



GLOBAL GAS FLARING REDUCTION  
A Public-Private Partnership

# Glossary of Terms Oil & Gas CDM/JI Projects

71379

Prepared by the Oil & Gas CDM/JI Methodology Workgroup

REPORT # 1



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GROUP

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## About this document

This technical glossary of terms was commissioned by the **Oil & Gas Methodology Workgroup<sup>1</sup>** (WG) to compile and explain how specific oil and gas terms found and/or required in relevant CDM/JI Methodologies, are understood and applied by industry, and how the concepts should be interpreted in the context of project activities. The document is intended to help reduce possible misinterpretations that can lead to delay and additional transactions costs during the formulation, validation, registration and verification of CDM/JI projects. The glossary features industry references as appropriate, and is meant to serve as a useful guide when suggesting improvement and/or requests for clarification and/or revisions of the approved methodologies.

### Why the need for a glossary of terms?

One of the main barriers to the successful development of O&G CDM/JI projects is that O&G terminology is used inconsistently and is interpreted differently in various methodologies and projects<sup>2</sup>. For this reason, it was agreed by the WG that one of the first useful collaborating documents to be produced would be a common O&G CDM glossary, which should help alleviate this barrier and support the evolution of O&G CDM project methodologies.

The document is intended to be a live reference, meaning that it should be updated regularly, based on periodic reviews to incorporate lessons learned by industry and practitioners, and to reflect the evolution of the framework that regulates the creation of carbon offsetting projects.

Any ideas, comments, suggestions or potential contributions, will be much welcomed. These should be sent to [ogmc@worldbank.org](mailto:ogmc@worldbank.org).

### Acknowledgment

This document is one of the outputs of the Oil & Gas CDCM/JI Methodology Workgroup, led by the Global Gas Flaring Reduction partnership. The work was prepared by Francisco Garcia Koch and Mike Bess (Camco); reviewed by Wiley Barbour (Camco) and Ron Collings (Ruby Canyon Engineering), finalized by Francisco Sucre (GGFR). Greig Callaghan (Total), Raul Hurtado (Statoil), Steve Ross (ISR), Martyn Howells (GGFR), Heike Lingertat (GGFR) and Rob Lesnick (COCPO) also provided valuable input and support.

*Cover photo: Maersk Al Shaheen – Qatar, from Oil Rig Photos, contributed by Garve Scott-Lodge*

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<sup>2</sup> As determined in 2009 after GGFR consulted with industry and project developers.

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*Videos and/or animations require to press CTRL+ Linking the word.*

## GLOSSARY OF TERMS

### A

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**Acid gas.** Sour gas containing hydrogen sulphide and carbon dioxide, as opposed to sweet gas. Acid gas is corrosive and would damage pipes and the plant if not removed early in the processing cycle.

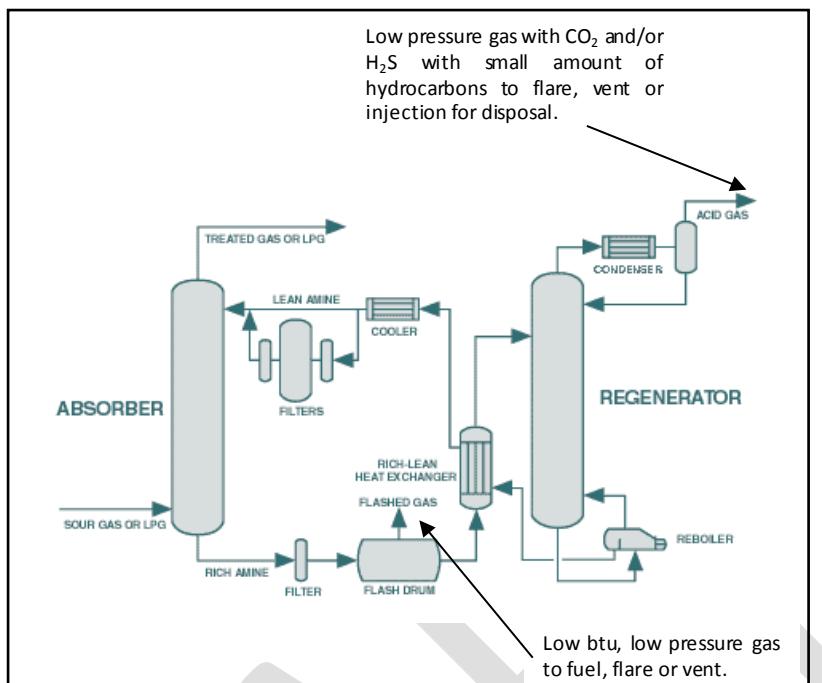
**Acid gas removal.** Natural gas contaminants hydrogen sulphide ( $H_2S$ ) and carbon dioxide ( $CO_2$ ) (acid gases) are removed through amine or other solvent process, membrane separation ( $CO_2$ ) and molecular gate (pressure swing adsorption) systems. All of these systems will have as product a low heating value-low pressure waste gas stream that will generally either be vented or flared.

**Allocation metering.** Allocation metering is used to measure movements of oil & gas between different processes, i.e. for the purpose of surveillance and flow assurance. It is also used to detect blockages, leaks, etc that could be restricting flow in certain parts of a plant. Allocation metering systems can be fairly accurate, but are not usually to fiscal standards, typically with overall uncertainty in the range  $\pm 3 - 5\%$  for dry gas. However, this could be as high as  $\pm 10 - 20\%$  or more depending on levels of maintenance and calibration carried out.

**Amines and amine plant.** Amines are a class of organic chemicals derived from ammonia that are used to remove contaminants (primarily hydrogen sulfide and carbon dioxide) from natural gas. This process is referred to as sweetening sour gas. In a gas processing plant, the sour gas is run through a tower which contains the amine solution (**Figures 1 and 2**). The two principle amine solutions used are monethanolamine (MEA) and diethanolamine (DEA). The effluent gas is virtually free of carbon dioxide and sulphur compounds. [5]



Figure 1: Amine plant [9]



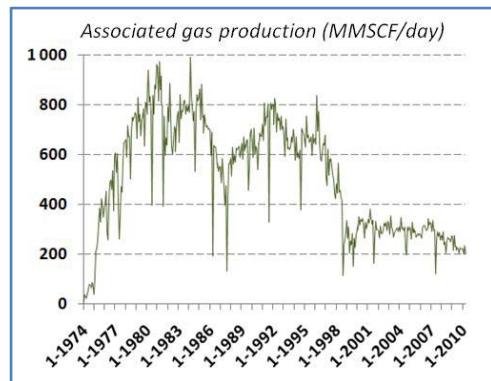
**Figure 2: Amine plant process diagram [10]**

Link to [3D animation](#) of amine plant [11]

**API gravity (oil density).** A specific gravity scale developed by the American Petroleum Institute (API) for measuring the relative density of various petroleum liquids, expressed in degrees. API gravity is gradated in degrees on a hydrometer instrument and was designed so that most values would fall between 10° and 70° API gravity. The arbitrary formula used to obtain this effect is: API gravity =  $(141.5/\text{SG at } 60^{\circ}\text{F}) - 131.5$ , where SG is the specific gravity of the fluid. [29]

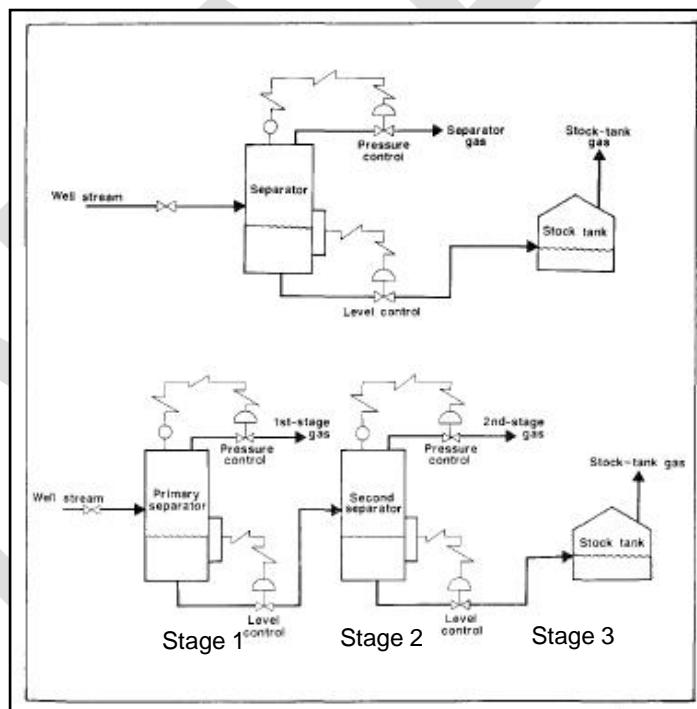
**Artificial lift.** One of several methods that provide pressure assistance to increase flow of liquids, such as crude oil or water, from a production well. The most common systems lighten (decrease density) the flowing fluid (gas lift), or remove all or part of the liquid head from the reservoir (beam and electric submersible pumps). Out of nearly 1,000,000 production wells in the world, more than 90% have some kind of artificial lifts for enhanced production. [23]

**Associated gas.** Natural gas that comes from oil wells, found in association with the oil, either dissolved in the crude (dissolved gas) or separated from the oil (free gas). At a field level, associated gas normally declines through time (**Figure 3**). [5]



**Figure 3: Norway's Ekofisk field in 1971 [19]**

**Associated gas recovery.** Associated gas is recovered from an oil well through two-phase (gas and oil) or three-phase (gas, oil and water) separation by using the density differences of the fluids. This is done using a cascading series of pressure vessels as shown in **Figure 4**.



**Figure 4: Two and three stage gas-oil separation [8]**

Multiple-stage separation (up to four) is required where the produced fluid is under high pressure and has a high gas-oil ratio. The first stage of separation is at a pressure less than the well pressure. The dissolved gases flash to form a free gas which is still at elevated pressure and can be either flared, used or sold. The remaining oil travels to the second stage of separation which is at a lower pressure,

the resulting flashed gas will also be at a lower pressure than at the first stage (**Figure 4**). A third stage of separation may be needed for very high gas-oil ratio well streams. The final stage of separation occurs in the stock tank which is at atmospheric pressure. Gas continues to evolve and is usually vented but may be captured, compressed and either flared, used or sold.

**Atmospheric pressure.** The pressure exerted by the atmosphere on the earth's surface. Standard atmospheric pressure at sea level is 1.01325 bar, 14.6959 psi, or 760 mm HG.

## B

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**Barrel of oil equivalent (BOE).** BOE is a method of equating the energy produced by a hydrocarbon gas to a standard oil measurement. One barrel of oil has about the same heat producing capacity as 6,000 ft<sup>3</sup> of gas at standard conditions. [31]

**Booster station.** A compressor or pump station located along the length of a pipeline to raise the pressure and overcome pressure losses over long distances, losses due to friction in, and elevation differences of pipelines.

**Blow down.** The process where gas that has been injected for pressure maintenance purposes is produced – consequently the reservoir pressure falls significantly and further production from the reservoir is unlikely.

**Bubble point.** The pressure at which gas begins to break out of an undersaturated oil and forms a free gas phase in the matrix or a gas cap. Accurate information on the oil fluid compressibility above and below bubble point pressure is very important for reservoir evaluation. [28]

## C

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**C<sub>+</sub> fraction.** This nomenclature is often used when expressing the properties of a group of higher hydrocarbons. For example if the mole fraction of the C<sub>6+</sub> fraction of a gas stream is 2% that means that all of the hydrocarbons with six carbon atoms or more within the gas combined represents 2% of the total gas composition.

**Calorific value** or heating value. The calories or thermal units contained in one unit of a substance and released when the substance is burned under standard conditions. For natural gas the gross or higher heating value (HHV) includes the heat of vaporization of any water produced by the combustion. The lower heating value (LHV) does not include the heat of vaporization. The LHV is commonly used

for most combustion applications. The heating value of natural gas is commonly expressed as MJ/m<sup>3</sup> or BTU/cf.

**Combined gas.** A gas stream consisting of associated and non-associated gas.

**Commercial:** A project is commercial if the degree of commitment is such that the accumulation is expected to be developed and placed on production within a reasonable time frame. A reasonable time frame for the initiation of development depends on the specific circumstances but, in general, should be limited to around 5 years. [27]

**Committed project.** Petroleum development projects are committed when firm commitments have been made for the expenditures and activities needed to bring a discovered accumulation to the production stage. Undeveloped projects are committed only when it can be clearly demonstrated that there is intent to develop them and bring them to production. Intent may be demonstrated with firm funding/financial plans, declarations of commerciality, regulatory approvals and satisfaction of other conditions that would otherwise prevent the project from being developed and brought to production. [27]

**Compressed natural gas (CNG).** The processed gas (mostly methane) that has been compressed to high pressure (typically > 200 bar, although not to the point of liquefaction) for the purpose of storage and / or transportation. CNG is used as a substitute for gasoline, diesel or propane and can be used in internal combustion engines. Fewer levels of pollutants (CO<sub>2</sub>, CO, NOx, SOx) are emitted which can help mitigate greenhouse gas emissions.

**CNG daughter station.** A facility where CNG is received from CNG mobile units and its pressure is reduced for delivery to a natural gas pipeline or to an end-user. Daughter stations deliver natural gas to vehicles in locations where a pipeline is not present, and thus provide a continuous supply of CNG in remote or underserved locations (**Figures 5 and 6**). [2]



Figure 5: CNG pressure vessels on trailers for truck transport

**CNG mobile units (Figure 5).** High strength pressure vessels designed to transport CNG from CNG mother station to one or more CNG daughter stations.

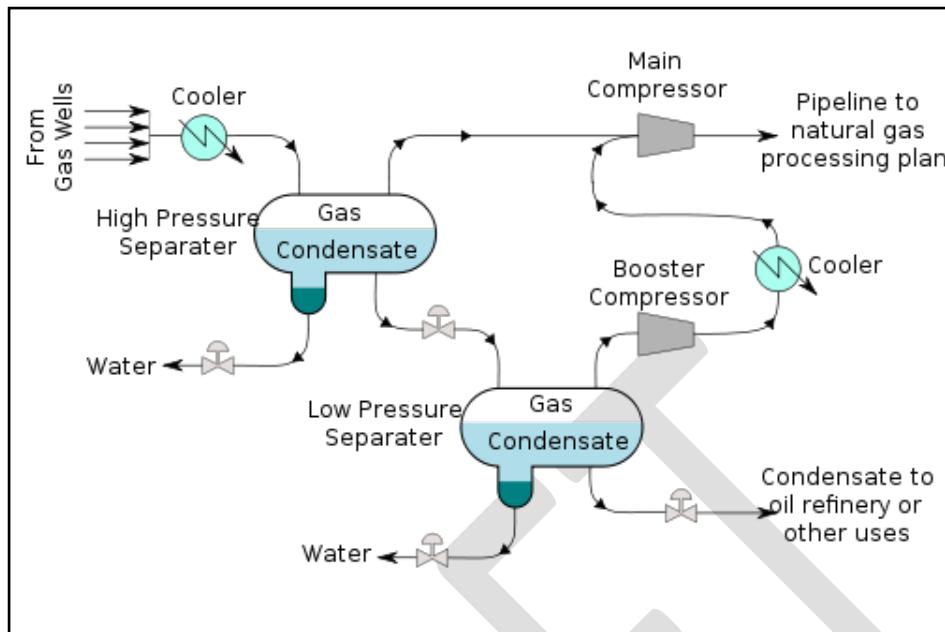
**CNG mother station.** A facility where natural processed gas is compressed to high pressure and loaded onto CNG mobile units for the purposes of transportation, typically to a network of daughter stations (**Figure 6**).



Figure 6: Capture of associated gas for use as fuel and transported as CNG [25]

**Cogeneration (also combined heat and power, CHP).** The production of electricity and useful heat simultaneously from a common fuel source. Conventional power plants emit the heat created as a by-product of electricity generation in the environment through cooling towers, flue gas, or by other means. By contrast, cogeneration captures the by-product heat for domestic or industrial heating purposes, either very close to the plant, or as hot water for district heating with temperatures ranging from approximately 80 to 130 °C.

**Condensate (also natural gas condensate, or gas condensate).** A low-density mixture of hydrocarbons that are present as gaseous components in the raw natural gas produced from crude oil wells (associated gas), gas wells (wet gas), or condensate wells (see condensate reservoir definition below); these light hydrocarbon compounds condense into liquid at surface temperatures and pressures (**Figure 7**). Condensate must be separated from the raw natural gas prior to the natural gas processing plant. Condensate generally has an API gravity of between 40 and 60 degrees. This is accomplished by various equipment configurations that serve to cool the raw natural gas feedstock to condense the condensable hydrocarbons. A representative schematic depicts the process:



**Figure 7: Three phase separation system for recovering gas and condensate [6]**

**Condensate reservoir (retrograde gas reservoir).** Initially, the retrograde gas is totally gas in the reservoir, as the reservoir pressure is reduced below the dew point of the mixture; liquid condenses to form a free liquid in the reservoir. This liquid will normally not flow and cannot be produced. Reservoir pressure is therefore often maintained above the dew point in order to maximize condensate (liquid) recovery. The initial gas/oil ratio for condensate is between 3,300 and 50,000 scf/STB with API gravity between 40 and 60 degrees. [8]

**Cost recovery.** Under a typical production-sharing agreement, the contractor is responsible for the field development and all exploration and development expenses. In return, the contractor recovers costs (investments and operating expenses) out of the gross production stream. The contractor normally receives payment in oil production and is exposed to both technical and market risks. [27]

**Current economic conditions.** Establishment of current economic conditions should include relevant historical petroleum prices and associated costs and may involve an averaging period that is consistent with the purpose of the reserve estimate, appropriate contract obligations, corporate procedures, and government regulations involved in reporting these reserves. [27]

## D

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**Degassing.** The routine removal of gases, both hydrocarbon and non-hydrocarbon, from oil, in a degassing plant at the production platform. The plant comprises high and low pressure separators and a small stripping unit for purifying the oil and extracting hydrogen sulphide gas.

**Density.** Mass per unit of volume. Density is typically reported in g/cm<sup>3</sup> (for example, rocks) or pounds per barrel (drilling mud) in the oil field.[\[29\]](#)

**Dehydration plant.** Water separation plant which serves to dry oil or gas, and so prevent moisture in hydrocarbons from contaminating pipes and vessels in succeeding phases of the processing operations. Water can be absorbed by passing it through a glycol/water solution in a separator, absorbed by a desiccant, or separated by electrical coalescence. It can also be boiled off but this method involves loss of some of lighter hydrocarbons.

**Desulphurization.** Removal of sulphur compounds from petroleum, a process which sweetens sour gas or oil, and is desirable, particularly in the interests of air pollution control. Hydrogen sulphide gas is first removed by passing hydrocarbon through an amine solution, then the gas is further treated to recover sulphur.

**Dew point.** The temperature at and below which some components of a gas stream condense – used as a measure of “dryness” of a gas stream – Prior to passing through a compressor, a gas stream must have its dew point reduced so that liquid does not form in the compressor and damage the unit.

**Dew point control.** Control of the pressure and temperature of natural gas flowing through a pipeline terminal, so that after separation of the liquids the gas remains dry for transmission to the consumer. Dew point is measured by a dew point meter, which is a type of hydrometer. Before natural gas is liquefied water is removed by lowering the dew point to about – 55 °C.

**Dissolved gas.** Gas which remains dissolved in oil at a given temperature and pressure. If dissolved gas is present in a reservoir, a latent source of energy is available as a primary production drive mechanism to force oil to the surface through a well bore.

**Dry gas.** Natural gas (primarily methane and ethane) that occurs in the absence of condensate or liquid hydrocarbons, or gas that has had condensable hydrocarbons removed. Dry gas as it is produced from the well may have up to two barrels of water vapor per million standard cubic ft of gas, whereas processed ‘pipeline ready’ dry gas has all liquids removed. [\[1\]](#)

**Dry gas reservoir.** Primarily methane with some intermediates. The hydrocarbon mixture is solely gas in the reservoir and at surface conditions. Some liquid water is condensed at the surface. [\[8\]](#)

## E

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**Economic limit.** When the revenue from the produced fluids falls below the cost of operations set by the company. Each oil well has an “economic limit” to keep from losing money. The equation’s major parameters are taxes, oil price, operating costs, and royalty fraction. Taxes on oil increases the economic limit, thereby shortening the life of the field. [30]

**Economically recoverable resource estimate.** An assessment of hydrocarbon potential that takes into account (1) physical and technological constraints on production and (2) the influence of exploration and development costs and market price on industry investment in exploration and production. [31]

**Equivalent energy.** A common base for comparing different sources of energy. Tons oil equivalent (toe) is used frequently.

**Electrical submersible pump or ESP.** An electrical powered rotating pump capable of lifting very large flow rates (>20,000 BPD).

**Estimated ultimate recovery (EUR).** Those quantities of petroleum which are estimated, on a given date, to be potentially recoverable from an accumulation, plus those quantities already produced there from. The EUR is not a resource category as such, but a term which may be applied to an individual accumulation of any status/maturity (discovered or undiscovered). [36]

## F

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**Feed gas.** The gas stream input to a process or facility.

**Feed stock.** A product of an oil refining process used as the starting material for conversion into petroleum chemicals. Naphtha is one of the most feedstocks, but natural gas and many derivates of crude oil and natural gas also serve as feedstocks.

**Field development plan.** A plan developed by the operator and its partners, with the technical objective of maximizing oil production via the optimal number and placement of wells and production rate. The plan implements the technical objective given regulation and capital availability. Some of the determinants of the plan are: approval of host government’s regulatory bodies; regular reviews by both operator and government; evolution of the knowledge and understanding of the oil field at a given time when the plan is prepared.

**Fiscal metering.** Sometimes referred to as custody transfer, it does not imply any standard of performance but applies to its service. Fiscal meters are used where

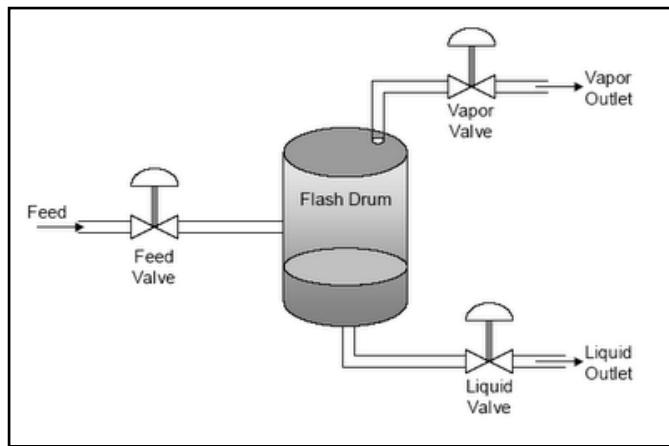
there is a transfer of ownership of the product in the pipeline, and hence are linked to transfer of money. For this reason, the accuracy requirements tend to be high. Certain standards may be applied (e.g. American Petroleum Institute) to define the tolerable levels of uncertainty. The exact level of uncertainty acceptable in the fiscal metering system will be determined by the contract established for the sale or production license for the oil and/or gas. Levels of overall uncertainty of  $\pm 0.25\%$  for dry gas can typically be required.

**Flaring.** A means of disposing of waste combustible products by burning them (**Figure 8**). As a safety measure all pressure vessels containing combustible fluids will have an emergency pressure relief system that will void the vessel's contents to a vent or flare. The flame at the tip is maintained by the use of pilot or electronic igniters. Flares destruction efficiencies will vary depending on design, composition and heating value of the waste gas, exit velocity and local wind conditions. Offshore platforms can have one or more flares to cater for low pressure (LP) and high pressure (HP) applications. LP flares are normally less complex in design and operate around atmospheric pressure. HP flares operate around 10 bar pressure and are often equipped with a number of additional features to condition the line to achieve ideal flaring conditions. [20]



Figure 8: Sample flaring operations ([video](#)) [20]

**Flash drum.** A low pressure separator, also known as a flash chamber or flash vessel. Liquid from a high pressure source is flashed into the vessel, enabling gas to be taken off to the top and liquids from the base of the vessel (**Figure 9**).



**Figure 9: Flash drum schematic**

**Flow chart.** Also called a flow diagram. It can also mean a piping and instrumentation diagram, which embodies a process flow diagram, details of piping and details of system instrumentation. Standardized symbols are used, which follows the recommendations of the Instrument Society of America (ISA). The piping and instrumentation diagram is known as a P and ID (P&ID), and this general term is also applied to another type of flow chart, the utility flow diagram.

**Flow meter.** An instrument for monitoring, measuring, or recording the rate of flow, pressure, or discharge of a fluid.

**FPSO.** A floating production, storage and offloading vessel (also called a “unit” and a “system”) is a type of floating tank system used by the offshore oil and gas industry and designed to take all of the oil or gas produced from nearby platforms or templates, process it, and store it (**Figure 9.1**). [31]

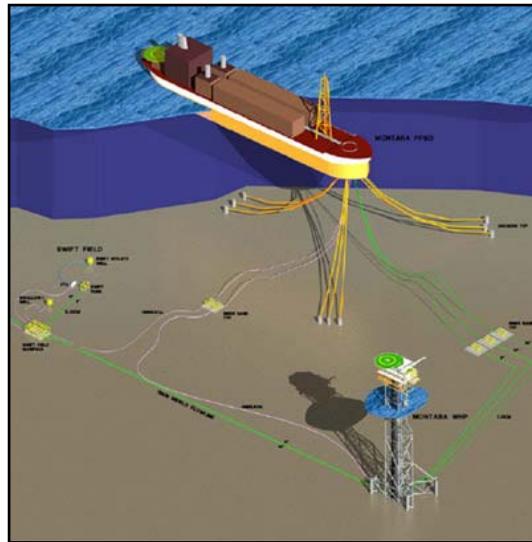


Figure 9.1: Illustration of an FPSO ([link to How does a FPSO works?](#))[35]

**Fraction.** A component of crude oil identified by the boiling point range of the hydrocarbons therein. Also called cuts, fractions are obtained by distilling crude oil at precise temperatures and pressures, and they range from light distillates (gases and gasolines) middle distillates (kerosines and gas oils), to heavy distillates (fuel oils), and residues (asphalts). Primary or straight-run fractions are individual fractions straight from the fractionating column, that is before blending to make finished products. These are used as charge stocks.

**Free gas.** The gaseous phase present in a reservoir or other contained area. Gas may be found either dissolved (i.e. [solution gas](#)) in reservoir fluids or as free gas that tends to form a gas cap beneath the top seal on the reservoir trap. Both free gas and dissolved gas play important roles in the reservoir-drive mechanism.[29]

**Fuel gas.** Any of several gases burned to produce electricity and/or heat. Natural gas (methane) is the most common, but others include propane, butane, town gas, syngas, and regassified liquid petroleum gas.

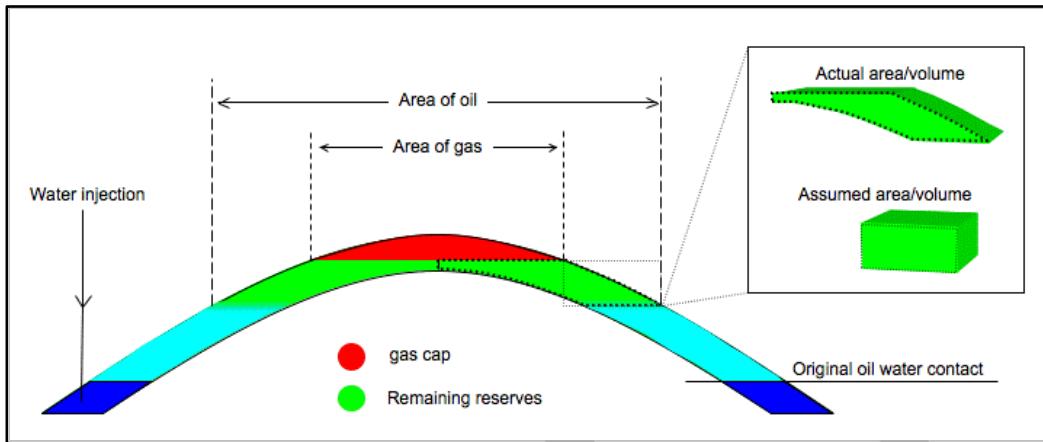
## G

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**Gas analyzer.** An instrument to monitor continuously specific gases in a process stream. Typically, a solid state gas detector incorporates a narrow pass band filter to discriminate hydrocarbons from carbon dioxide and carbon monoxide, and displays the measurement on a flow meter.

**Gas cap gas.** The free natural gas that accumulates in the upper portions of a reservoir where the pressure, temperature and fluid characteristics are conducive to

free gas (**Figure 10**). The energy provided by the expansion of the gas cap provides the primary drive mechanism for oil recovery in such circumstances.



**Figure 10: Gas cap area**

**Gas collection.** A generic term involving a process of gathering several gas streams into a single stream. May or may not include any processing/treating/recovery etc.

**Gas chromatography.** A method of separating the components of a volatile mixture by distribution between two phases, one a stationary phase over which the second, a gas phase, flows. Analysis of the components is made by reference to the characteristics of a known sample and using a gas carrier. The liquid to be analyzed is carried by an inert gas through a tube containing an absorbent material coated with a non-volatile liquid. The latter interfaces with the passing liquid cause some components to pass more quickly than others. The electrical conductivity of the gas and liquid leaving the tube is then measured and recorded. Peaks of conductivity are correlated with sample recordings whose characteristics are known. In CDM projects dealing with natural gas, this method is used to measure gas composition. Sample 5 minute [video](#) explanation. [22]

**Gas injection.** The process of maintaining the pressure in a hydrocarbon reservoir by injecting gas into the gas cap. The gas to be injected needs to be compressed. Gas treating/processing/recovery may be required to ensure that the gas to the compressor has an acceptable water and hydrocarbon dew point for the compressors.

**Gas-lift.** One of the oldest methods of artificial lift (introduced in the mid 1800's) for oil well production in which gas is injected into the production tubing at depth to reduce the hydrostatic pressure of the fluid column where there is insufficient reservoir pressure to produce the well (**Figure 11**). Injected gas creates bubbles in the produced fluid contained in the tubing, making the fluid less dense. The resulting

reduction in bottom hole pressure allows the reservoir liquids to enter the wellbore and flow to the surface [1].

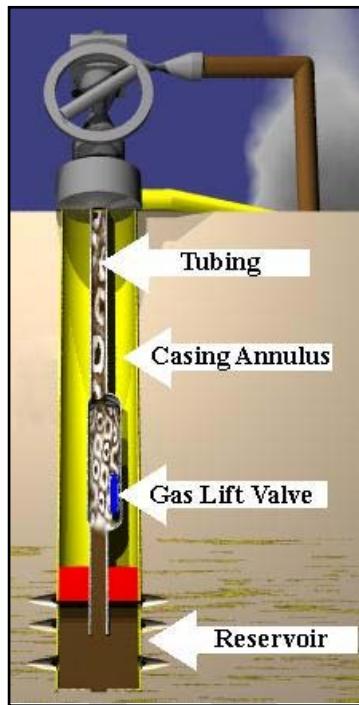


Figure 11: [Video Demonstrating gas lift in production well \[12\]](#)

**Gas-lift gas.** High-pressure gas used for gas-lift in the oil wells. Gas-lift gas can be from various sources including a commercial pipeline, a neighboring gas field, or associated gas that has been treated to remove condensate. Associated gas would also have to be compressed to the desired pressure, so high pressure non-associated gas is preferred if available. The recovered gas-lift gas will also be at low pressure and may be flared or compressed for sale or use.

**Gas liquefaction.** The process of cooling gas to  $-162^{\circ}\text{C}$ , reducing its volume by 600 fold over the gas volume at standard conditions (see also LNG). [1]

**Gas oil.** The residue from crude petroleum after distilling out light and intermediate fractions. With its specific gravity ranging between 0.82 and 9.0, gas oil is heavier than kerosene. Its calorific value is about 19,200 Btu per pound, and it is chiefly used as a fuel in compression-ignition (diesel) engines.

**Gas-oil ratio.** The proportion between oil and gas obtained from a producing well under given conditions of temperature and pressure. Commonly abbreviated GOR and measured in standard cubic feet of gas per barrel of oil (SCF/BBL, used in the table below) or expressed in barrel per barrel (BBL/BBL). Total GOR includes solution and free gas from the reservoir, while solution GOR include only the GOR of the oil as it reside in the reservoir. [31].

Oil well	<2,000
Oil (volatile) well	2,000-3,300
Condensate well	3,300-50,000
Gas well	>50,000

The US Geological Survey defines an “Oil Field” as a field with a GOR of less than 20,000 (in cubic feet/barrel).

**Gas pre-treatment** (as defined under AM0009). After the associated gas is recovered (separated from the oil, see “Associated gas recovery” above) the gas must be treated in order to be compressed and transported to a gas processing facility. This pre-treatment may involve condensate removal as well as water removal (dehydration).

**Gas processing plant/facility.** A facility that separates or processes the associated gas, non-associated gas and, if applicable, combined gas from the project through chemical, physical or physical-chemical procedures in order to produce marketable hydrocarbon and other products, e.g. sulphur (**Figure 12**). Gas pre-treatment to remove condensable components and water may be needed before transport to the plant/facility for further processing.

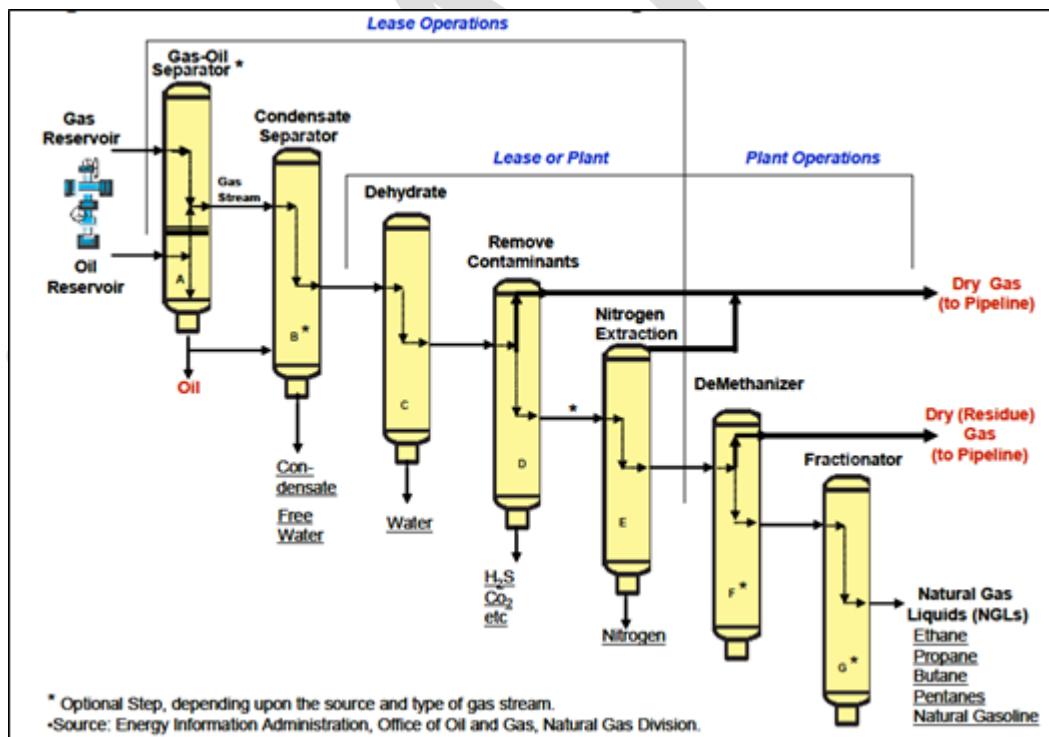


Figure 12: Generalized steps in natural gas processing [4]

**Gas transportation.** Transportation of the processed gas by means of a pipeline, LNG, CNG mobile units or any combination thereof. The gas is compressed to a

sufficiently high pressure to overcome the pipeline friction/altitude and meet the required delivery pressure. As inlet compression is required some gas treating/processing/recovery may be required to ensure that the inlet gas has an acceptable water and hydrocarbon dew point.

**Gas to liquids (GTL).** Gas to liquids or GTL is a refinery process to convert natural gas or other gaseous hydrocarbons into longer-chain hydrocarbons. Methane-rich gases are converted into liquid fuels either via direct conversion or via syngas as an intermediate, for example using the Fischer Tropsch process. Using such processes, refineries can convert some of their gaseous waste products into valuable fuel oils, which can be sold as or blended only with Diesel fuel. (See detail [video](#) of GTL plant).[\[34\]](#)

**Gas turbine.** A gas turbine consists typically of an axial-flow air compressor and one or more combustion chambers where liquid or gaseous fuel is burned and the hot gases are passed to the turbine and where the hot gases expand drive the generator and are then used to run the compressor [\[1\]](#). The gas turbine is a logical choice of prime mover for power generation in an offshore platform where supplies of natural gas are available as fuel.

**Gas utilize.** Specific equipment (i.e., generator, boiler) where the processed gas displaces other fossil fuels.

**Gas well.** A well that is designed to produce mainly or only gaseous hydrocarbons, that contains little if any liquid hydrocarbons; a gas-liquid ratio of greater than 50,000 scf/STB. [\[3\]](#)

**Gas well wellhead.** Wellhead with associated tubes and valves that control the flow of hydrocarbons and other fluids out of the well ("Christmas tree"). See [Figure 13](#) below. [\[7\]](#)



**Figure 13: Typical gas well wellhead** [\[13\]](#)

**Gathering station.** Satellite facility that gathers and commingles produced fluids from several wells in vicinity and pre-processes the fluids through gas/oil/water

separation and distributes those fluids (gas, oil and water) to central facilities for additional processing, sale or disposal. Associated gas may be flared at the gathering station or sent to a central flare facility. These stations may or may not have facilities to test individual well flow rates so that the total station production can be allocated back to the wells. Stations are often built to accommodate additional wells as field development progresses. Diagram of the relationship of a satellite collection station to centralized field facilities. Several satellite collections stations typically feed the central facilities (**Figures 14 and 15**).

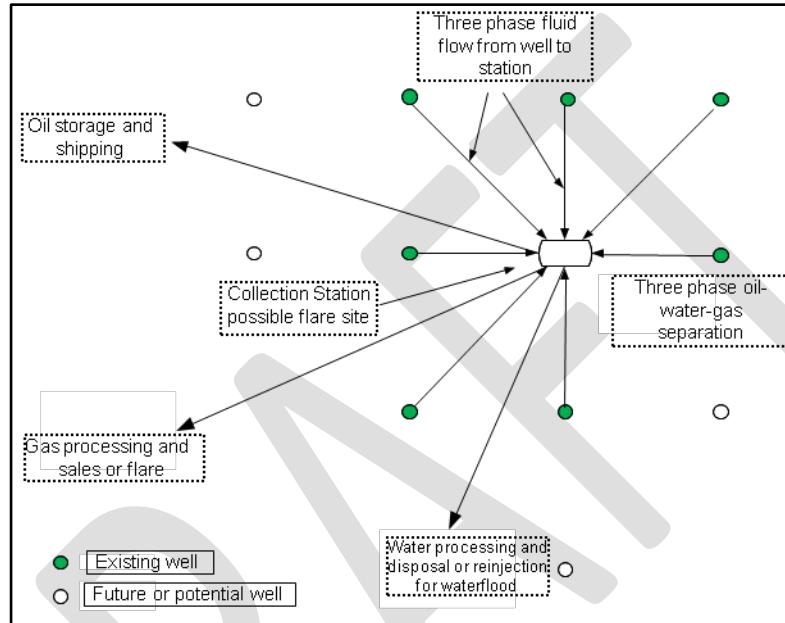


Figure 14: Diagram of satellite collection station and centralized field facilities.



Figure 15: Header at a gathering station [14]

**Glycol dehydration.** Liquid desiccant glycol is used to absorb water vapor from the gas stream. The glycol (boiling point 205 °C / 400 °F) can be regenerated by boiling off the water (boiling point 100 °C / 212 °F). In addition to water, glycol occasionally carries with it a small amount of methane and other compounds found in the wet gas. Flash tank separator-condensers reduce the pressure of the glycol solution stream, allowing the methane and other hydrocarbons to vaporize ('flash') (**Figure 16**). This gas may be flared or compressed for sale or use.

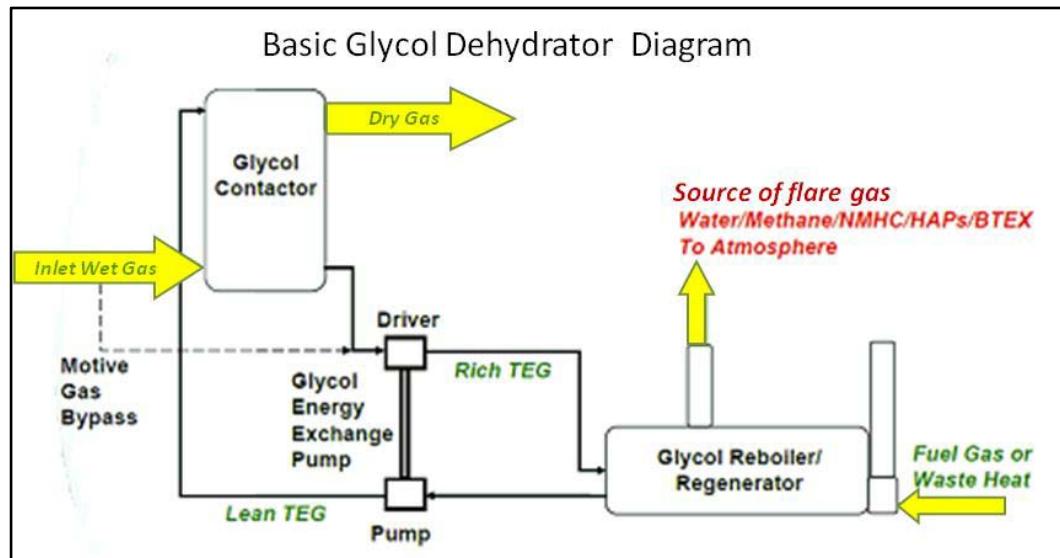


Figure 16: Generalized process diagram for a glycol dehydration facility [15] ([video](#) [Glycol Dehydration Principles](#)) [26]

**GOSP.** The initial letters for gas-oil separation plant.

## H

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**History Matching.** The act of adjusting a model of a reservoir until it closely reproduces the past behavior of a reservoir. The historical production and pressures are matched as closely as possible. The accuracy of the history matching depends on the quality of the reservoir model and the quality and quantity of pressure and production data. Once a model has been history matched, it can be used to simulate future reservoir behavior with a higher degree of confidence, particularly if the adjustments are constrained by known geological properties in the reservoir. [29]

**Hydrate.** A compound formed when water or its elements combines with another substance. When methane, a hydrocarbon, contains water a hydrate known as methane snow (resembling ice like crystals) may be formed inside pipes and interfere with efficient transmission. Should these hydrates accumulate, they can

impede the passage of natural gas through valves and gathering systems. To reduce the occurrence of hydrates, small natural gas-fired heating units are typically installed along the gathering pipe wherever it is likely that hydrates may form.

**Hydration.** Taking in water, either by absorption or adsorption. The principle has many uses in the treatment of gas and oil, chief of which is to separate water from gas and oil.

**Hydrocarbon.** An organic compound made up of atoms of carbon and hydrogen.

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## I

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**Improved recovery.** Improved Recovery is the extraction of additional petroleum, beyond Primary recovery, from naturally occurring reservoirs by supplementing the natural forces in the reservoir. It includes water-flooding, secondary processes, tertiary processes and any other means of supplementing natural reservoir recovery processes. (also called Enhanced Recovery).

**Inert gas.** A general term meaning non-reactive with the materials with which it contacts. [1]

**Injection gas.** Gas injected into the reservoir to maintain pressure. [1]

**Injection well.** A borehole drilled for the purpose of injecting water or gas into the pore spaces in a reservoir rock to maintain reservoir pressure or to encourage oil or gas to flow into adjacent, producing wells (as in improved recovery projects). Producing wells may also be converted to injection wells.

**Instrument.** Any control valve, relief valve, transmitter, recorder, pressure and temperature indicator, or other electrical or electronic device used to measure, control or record a variable.

**Instrument air.** Compressed air from the instrument and utility air plant, which is distributed around an installation for the operation of pneumatically operated instruments and valves. Unlike utility air, instrument air has to be dried and cleared of impurities before it can be used.

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## L

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**LNG or liquefied natural gas.** Natural gas mostly methane and ethane (typically 91 per cent and 7 per cent respectively), with some propane and butane,

and small quantities of pentane and higher alkanes that has been converted temporarily to liquid form for ease of storage or transport in regions without a natural gas pipeline system in place. The liquefaction process occurs after normal gas processing to remove contaminants; it is then condensed into a liquid by cooling it to approximately -162 °C or -260 °F . LNG takes up 1/600th the volume of gaseous natural gas.

LNG is produced at LNG plants consisting of one or more LNG trains, or liquefaction and purification facilities (**Figure 17**). LNG is loaded onto special cryogenic ships or trucks for transport, then delivered to a regasification terminal, where the LNG is reheated and turned into gas. Regasification terminals are usually connected to a storage and pipeline distribution network to distribute natural gas to local distribution companies or independent power plants. [3], [5]

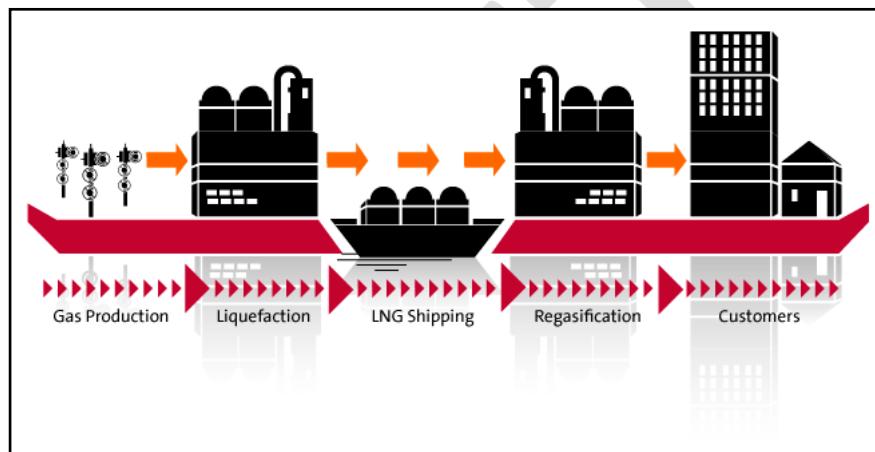


Figure 17: Generalized process diagram for LNG plant [3]. ([Video of process](#)) [24]

**LPG or liquefied petroleum gas.** A mixture of hydrocarbon gases used as a fuel in heating appliances and vehicles, and increasingly to replace chlorofluorocarbons as an aerosol propellant and a refrigerant. Varieties of LPG include mixes that are primarily either propane or butane, and more commonly mixes including both propane (60%) and butane (40%), depending on the season – in winter more propane, in summer more butane. Propylene and butylenes are usually also present in small concentration. A powerful odorant, ethanethiol, is added for easy leak detection. LPG is produced by refining petroleum or ‘wet’ natural gas. [3],[5]

**Live oil.** Crude oil before gas has been separated out of the liquid. Also known as unstabilized oil, it presents a serious fire hazard. Once gas has been separated the oil is dead, or stabilized.

## M

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**MEG.** Mon-ethylene glycol or glycol (IUPAC name: 1,2-ethanediol). Rich MEG is MEG rich in water, typically 40-70 wt% MEG. Lean MEG is MEG with little water, typically 90 wt% MEG.

**Measurement point.** Location where gas flows through the measurement equipment, which measures the quantity and quality of gas delivered at the delivery point. [30]

**Metering valve.** A valve for controlling the rate of flow of a gas or liquid.

## N

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**Natural gas.** A generic term denoting a primarily hydrocarbon gas stream produced from geologic formation.

**Natural gas processing facility.** See gas processing plant definition.

**NGL or natural gas liquids.** NGLs are hydrocarbons associated with natural gas and are a by-product of natural gas processing. NGLs include ethane, propane, butane, iso-butane, and natural gasoline. They are sold separately and have a variety of different uses, including enhancing oil recovery in oil wells, providing raw materials for oil refineries or petrochemical plants, and as sources of energy. [3], [5]

**Non-associated gas.** Natural gas not associated with liquid hydrocarbons in the reservoir. This can be dry gas, wet gas or retrograde gas condensate (gas condensate is in the gaseous state in the reservoir but can contain significant amount of liquids under surface conditions).

**Normal cubic meter (metre).** A cubic meter, for example of natural gas, measured and converted to standard conditions. The normal cubic meter is used in some countries like standard cubic feet is used in others for quantifying natural gas, and is abbreviated to Nm<sup>3</sup>.

**Normal (standard) conditions.** A combination of temperature and pressure values which is used to normalize volumes of gas measured at various temperatures and pressures. Used to determine the mass of a gas at a specified (standard or normal) temperature and pressure. Various organizations use different combinations of temperature and pressure. Standard temperature can range from a low 0 degrees C to a high of 25 degrees C. Standard pressure can be either 100 kPa or 101.325 kPa. Different combinations of temperature and pressure can have a large effect on mass calculations therefore normal (standard) conditions should be

specified when comparing measurements or volumes in petroleum production and reserves estimation, indicating the values of temperature and pressure applied.

## O

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**Oil.** A hydrocarbon mixture that is found in liquid state in the reservoir. There are generally two types of oil; black oil and volatile oil. Black oil (which is not necessarily black) has an initial gas-oil ratio of less than 2,000 scf/STB and contains greater than 30% mole percent hydrocarbons heavier than hexane. Volatile oil has an initial gas-oil ratio of between 2,000 and 3,300 scf/STB and between 12.5% and 30% mole percent hydrocarbons heavier than hexane. [8]

**Oil field.** A region with an abundance of oil wells extracting crude oil and associated liquids and gases from below ground. The term usually includes not only the surface area overlying the oil reservoir, but also the reservoir, the wells, and the production equipment. [1] An oil field may produce from several different discrete reservoirs (geologic formations or units) each of which may be produced individually or together within a wellbore. After the initial discovery well, as part of oil field development, additional wells are drilled to delineate the areal extent of the field (**Figure 18**). This is followed by development wells that are drilled in a pattern or a manner deemed to best exploit the resource. Depending on the nature of the oil reservoir, additional wells may be drilled later to improve recovery of the resource. Wells may also be drilled to inject fluids for improved oil recovery (e.g. water or CO<sub>2</sub>). Oil field development can take place over many years with some wells being plugged and abandoned and new wells being drilled. It is a dynamic process.

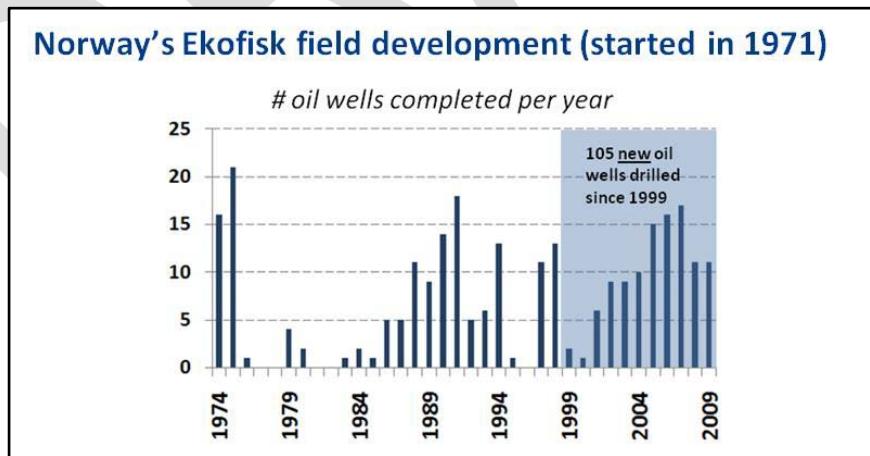


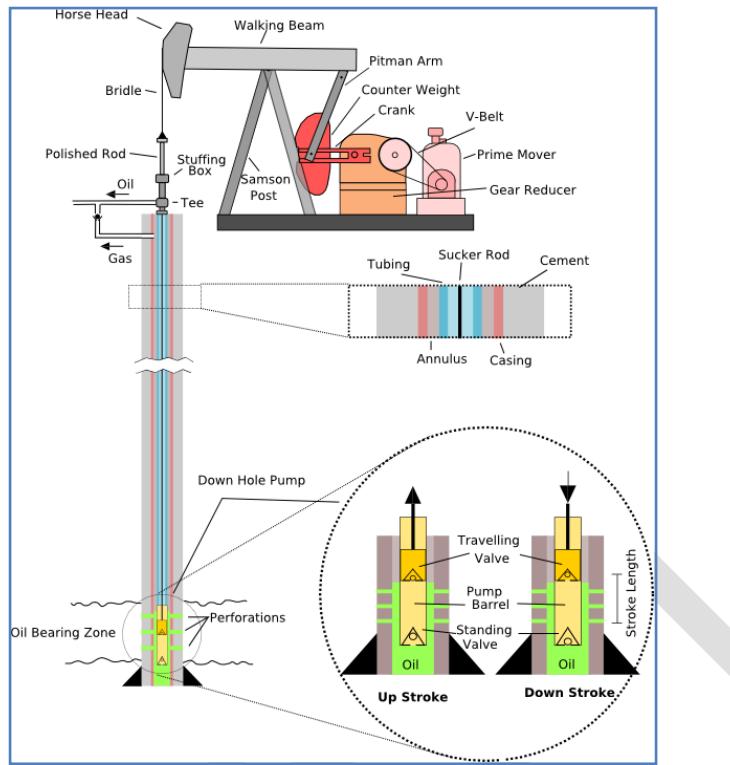
Figure 18: Sample oil field wells drilled over time from start of project in 1991 [19]

**Oil reservoir.** A subsurface pool of hydrocarbons in the liquid state contained in porous or fractured rock formations. The naturally occurring hydrocarbons are trapped by overlying rock formations with lower permeability.

**Oil reservoir life cycle.** The commercial exploitation of an oil reservoir generally proceeds through several phases in order to maximize the total recovery of fluids from the reservoir. The changes of the characteristics of the reservoir due to reducing pressure trigger the need to change the reservoir exploitation strategy to maximize fluid recovery. As the natural pressure in a reservoir falls then there is less motive force to push the fluids to the surface. Also there is a danger that the reservoir pressure will drop below the Bubble point and at that point some of the components in the liquid phase will move into the gas phase. Most fields will start with Primary Recovery and move on to Secondary and Tertiary recovery if conditions are appropriate.

**Oil water separator** (oil coalescer). Part of a crude oil processing plant which treats oily waste water to recover oil and disperse water. The separator receives the mixture from the piping system and the liquid is forced through a coalescer packed with rope mop, to which the fine particles adhere and increase in size, making it easier for gravity separation to take place. This is specialized equipment used for the final removal of water prior to oil shipment. The term oil water separator also refers to a primary oil treatment used where large volumes of water are separated from an oil/water stream as in a waterflood where the produced fluid may be over 90% water. In this case the fluids are separated by density differences.

**Oil wells.** Wells that produce mainly liquid hydrocarbons in the form of crude oil as its primary commercial product (there may be various degrees of associated natural gas produced with the oil). The oil may be produced through natural pressure or by various means of physical extraction. A portion of the associated gas is often produced up the casing-tubing annulus (space between the casing and tubing which carries the oil) which may be sent to a processing facility or flared. (**Figures 19 and 20**).



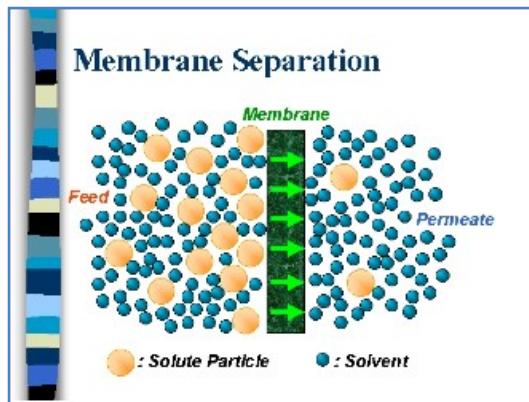
**Figure 19:** Diagrammatic representation of an oil well with a beam pump [3]



**Figure 20:** Oil well wellhead. [16]

P

**Permeate gas.** A low heating value off-gas from the treatment of natural gas in membrane gas separation processing facilities. Membrane facilities are often used for  $\text{CO}_2$  separation from natural gas (**Figure 21**). When used for  $\text{CO}_2$  separation from natural gas the solvent would be  $\text{CO}_2$  while the solute would be methane so the permeate would be  $\text{CO}_2$  rich.



**Figure 21: Membrane separation**

**Petroleum.** A broadly defined class of liquid hydrocarbon mixtures. Included are crude oil, lease condensate, unfinished oils, refined products obtained from the processing of crude oil, and natural gas plant liquids. Note: Volumes of finished petroleum products include non hydrocarbon compounds, such as additives and detergents, after they have been blended into the products [18].

**Pigging.** A process whereby a solid object (the pig) is inserted into a pipeline to either push the contents of a pipeline through the pipe. Often required to move liquids (water or hydrocarbons) that have condensed in the pipeline to the receiving end. The pig could also be an “intelligent pig” that measures pipeline wall thickness as it travels through the pipe so that corrosion may be monitored. The pigs are usually “blown” through the pipe by the inlet pressure.

**Pig receiver.** A device at the receiving end of a gas pipeline to allow a pig to be removed from the pipeline.

**Planned for development.** Satisfies all the criteria for reserves, and there is a firm intent to develop, but detailed development planning and/or necessary approvals/contracts have yet to be finalized. [27]

**Power generator.** A diesel, gas, steam, or electricity driven unit producing alternating or direct current power for driving motors (for example, pumps, compressors), lighting and miscellaneous purposes. Power generation equipment comprises a driving element, called prime mover, and an electricity generator or alternator, together with associated control equipment.

**Pressure gauge.** An instrument for measuring fluid pressure. It usually measures the difference between atmospheric pressure and absolute pressure. An alternative type of pressure gauge is a column of liquid, for example, a water column. Another is a pressure sensitive diaphragm.

**Primary Recovery.** Generally means allowing fluids to be produced using the reservoir pressure to move the fluids from the reservoir to the surface.

**Process.** Any operation resulting in a change of state or composition with respect to a datum, and forming a set of regularly occurring actions taking place in a planned manner, as in a process train.

**Processed gas.** The marketable natural gas that is produced in a gas processing plant. The gas is ready to be consumed and must be transported from the areas where it is produced to those areas that require it. [5]

**Processing plant.** A facility designed to separate or process hydrocarbons through chemical, physical or physical-chemical procedures in order to produce marketable hydrocarbons and other (e.g. sulphur) products. See "Gas processing plant" above.

**Production forecast.** Forecast that shows either average daily or monthly oil and gas production estimates for each calendar year. In the forecast report, daily oil production rates normally include oil and condensate production, and daily gas production rates include gas-well gas and associated gas production. [27]

**Project:** It represents the link between the petroleum accumulation and the decision-making process, including budget allocation. A project may, for example, constitute the development of a single reservoir or field, or an incremental development for a producing field, or the integrated development of a group of several fields. In general, an individual project will represent the level at which a decision is made on whether or not to proceed (i.e., spend money), and there should be an associated range of estimated recoverable volumes for that project. [27]

**PVT.** The initial letters for pressure, volume and temperature. By Boyle's Law the pressure upon a perfect gas is inversely proportional to its volume, at a constant temperature. The interrelationship of pressure, volume and temperature (and density which is proportional to pressure) plays an important role in fluid engineering, and effects the techniques used to handle fluids at all stages from the tapping of a hydrocarbon reservoir to the sale of a petroleum derived product.

## R

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**Reboiler.** A fired pressure vessel used, for example, in gas dehydration systems. In this application the reboiler accepts water and glycol after the glycol has been in contact with a gas stream and filtered to separate the water, before the glycol is recycled.

**Recovered gas.** The associated gas and/or gas-lift gas recovered from the project oil wells. See "Associated gas recovery" above.

**Recovery factor.** The percentage of the hydrocarbon in place that can be produced with each production plan: primary, secondary and tertiary.

**Recuperator.** A type of heat exchanger that recovers heat from waste gas and uses it to reheat air for combustion in gas turbine.

**Refinery gas.** Also known as still gas, can be defined as: Any form or mixture of gases produced in refineries by distillation, cracking, reforming and other processes. The principal constituents are methane, ethane, ethylene, normal butane, butylene, propane, propylene, etc. Still gas is used as a refinery fuel and a petrochemical feedstock 2,3,4,5 and is generally produced from light ends distillation units of refinery facilities, where it has a pressure that allows its immediate use.

**Refinery processes.** A variety of techniques employed in a refinery to obtain chemical intermediates and end products. These may be divided into primary and secondary processes. Distillation is the primary refinery process, in which ranges of distillates are produced without changing the chemical nature of the constituent hydrocarbons. Secondary refinery processes involve conversion, such as cracking, extraction (for example solvent extraction), and special treatment, such as desulphurization.

**Relief valve.** A type of fluid control valve which operates only in a condition of over-pressure. A spring-loaded diaphragm or rupture disc in the body of the valve reacts to over-pressure and diverts fluid, usually into a by-pass line, or to atmosphere, until pressure falls below the operating level.

**Reserves.** Those quantities of hydrocarbons which are anticipated to be commercially recovered from known accumulations from a given date forward. [27]

**Reservoir.** A subsurface rock formation containing one or more individual and separate natural accumulations of moveable petroleum that is confined by impermeable rock and is characterized by a single-pressure system (Also referred to as Pool). [27]

**Reservoir management.** Reservoir management uses elements of geology, geophysics and petroleum engineering to predict and manage the behavior of oil and natural gas within wells and rock formations inside the earth. Reservoir management is used throughout the life cycle of crude oil and natural gas fields. It is used to determine the most cost-effective way to develop a new field or to bring new life to a mature field with, for example, enhanced oil recovery measures such as steam flooding, or steam injection. Through the use of technologies, such as remote sensors and simulation modeling, reservoir management can improve production rates and increase the total amount of oil and gas recovered from a field.

**Reservoir simulator.** A computer run of a reservoir model over time to examine the flow of fluid within the reservoir and from the reservoir. Reservoir simulators are built on reservoir models that include the petrophysical characteristics required to understand the behavior of the fluids over time. Usually, the simulator is calibrated

using historic pressure and production data in a process referred to as "history matching." Once the simulator has been successfully calibrated, it is used to predict future reservoir production under a series of potential scenarios, such as drilling new wells, injecting various fluids or stimulation. [29]

**Residence time.** The period occupied during a phase in a process stream. For example, a residence time of three minutes may be allowed for produced water to separate from oil in a flash drum, allowing vapor to be burnt off.

**Rich gas.** Natural gas which, although primarily methane, contains other low carbon chain alkanes such as ethane, propane and butane which increases its heat content. May also be known as a wet gas.

**Reid vapor pressure (RVP).** Vapor pressure (the pressure exerted by vapor from a substance) as measured in the petroleum industry. Reid apparatus measures vapor pressure in pounds per square inch (psi) at a temperature of 38 °C (100 °F), not at the temperature at which the liquid boils. The RVP of crude oil may be plotted on a crude oil analysis graph, and typically varies between 2 psi and 10 psi, according to the volume of deutanized gasoline present. Crude oil may be classified as stabilized or unstabilized by reference to its RVP, a stabilized crude oil reading about 5 psi, and an unstabilized one about 100 psi.

**Resource uncertainty category.** Any estimation of resource quantities for an accumulation or group of accumulations is subject to uncertainty and should, in general, be expressed as a range. The function of the three primary categories of reserves (proved, probable, possible) is to illustrate the range of uncertainty in the estimate of the potentially recoverable volume of petroleum from a known accumulation. Such estimates, which are done initially for each well or reservoir, may be made deterministically or probabilistically and are then aggregated for the accumulation/project as a whole. [27]

**Risk and reward.** Risk and reward associated with oil and gas production activities stems primarily from the variation in revenues from technical and economic risks. Many companies use exposure to risk in conjunction with the rights that they are assigned to operate and to take volumes in kind to support reserves reporting. Technical risk affects a company's ability to physically extract and recover hydrocarbons and is usually dependent on a number of technical parameters. Economic risk is a function of the success of a project and is critically dependent on the ability to economically recover the in-place hydrocarbons. [27]

**Royalty.** Refers to payments that may be due to the host government, mineral owner, or landowner, in return for the producer having access to the petroleum.

## S

**Secondary Recovery.** Generally used for water flooding or displacing oil by water and thereby “pushing” the oil to a producing well. May also include maintaining a reservoir pressure by gas injection or water injection.

**Separator.** A production treating vessel designed to facilitate the separation of gas, oil, and/or water from a produced fluid stream (**Figure 22**) [1]. See “Associated gas recovery” above.

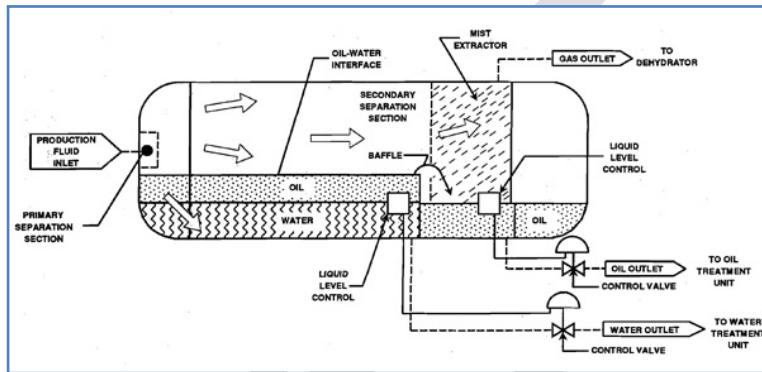


Figure 22: Diagram of a three phase separator [17]

**Slug catcher.** Large pipelines may produce large quantities of condensed liquids either due to pigging or due to unusual circumstances. The sudden appearance of large quantities of liquids at a gas receiver can damage the equipment. The slug catcher is a series of vessels that enable the large quantity of liquids to be safely contained.

**Solution gas.** Represents the dissolved gas in wellbore or reservoir fluids. The gas will remain in solution until the pressure or temperature conditions change, at which time it may break out of solution to become free gas. [29]

**Sour gas.** An acid gas containing hydrogen sulphide ( $H_2S$ ), as opposed to sweet gas. Natural gas with more than 1.5 grains of hydrogen sulphide per cubic feet is sour gas.

**Sour oil.** Crude oil containing hydrogen sulphide gas, as opposed to sweet oil. Sour oil is corrosive and must be treated to remove the sulphur content.

**Stabilized crude oil.** Crude oil which has been treated to separate out any dissolved gas. Stabilization is achieved in a series of pressure vessels, called gas separators, in which gas bubbles out of solution, leaving the stabilized oil to be drained off. After the oil has been treated in this way it will have a low vapor pressure. Stabilized oil is also called stock tank oil.

**Stabilizer.** Another name for a crude oil fractionating column. Or a part of a gas oil processing plant wherein wild, volatile, low boiling point hydrocarbons are removed by distillation to leave a stabilized crude oil.

**STB (Stock Tank Barrel).** One barrel of stabilized or dead oil at the surface after the gas has escaped. A barrel of oil in the underground reservoir is more than a barrel of oil at the surface because the gas dissolved within the oil underground (related to temperature and pressure in the reservoir and the nature of the hydrocarbons contained within) swells the oil. When the gas is released at the lower temperature and pressure at surface conditions the volume of oil shrinks.

**Stream.** A term used in oil and gas operations, with and without a prefix. It denotes a continuously flowing process, for example, the production and transportation of oil from a well, or processing of a feedstock through a refinery. Thus, downstream is used to indicate those operations away from the source, and upstream to mean those closer to the source. A process is on stream when flow begins.

**Sweet Gas.** Natural gas that does not contain significant amounts of hydrogen sulfide ( $H_2S$ ). Gas that does contain  $H_2S$  is referred to as sour gas.

**Sub-commercial.** A project is sub-commercial if the degree of commitment is not such that the accumulation is expected to be developed and placed on production within a reasonable time frame. A reasonable time frame for the initiation of development depends on the specific circumstances but, in general, should be limited to around 5 years. [27]

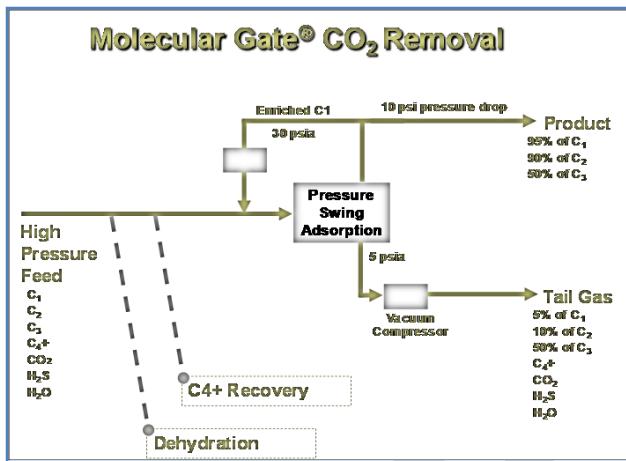
## T

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**Tail gas.** A term most commonly used for residue gas from a sulphur recovery unit (SRU). However it can also apply to other natural gas processing units that remove contaminants where the tail gas is the contaminant stream that has been removed. Hydrocarbons may also be contained within this gas stream which may or may not be of sufficient quantity to be useful as a fuel.

**Examples of tail gas.**

Pressure swing adsorption removes contaminants from the adsorbent by vacuum (**Figure 23**). Depending on the composition of the feed gas this tail gas may have sufficient heat value to be used as a fuel gas but may be vented or flared.



**Figure 23:** Diagrammatic representation of a pressure swing adsorption gas sweetening facility

Other examples of tail gas would be flash gas from amine or glycol reboilers (**Figures 2 and 12**). Cryogenic nitrogen rejection units also have a tail gas stream that is mostly nitrogen with very small amounts of hydrocarbons.

**Tertiary Recovery.** An enhanced recovery process that goes beyond water or gas flooding. It may involve steam, fire, chemicals, miscible gases, bacteria or other techniques. [1]

**Tons oil equivalent.** A basis for assessing the work value or the calorific value of different sources of energy in terms of those pertaining to one tonne of oil. British thermal units or calories, are also used in assessing energy reserves or conversion. Tons of oil equivalent is abbreviated “toe”.

**Total GOR.** Gas-to-oil ratio that includes solution and free gas from the reservoir. [28]

**Transmitter.** In instrumentation terminology, a device that passes the output of a primary element, for example, a pressure gauge which sense a change in a process variable, to another controlling device within a loop.

## U

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**Unconventional resource.** An umbrella term for oil and natural gas that is produced by means that do not meet the criteria for conventional production. What has qualified as “unconventional” at any particular time is a complex function of resource characteristics, the available exploration and production technologies, the economic environment, and the scale, frequency and duration of production from

the resource. Perceptions of these factors inevitably change over time and often differ among users of the term. At present, the term is used in reference to oil and gas resources whose porosity, permeability, fluid trapping mechanism, or other characteristics differ from conventional sandstone and carbonate reservoirs. Coal bed methane, gas hydrates, shale gas, fractured reservoirs, and tight gas sands are considered unconventional resources.[\[29\]](#)

**Unsaturated hydrocarbon.** A hydrocarbon with at least one double or triple bond in its structure, in which one or more elements has an unsatisfied valence. Alkenes are unsaturated hydrocarbons, as are the alkynes.

**Undersaturated oil.** Oil containing some dissolved gas, but which could hold more, at a given temperature and pressure.

**Undeveloped oil and gas reserves.** Undeveloped oil and gas reserves are reserves of any category that are expected to be recovered from new wells on undrilled acreage, or from existing wells where a relatively major expenditure is required for recompletion. [\[33\]](#)

**Unstabilized crude oil.** Raw crude oil straight from the well, before it is treated in a gas separation plant. As in stabilized oil the degree of stabilization is specified in terms of RVP, and a typical raw crude might display an RVP of 100 psi.

## V

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**Vapor recovery unit.** A system composed of a scrubber, a compressor and a switch. Its main purpose is to recover vapors formed inside completely sealed crude oil or condensate tanks.[\[29\]](#)

**Venting.** Is the controlled release of unburned gas directly to the atmosphere for gas disposal or for safe facility operation. Venting excludes fugitive gas releases from piping and equipment leaks and includes gas purges.

## W

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**Waste gas.** Waste gas is a by-product generated in several of the processing units of a refinery and in normal operational processes this gas is directed to the flares. The principal constituents of this gas are the same as in refinery gas (methane, ethane, ethylene, normal butane, butylene, propane, propylene, etc). Waste gas is also a by-product of natural gas processing to remove containments such as water and carbon dioxide through glycol dehydration and amine adsorption of acid gases. Waste gas is characterized by a low pressure for which no economically useful application is found, (e.g. because of low pressure, heating value or quantity available). In some cases, waste gas is potentially recoverable and useful as a fuel.

**Waste gas system (refinery, petrochemical, chemical and LNG production facilities).** Oil and gas processing facilities of all types have waste gas streams, whether or not they are used as fuel gas, returned to the plant inlet or flared is a matter of the composition of the gas and its pressure. If there are sufficient valued products in the waste gas it is economically feasible to recycle through the plant inlet or be used as a fuel gas. However waste gas is at low pressure and so if it is to be used as fuel gas it must be compressed and blended into the fuel gas system. This is often economically prohibitive so the gas is usually vented or flared. For example flash gases from glycol and amine reboilers in an LNG plant are usually captured and flared. These gases could be captured compressed and rerouted for blending with the feed gas at the front of the plant thereby eliminating the need to flare the gas.

**Water injection.** Used for water flooding or for maintaining the pressure in a reservoir by injecting water into the base of the reservoir.

**Water flood.** The process of using water injection to move reservoir fluids towards the producing wells.

**Well abandonment.** The permanent plugging of a dry hole or of a well that no longer produces petroleum or is no longer capable of producing petroleum profitably. Several steps are involved in the abandonment of a well: permission for abandonment and procedural requirements are secured from official agencies; the casing is removed and salvaged if possible; and one or more cement plugs and/or mud are placed in the borehole to prevent migration of fluids between the different formations penetrated by the borehole. [27]

**Well completion.** The process of installing equipment within a well such that fluids can flow from the reservoir into the well bore. May include procedures such as perforating the well casing and stimulating the well with acid or fracturing with sand laden fluid. Artificial lift equipment may also be installed at this time.

**Well recompletion.** To move the primary completion from one zone to another. May involve reperforating, running other tubulars (different size or material) or setting a new packer.

**Wet gas.** Natural gas containing significant heavy hydrocarbons (C<sub>2</sub>+), or typically less than 85% methane. Some liquid hydrocarbon liquid will condense at surface conditions (condensate) however the fluid will remain in the gas phase in the reservoir throughout the life of the field. One definition based on Gas-liquid ratio is that it is greater than 50,000 scf/STB. Natural gas is also said to be wet when more than 300 gallons of propane, butane and other liquid hydrocarbons, can be separated from every thousand cubic feet of gas. Wet gas is an important source of liquefied petroleum gas (LPG). May also be called rich gas.

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## Useful Links

<http://www.ontime.methanetomarkets.org/m2mtool/index.html>

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