - 5000 - 8000 RPM, 200000 m cubed/hour
    - Centrifugal
      - Large O&G installations
      - 6000-20000 RPM, 80MW, 50 Bar , 500000 m cubed/hour
  - Compressor Control Systems
    - Speed and Anti-surge Control
      - Set Point
      - Equal Margin
      - Model Based Control
    - Load Sharing
    - Vibration
    - Speed Governor
    - Lube and Seal Oil