

Upstream Oil & Gas Glossary

Now including LNG

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[Contents](#)

[Introduction](#)

[Glossary](#)

[Petroleum Chemistry](#)

[A Brief Oil and Gas History](#)

[LNG History](#)

[Some Useful Conversions](#)

[SPE Petroleum Reserves Categorisation](#)

[Esanda Course Offering](#)

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Glossary

AAV Ambient Air Vaporizer

ABS American Bureau of Shipping. US-based classification and standards setting society for shipping including LNG ships, FSRU's and FLNG

Abandonment End of production, plug and abandon wells, dismantle and remove all material and equipment

Acidising Treatment of reservoir with hydrochloric or hydrofluoric acid to improve performance

ACQ Annual Contract Quantity. The annual gas delivery quantity contracted for during each contract year as specified in an LNG contract

AFC Approved For Construction

AFD Approved For Design

AFE Approved For Expenditure

Aggregator collects gas from a group of producers. Do not take title to the gas but find markets and negotiate prices for a pool of upstream producers

AGR Acid Gas Removal (Unit) Generic name for process units designed to remove H₂S, CO₂ and other sulphur compounds that 'sour' the gas

AHV Anchor Handling Vessel

Alkane Any of various saturated open-chain hydrocarbons having the general formula C_nH_{2n+2}, the most abundant of which is methane (CH₄)

Alkene Any unsaturated aliphatic hydrocarbon with the general formula C₂H_{2n} such as ethylene, also known as olefins

Alluvial fan Pattern of sedimentary deposit frequently laid down by streams or rivers which spread out into plains

Annulus Space between two concentric objects such as between the wellbore and casing

Anoxic Lack or absence of oxygen

ANSI American National Standards Institute

Anticline An arched shape fold in which rock layers are upwardly convex

APCI Air Products and Chemicals Inc. The licensor of the C3MR and APX technology

API American Petroleum Institute

API gravity Density measurement for oil. API gravity = 141.5/(specific gravity) – 131.5

Aquifer Water-bearing rock strata

Arbitrage Trading the same commodity in two or more markets in order to benefit from the difference in prices

Aromatics Relating to an organic compound containing at least one benzene ring (C₆ ring) or similar ring-shaped component. Naphthalene and TNT are aromatic compounds. Notable for their distinctive, usually fragrant smell

Artificial lift Sucker rod-pumps (nodding donkeys), gas lift, hydraulic pumps, and submersible electric pumps, used to aid the production of oil as reservoir pressure declines

Asphalt Solid petroleum residue, similar to bitumen, tar and pitch

Associated gas Natural gas which is dissolved in crude oil in the reservoir and is released as a by-product of oil production. In these fields gas production fluctuates with oil production

BAHX Brazed Aluminium Heat Exchanger, also known as Plate Fin Heat Exchanger

Bar Unit of pressure

Bara bar, absolute pressure

Barg bar, gauge pressure

Barrel A volumetric unit equivalent to 42 US Gallons or 158.99 litres

Bbl Blue barrel, 42 US Gallons

bbl/d barrel of oil per day (see also Mbb/d and MMbbl/d)

bbl/MMscf barrels per million standard cubic feet

bcf billion cubic feet (10⁹)

BCFD Billions of Cubic Feet of Gas per Day

Beam The width of a ship. Also called 'breadth'

BH Bottom Hole

BHA Bottom Hole Assembly

BHP Bottom Hole Pressure

Bit The cutting/boring element used in drilling wells, consisting of a cutting and a circulating element

Bitumen Form of heavy, solid petroleum. See Asphalt

Block Subdivided areas for the purpose of licensing to a company for exploration or production rights

Blow down Process of releasing pressure. Producing a gas cap after oil production has concluded

Blowout Uncontrolled release of fluids from the well bore



Bbl-Blue Barrel
42 US gallons



Drill Bit

Blowout preventer See BOP

BOD Basis Of Design

BOE Barrels of Oil Equivalent (5,800 scf of lean gas is equivalent to 1 bbl of oil in calorific terms)

BOG Boil-off gas. The amount of LNG which evaporates from the tank during transportation or storage

Bow Thruster propeller at the bow of a ship that provides transverse thrust as a manoeuvring aid

BP Boiling Point

BOP Blowout preventer, arrangement of valves and rams installed at wellhead to prevent sudden escape of fluids from reservoir



BOP

Bopd Barrels of oil per day

Borehole Refers to the face of the rock outside or below the casing

Bottom-hole Deepest part of a well

Bottom-Hole Assembly (BHA) Includes drill bit, drill collars, stabilizers and other drilling components

Bottom-Hole Pressure (BHP) Formation pressure at reservoir depth

Bottom-hole pump Pump installed in the wellbore, to increase productivity, (Also downhole pump)

Bpd Barrels per day

Break Bulk to commence discharge of a cargo

Bridge plug Down hole packer assembly used in a well to seal off or isolate a particular formation for testing, acidizing, cementing

BS&W Basic Sediment and Water

BTEX Aromatic Hydrocarbons: Benzene, Toluene, Ethylbenzene and Xylene

Btu British thermal unit. A measure of heat content. 1 Btu=252 calories, 1,055 Joules

Bubble point The pressure and temperature at which the first bubbles of gas come out of solution

Bunkering The use of LNG as fuel on ships

Bwpd Barrels of water per day

C3MR Propane pre-cooled Multicomponent Refrigerant Cycle

Calliper Tool for checking casing in a well for deformation

CALM Catenary Anchor Leg Mooring

Calorific value Quantity of heat produced by complete combustion of a unit weight of a fuel. This can be measured net or gross (gross means that the water produced during combustion has been condensed releasing its latent heat, net means the water remains as a vapour)

Cantilevered jackup Jackup drilling unit where the drill rig is mounted on two cantilevers – see also Jackup

CAPEX Capital expenditure

Cap rock Impermeable layer of rock providing a seal to contain the reservoir fluids

Cargo Handling the act of loading and discharging a cargo ship

Casing Steel pipe placed in the well and cemented in place

Catenary The natural curve assumed by a chain or cable suspended between two points (e.g. an anchor chain)

CBM Coal Bed Methane. Methane extracted from coal seams. In the US alone, 100 TCF of CBM appears to be economically recoverable

cc Cubic centimetre (cm³)

CCGT Combined Cycle Gas Turbine. High efficiency power generation (typ 50%+) using gas turbines with heat recovery steam generators (HRSG) and a steam turbine in a power generation plant

CCR Central Control Room

CCS Carbon Capture and Storage

Cellar deck Deck beneath the working floor of a drilling rig or below the main deck of an offshore platform

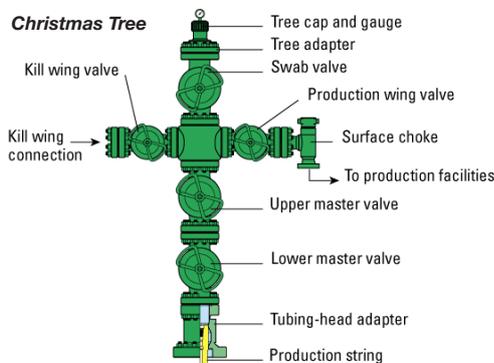
Centipoise (cP) A unit of measurement for viscosity

Charter Party contractual arrangement between a ship owner and a cargo owner, usually arranged by a broker, whereby a ship is chartered (hired) either for one voyage or for a period of time

Check valve A non-return valve, allowing flow in only one direction

Choke Device incorporating an orifice that is used to control fluid flowrate or downstream system pressure

CHP Combined Heat and Power. The generation of electricity and steam (or process heat) simultaneously



Christmas tree (Xmas Tree) The set of valves, spools, pressure gauges and chokes fitted to the wellhead of a completed well to control production

CIF Cost, Insurance, Freight, describes a transaction where the seller arranges for shipping of LNG

Classification Society (Class) companies that arrange inspections and advise on the hull and machinery of a ship. Also supervise vessels during their construction and develop construction rules. Main societies include ABS, Lloyds Register, Det Norske Veritas and Germanischer Lloyd

Clastic Rock Rock which has been formed from sediment of other rocks e.g. sandstone, shale, conglomerates, etc.

Cloud Point The temperature at which paraffin waxes solidify and give a cloudy appearance to the oil which they form part

CNG Compressed Natural Gas

CO₂ Carbon dioxide. By-product from the combustion of natural gas. A greenhouse gas

COD Commencement of Deliveries (First LNG cargo)

Concession Licence, lease, or other permit for exploration and/or production in an area or block

Condensate Low density, high API gravity liquid hydrocarbon phase that generally occurs in association with natural gas

Conductor casing Generally the first string of casing in a well

Conductor pipe A short string of large diameter casing used to keep the wellbore open and prevent it from caving in. It is usually put into the well first

Coning At excessive rates the reduction in reservoir pressure may tend to draw up underlying water or overlying gas towards the well in a cone like shape

Continental Shelf The area at the edge of a continent from the shoreline to a depth of 200m, where the continental slope begins

Conventional A reservoir in which buoyant forces keep hydrocarbons in place below a sealing caprock. Reservoir and fluid characteristics of conventional reservoirs typically permit oil or natural gas to flow freely into wellbores

Core A cylindrical sample taken from a formation for geological analysis

Coring The process of cutting a vertical, cylindrical sample of the formations

Cp Centipoise, a unit of measurement of dynamic viscosity (See Centipoise)

CP Conditions Precedent. Common conditions precedent included in LNG sale and purchase agreements are key governmental approvals required by either party

CPF Central Processing Facility

CPOC Conoco Phillips Optimised Cascade Process

CPU Central Processing Unit

CRA Corrosion Resistant Alloy

Cretaceous Rock formed in the last period of the Mesozoic era, between the Jurassic and the Tertiary periods, during which chalk deposits were formed.

Crude Oil An unrefined mixture of naturally occurring hydrocarbons

CTMS Custody Transfer Metering System. A measurement system fitted on LNG ships so that the volume of cargo can be measured accurately as the basis for the quantity of LNG purchased or sold

Cuttings Small chips of rock retrieved from a well by the circulation of the mud, studied/logged by well-site geologist

Daisy chaining Subsea wells connected in series by flowlines

Darcy Unit of measurement of rock permeability, the extent to which fluid will flow through it

DCF Discount Cash Flow

DCQ Daily Contract Quantity

DCS Distributed Control System

DDCV Deep Draught Caisson Vessel

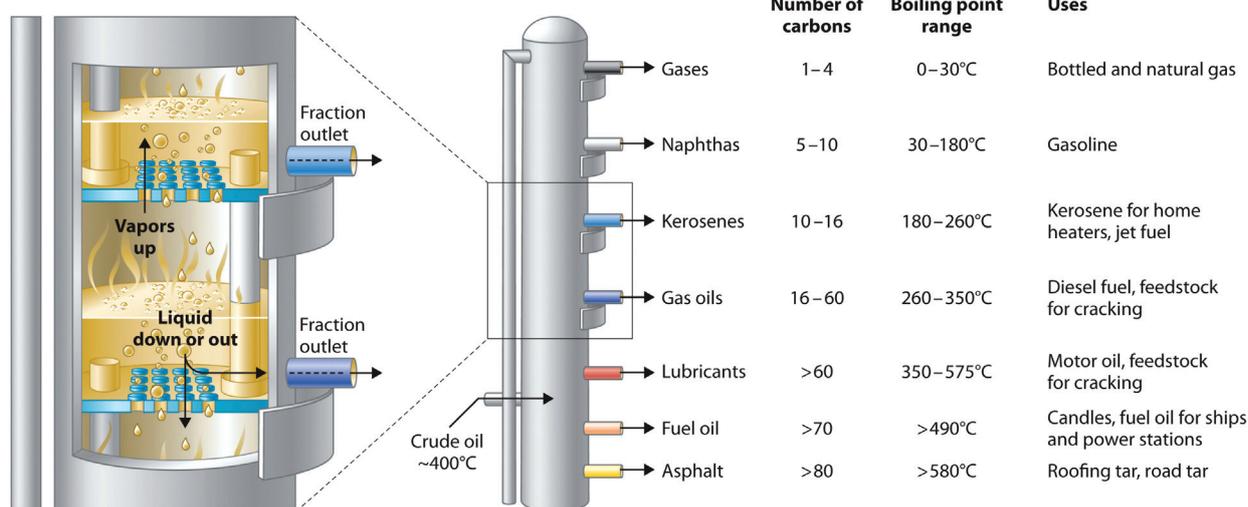
DEA Diethanolamine

Dead Oil Oil containing no natural gas

DEG Diethylene glycol

Degasser A separator which removes entrained gases from liquids (oil or water)

Dehydrator Equipment for the removal of water from oil or gas



Distillation Tower

Petroleum Fractions

Dehydration Removal of water from oil or gas to meet an end user specification

Delineation well An appraisal well, drilled to determine the boundary of a discovered reservoir

Demurrage fee levied by the shipping company on the port or supplier for not loading the vessel by a specified date agreed upon by contract assessed on a daily basis

Density Mass divided by volume, kg/m³, lb/ft³ etc.

Density log Measurement of density, a guide to porosity

Depletion Progressive reduction in reserves as a result of production

Depth map Relief map of sub-surface structure, contours relating to depths from surface datum level, (i.e. sea level)

Derating reduction of a generating unit's (GT) net dependable capacity to a point below manufacturer's nameplate capacity. Often as a result of fouling

Derrick A large load-bearing structure, used for drilling

DES Delivered Ex Ship describes a transaction where shipping of LNG is arranged by the seller

Development well A well drilled to allow production

Deviated well Well diverted from the vertical

Dew point Temperature and pressure condition at which liquids first condense from a gas

Dewpointing Removal of heavier hydrocarbons from a gas stream to meet end user specifications

DFDE Dual Fuel Diesel Electric propulsion system for LNG Carriers

DGA DiGlycolAmine. An acid gas removal solvent

Diaper Up-thrust intrusion of lower-density rocks

through overlying formations, e.g. a salt dome

Directional drilling Intentional deviation of a wellbore from the vertical

Discovery well A successful wildcat or exploration well

Distillates The products of distillation

Distillation The process of heating and "flashing" or boiling off successive fractions, component hydrocarbon, from a crude oil feedstock, or a product of earlier distillation

DMR Dual Mixed Refrigerant Liquefaction Cycle

DoE US Department of Energy. DOE sets federal energy policy

Down Hole Down a well

Downstream Generally refers to crude oil refining, petrochemicals, marketing and distribution

Downtime A period when equipment is unserviceable or out of operation for maintenance etc.

DP Dynamic Positioning

Draft The vertical distance between the bottom of a vessel floating in water and the waterline, expressed in feet or metres

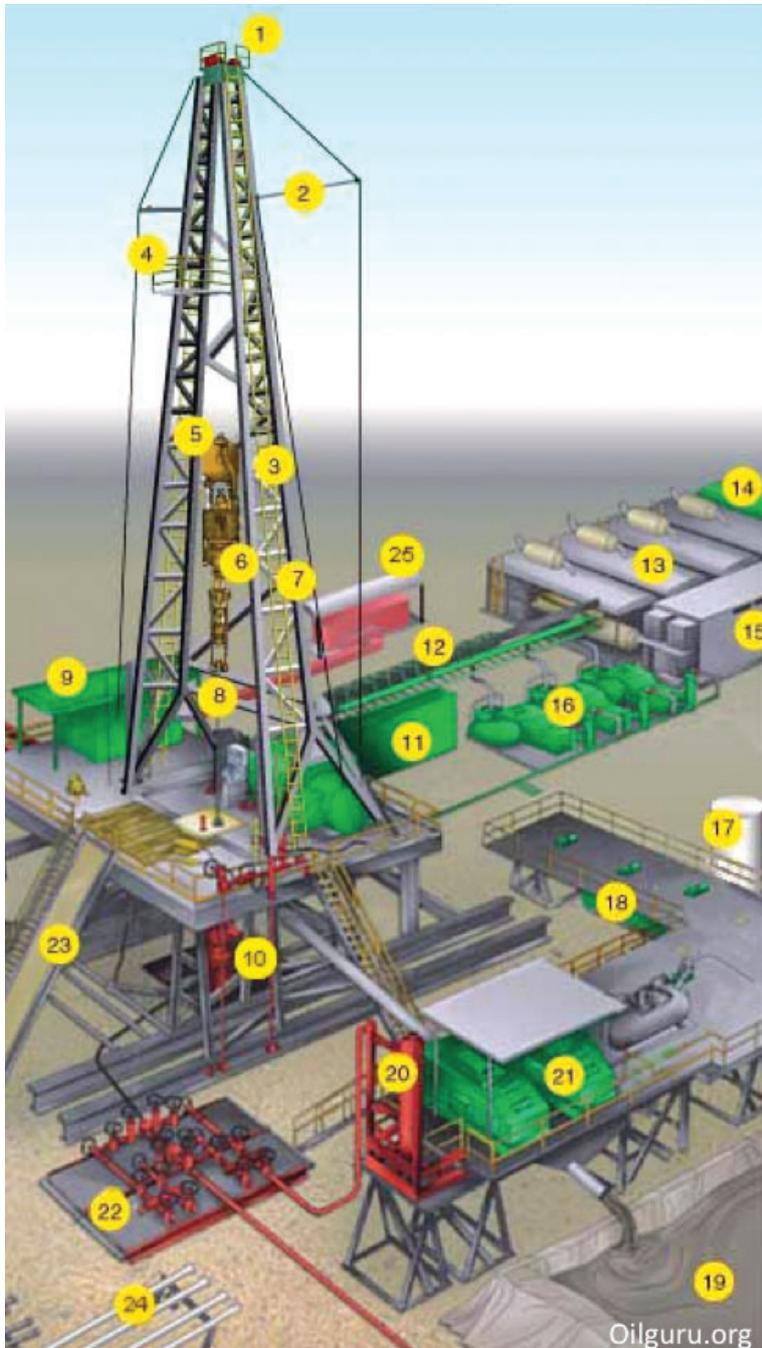
Drawdown The difference between the static and the flowing bottom hole pressures

Drawworks The hoisting mechanism in a drilling rig

Drilling fluid Circulating fluid, removes cuttings from wellbore to surface, cools the bit and counteracts downhole formation pressure. See mud

Drilling mud Specially compounded liquid circulated through the wellbore during rotary drilling operations. See mud

Drill Rig schematic and definitions



1. Crown Block
2. Catline Boom and Hoist Line
3. Drilling Line
4. Monkey board
5. Travelling Block
6. Top Drive
7. Derrick or Mast
8. Drill Pipe
9. Doghouse or drillers shack
10. Blowout Preventer
11. Water Tank
12. Electric Cable Tray
13. Engine Generator Sets
14. Fuel Tanks
15. Electrical Control Room
16. Mud Pump
17. Bulk Mud Components Storage
18. Mud Pits
19. Reserve Pits
20. Mud Gas Separator
21. Shale Shakers
22. Choke Manifold
23. Pipe Ramp
24. Pipe Racks
25. Accumulator

Drilling rig Comprises derrick, draw-works, lifting tackles and blocks, Kelly and rotary table, mud pump and mud circulation system, blowout preventer, and a system for handling drillpipe and casing

Drill pipe Heavy, seamless tubing used to rotate the drill bit and circulate the drilling fluid

Drill ship Self-propelled ship with an offshore drilling unit

Dry Gas Natural gas, methane and ethane, with small amounts of heavier hydrocarbon fractions

Dry dock an enclosed basin into which a ship is taken for repair of areas below the waterline

Dry Hole Unsuccessful well, also called a “Duster”, containing no or uncommercial quantities of hydrocarbon

DSME Daewoo Shipbuilding & Marine Engineering

DST Drill Stem Test

DSV Diving Support Vessel

Duster A dry well drilled during exploration. See dry hole

DWPA Deep Water Ports Act

DWT Dead Weight Tonnage. The number of tonnes of cargo, stores and bunkers that a ship can transport

Dynamic positioning A satellite monitoring system used to control the action of thrusters/propellers to maintain a vessel on location without deploying anchors

ECA Export Credit Agencies. A government agency whose role is to facilitate the export of goods and services by providing credits and providing credit and political risk security

EDU Electrical Distribution Unit

EFL Electrical Flying Lead

EH Electro-Hydraulic

EHDM Electro-Hydraulic Distribution Manifold

E/H MUX Electro-Hydraulic Multiplexed

9k,k,mpl Environmental Impact Assessment

EIA Environmental Impact Assessment. An assessment of the impact of an industrial installation on the surrounding environment, before any construction work is undertaken

EIS Environmental Impact Statement

EM Electric Motor

Emulsion Suspension of one liquid in another, e.g. oil in water

Enhanced oil recovery Assisted extraction of oil either by installing equipment into the production tubing or by injecting water, gas or steam into the reservoir

EMP Environmental Management Plan

EMS Environmental Management Study



Drill Ship

EPC Engineering, Procurement and Construction. A contract for the construction of LNG or other facilities

EPIC Engineering, Procurement, Installation and Construction

EPU Electric Power Unit

ERD Extended Reach Drilling

ESD Emergency Shutdown

ESP Electric Submersible Pump

ESS Expandable Sand Screen

EWT Extended Well Test

Fault A break in subsurface strata

FBHP Flowing Bottom Hole Pressure

FC Full Containment LNG tank

FEED Front End Engineering Design, early phase of field development engineering

FERC Federal Energy Regulatory Commission, the chief energy regulatory body of the US Government, responsible for regulating LNG facilities

FFD Full Field Development

Fiscal metering Measurement of oil, gas or condensate for taxation purposes

FID Final Investment Decision

Fixed installation A fixed offshore structure involved in the production of oil and gas

Flare Vent for burning off unwanted gas or hydrocarbons which due to process upsets cannot be safely retained in process vessels

Flare stack Elevated tower containing piping for the discharge and burning of waste gas

Flash drum Pressure vessel used to reduce pressure of oils and other liquids to encourage vaporisation of dissolved gases



FLNG

Flash To vaporize or “boil off” a hydrocarbon gas by reducing pressure or heating

Flash Point Lowest temperature at which a vapour will burn when ignited.

FLNG Floating Liquefied Natural Gas Facility

Floater Floating substructure for drilling or production

Flowing Bottom Hole Pressure Bottom hole pressure (reservoir) measured at a given flow rate.

Flowline Pipe from the Xmas tree through which produced fluid travels to a manifold, processing equipment or storage

Flowline Bundle A combined assembly of production flowlines, hydraulic and/or electrical control lines

Flowmeter Used to measure the rate of flow of a fluid

FOB Free on Board. Describes a sale where the buyer arranges for the shipping either owning them or chartering from a shipowner

Formation Reservoir rock

Formation Damage Reservoir damage due to plugging with mud, crumbling under pressure or high flow rate, etc.

FPF Floating Production Facility

FPP Floating Production Platform

FPS Floating Production System

FPSO Floating Production, Storage and Off-loading (vessel)



FPSO

FPDSO Floating Production, Drilling, Storage and Off-loading (vessel)

Fracturing Fracturing formation adjacent to well bore to improve well productivity (flow) by applying hydraulic pressure downhole

Free-water knockout Removing any water that is not emulsified with the oil, usually in a vessel

FRU Floating Regas Unit

FSO Floating Storage and Off-loading (vessel)

FSRU Floating Storage and Regasification Unit

FSU Floating Storage Unit

FTA Free Trade Agreement countries

FTP Flowing Tubing Pressure

FWHP Flowing Well Head Pressure

FWHT Flowing Well Head Temperature

FWKO Free Water Knock Out. See free water knockout

Gamma ray log Log of the total natural radioactivity. Shales and clays are responsible for most natural radioactivity, so the gamma ray log often is a good indicator of such rocks

Gas Cap Free gas at the top of a reservoir

Gas Cap Drive Primary production utilising the pressure and expansion of the gas cap to drive the oil to the surface

Gas Chromatography Laboratory method of separating and analysing the components of hydrocarbon mixtures. Important for defining trace components in an LNG plant

Gas Column See Oil Column/Gas Column

Gas Condensate Light hydrocarbons in gas which condense into liquid when brought to the surface

Gas Injection Gas is injected if there is no market for it, as a means of recovering condensate in certain reservoirs or until oil production is complete and then gas blowdown (production) can take place

Gas lift Process of lifting liquids from a well by injecting gas into the wellbore to reduce the density of the liquid, i.e. making it lighter

Gas/Oil Ratio (GOR) Ratio of gas to oil in reservoir, scf/bbl

GBS Gravity base structure

GC See Gas Chromatography

GCR Ratio of Gas to condensate in a reservoir, bbl/MMscf

GE General Electric. Manufacturer of Turbines and Refrigerant compression systems

Geochemical Survey Analysis of the hydrocarbon-bearing potential of an area by studying shallow cores and subsurface water for evidence of seepage or kerogens

Geology The study of the history of the earth and its rocks

Geologist Geologists in the oil and gas industry specialise in Sedimentology, Palaeontology

Geophones Sound wave receivers for onshore seismic surveys. See also Hydrophone

Geophysics Application of physics to the measurement of the earth and the study of its composition.

Geophysicist A Geophysicist in the oil and gas industry usually specialises in the interpretation of seismic survey data

Geothermal Gradient Increase of temperature with depth in the earth's crust, (Approximately 1 F°. per 70 feet).

GHG Greenhouse Gases. Defined by Kyoto Protocol as gases increasing global warming. Includes CO₂ and methane

GHV see HHV

GI Gas Injection

GIS Geographic Information System

GJ Gigajoules

GLR Gas Liquid Ratio

GOC Gas Oil Contact

GoM Gulf of Mexico

GOR Gas Oil ratio. See Gas oil ratio

GPD Gallons per day

GPH Gallons per hour

GPM Gallons per minute

Grass-Roots Development project which is built from scratch on a green field site

Gravel Pack Unconsolidated formations may require the wellbore in the producing zone to be filled with fine gravel which supports the formation and prevents sand production into the well

Gravimeter Device used to measure the variations in the gravitational field between 2 or more points

Gravity Platform/Structure Offshore platforms which rely on weight alone to keep them stable and in place

Gravity survey Exploration method measuring the intensity of the earth's gravity in order to detect geological structures

GRP Glass Reinforced Plastic

GTL Gas To Liquid technology for gas monetisation

GTT Gas Transport and Technigaz. Designer of membrane type LNG storage tanks

GWC Gas Water Contact

H₂S Hydrogen sulphide, toxic sour gas.

Hawser Heavy rope for mooring or towing

HAZAN Hazard analysis

HAZID Hazards in design analysis

HAZOP Hazard and operability analysis

Header Pipe in which several pipes feed fluid into or from

HC Hydrocarbon

HDPE High density polyethylene

Heat Exchanger Process vessel equipment which passes fluid through pipes or plates to heat or cool another fluid (without mixing)

Heat Rate a measure of power plant efficiency in converting input fuel to electricity. Usually measured in Btu of fuel required per kWh of electricity produced (Btu/kWh)

Helipad Helicopter landing deck or landing area

Henry Hub Reference hub in Louisiana used for gas futures pricing in the United States

HFO Heavy Fuel Oil

Hg chemical symbol for mercury which is a contaminant that must be removed from natural gas prior to liquefaction

HHI Hyundai Heavy Industries

HHV Higher Heating Value (also known as Gross Heating or Calorific Value)

HIPPS High Integrity Pipeline Protection System

HOA Heads of Agreement. Preliminary Agreement covering the outline terms for sale and purchase of LNG. Includes timings, volumes, durations and whether sale includes shipping

Holding Mode Period when no LNG (un)loading takes place. During the holding mode, cryogenic conditions will be maintained in the unloading line by circulating LNG to the jetty head and back to the onshore storage tanks or the sendout system via a dedicated re-circulation line

Horizon Formation at a given depth is identified by geological age, e.g. "Middle Jurassic Horizon"

Horizontal Drilling Wells drilled up to 90° from the vertical, "horizontal", to the reservoir strata in order to increase well productivity

HP High Pressure

HPHT High Pressure High Temperature

HPU Hydraulic Power Unit

HSE Health, Safety, Environment

HUC Hook-Up and Commissioning

Hydrates Ice like crystals formed of water and methane in well bores or pipelines under certain pressure and temperature conditions. Problematic in that they can cause blockages that prevent continual production

Hydrocarbons Organic compounds formed of hydrogen and carbon atoms

Hydrocyclone Separation device utilising centrifugal force to remove oil from water

Hydrofrac See Fracturing

Hydrophones Instruments used for detecting and returning sound waves in offshore seismic operations.

Hydrostatic Pressure/Head pressure exerted by a column of liquid at a given depth

Hydrostatic Testing Pressure-testing vessels and piping systems with the use of water to a specified pressure

IAC Inlet Air Cooling

ID Internal Diameter

IEA International Energy Agency

IGC International Gas Code

Igneous rock Rock mass formed by solidification of molten material into/onto the earth's crust e.g. Granite

IHI Ishikawajima Heavy Industries. Japanese company with LNG shipbuilding and SPB containment system license

Impermeable Rock that will not allow hydrocarbons to flow through it

IMO International Maritime Organisation. Responsible for developing codes for ship transportation of LNG

Impoundment Spill control for tank content designed to limit the liquid travel in case of release. May also refer to spill control for LNG piping or transfer operations

Inert Gas Chemically unreactive gas, e.g. nitrogen. Often used for purging of vessels and tanks

Infill Drilling Production wells drilled between existing wells to increase recovery of hydrocarbons.

Injection Well Well through which water/gas is injected to maintain pressure and improve 'sweep' recovery of reserves. Or for the return of gas to the reservoir if it has no market

Injector See injection well

In Place Total hydrocarbon content of a reservoir, as distinct from 'Reserves' which can be 'recovered' or produced

Instrument/Intelligent Pig Pipeline pig fitted with monitoring/gauging devices to check pipe integrity, wall thickness and or damage

IOC International Oil Company

IP Institute of Petroleum

IPE International Petroleum Exchange

IPP Independent Power Producer. An IPP generates power that is purchased by an electricity utility at wholesale prices



Jack-Up Drilling Rig

IR Injection Rate

IRR Internal Rate of Return

ISO International Standards Organisation

ITT Invitation To Tender

Jacket Steel framework supporting platform topsides

Jack-Up Rig Drilling rigs/barges which once floated to location raise their legs clear of the water by 'jacking' themselves up

JCC Japanese Crude Cocktail - price used as a reference for LNG pricing in Asia

JIP Joint Industry Project

JOA Joint Operating Agreement

Joint Venture A common form of risk-sharing in Oil and Gas operations, especially during exploration and production

JT Joule Thompson -Change in temperature when gas expands from a high pressure to low pressure, such as across a valve, aids in the cooling and condensation of hydrocarbon liquids from gas

J-tube Open-ended J section of pipe attached to a jacket structure or to a pipelay vessel providing a means of installation and protection for flexible flow lines and umbilicals

J-T valve Joule-Thompson valve. Throttle valve using pressure reduction of a gas stream for NGL removal. See JT

Jurassic Rock formed in the second period of the Mesozoic era, between the Triassic and the Cretaceous periods. (from the French, after the Jura mountains)

JV Joint Venture. See Joint venture

K 10³, kilo, thousand (Europe)

KBR Kellogg, Brown & Root. One of the major EPC Contractors in the LNG Industry

Kelly A long square or hexagonal steel bar with a hole drilled through the middle for a fluid path

Kerogen Organic material (originating from phytoplankton and zooplankton) from which oil or gas matures with time through burial, temperature and pressure

Kerosense Liquid mixture consisting mainly of alkane hydrocarbons with boiling points in the range 150° to 300°C, used as aircraft fuel, in domestic heaters, and as a solvent

Kitchen Term for rock rich in organic sediments and in which under the right conditions become a source of hydrocarbons

Knock-Out Drum Tank or vessel used to separate water from oil or liquids from gas

Knot Nautical miles per hour. LNG ships typically operate at speeds of 16-19 knots

KO Kick Off (deviated well)

kPa kilopascals, measure of pressure

kW Kilowatt, measure of electrical power

LAT Lowest Astronomical Tide

Lay barge Barge used in the construction and placement of underwater pipelines

Licence A right to explore for and/or produce hydrocarbons issued by a Government agency

KPI Key Performance Indicator

LDC Local (Gas) Distribution Company. A company that takes gas from a local delivery point (usually called the city gate) and distributes it to local customers

LFL Lower Flammability Limit. The lowest concentration of a substance that will burn in air, usually expressed in vol %. 5% for Natural Gas

LHV Lower Heating Value

Lifting Collection of a shipment of crude oil etc. at the point of sale

Lithification The process by which unconsolidated materials are converted into coherent solid rock, by compaction or cementation

Lithology The study of rocks

Live Oil Crude oil containing volatile gases

LLI Long Lead Item. An item with a long manufacturing and delivery time. Examples of this on an LNG plant include main exchangers, GTG's and compressor/driver sets

LMRP Lower Marine Riser Package

LNG Liquefied Natural Gas (CH₄)

LOA Overall length of ship (bow to stern)

Load Factor Usually applies to power plants and is an

indication of how close they are operating to nameplate capacity (as a % of nameplate)

Log Systematic recording of well data

LOI Letter of Intent

LPG Liquefied Petroleum Gas, essentially propane and butane

LSTK Lump Sum Turn Key. An EPC Contracting approach

LTA Long-term tolling agreement

LTS Low Temperature Separator

LTSA Liquefaction Tolling Services Agreement

LWD Logging While Drilling

M Thousand (oilfield), Roman M=1,000, M in metric and some other fields relates to million. Care must be taken to ensure that the value is understood

Magnetic survey Exploration method measuring the changing magnetic intensity in the earth to indicate the existence of hydrocarbon reservoirs

Magnetometer Instrument used to measure magnetic fields

MAOP Maximum Allowable operating pressure. The design pressure of a pipeline

MARAD US Maritime Administration

Mat/Mattress A structure placed on poorly consolidated, soft or unstable seabed as a footing for jackup rigs, flowlines and subsea equipment

Maturity Function of burial pressures/temperatures, and time determining whether source of hydrocarbons will provide oil or gas

Maximum exposure Maximum negative cash flow of a project

MBbls Thousand barrels. See M

Mcf Thousand cubic feet. See M

MCHE Main Cryogenic Heat Exchanger, where natural gas is chilled, condensed and subcooled to form LNG. Can either be of SWHE or PFHE type

MCM Manifold Control Module

Mcm/d Million cubic metres per day. See M

Md Millidarcies (unit of permeability)

MD Measured Depth (well)

MDEA Methyl Diethanolamine. An acid gas removal solvent

Measurement While Drilling (MWD) The evaluation of physical properties, pressure, temperature and wellbore trajectory in 3D while drilling

MEG Monoethylene glycol

MEGi M-type, Electronically controlled, Gas Injection engines. New fuel-efficient engines for LNG shipping

MEOH Methanol

Metamorphic rock Rock formed by mineralogical, chemical and structural alterations caused by processes within the earth's crust. Marble is a metamorphic rock

MFM Multiphase Flow Meter

Midstream Transportation to market or refinery

Migration Movement of hydrocarbons from source rock either into a reservoir or seeping to the earth's surface

Millidarcy See Darcy

Miocene Rocks formed in the fourth epoch of the Tertiary period, between the Oligocene and the Pliocene, see Tertiary

MM Million (oilfield), Roman M=1,000, MM = 1,000*1,000 = 1,000,000, M in metric and some other fields relates to million. Care must be taken to ensure that the value is understood

MMbbl/d Million barrels of oil per day

MMboe Million barrels of oil equivalent. See BOE

MMBTU Million British Thermal Units. The Btu is the standard unit of measurement for heat. A Btu is defined as the amount of energy needed to raise the temperature of one pound of water one degree Fahrenheit from 58.5 to 59.5 degrees under standard pressure of 30 inches of mercury

MMcf Million cubic feet

MMcf/d Million cubic feet per day

MMSCF Million standard cubic feet

MMSCFD Million standard cubic feet per day

MMTPA Millions of Tonnes (of LNG) per Annum. Used to measure LNG export terminal capacity

MOD See Money Of The Day

MODU Mobile Offshore Drilling Unit.

Module A self-contained, liftable package forming part of a facility, e.g. accommodation, gas treating, compression module, drilling module, etc.

MOF Material Offloading Facility. A temporary construction dock

Money of the Day Nominal or current value. This is the money, which as coins, bank notes and cheques, changes hands all over the world in exchange for goods and services. Its purchasing power will change with time

Monopod Small offshore platform, usually resting on a single conductor, usually in shallow water

Moonpool A hole in the hull of a ship through which operation can take place

Moss Rosenberg Type of LNG Containment system employing Moss Rosenberg Spheres

MR Mixed Refrigerant

MSL Mean Sea Level

MSV Multi-Service Vessel

MTD Measured Total Depth

Mud Drilling fluid, mixture of water, or oil distillate, and 'heavy' minerals such as bentonite or barites

Mudline The seabed, or bed of any body of water

Multilateral Multiple boreholes drilled from an existing single bore well

Multiphase Fluid consisting of oil, gas and or water

Multiple Completion Well perforated and completed to produce from more than one formation/zone

MW Megawatt

MWD Measurement While Drilling

N Newton (unit of force)

NACE National Association of Corrosion Engineers (USA)

Napthenics Any of a group of hydrocarbon ring compounds of the general formula, C_nH_{2n}, derivatives of cyclopentane and cyclohexane, found in certain petroleum.

Natural Depletion Reservoir production by use of its natural pressure

Natural Gas Natural Gas is primarily methane which can contain some ethane and small quantities of propane, butane, etc. which can be condensed from the natural gas (methane) and are known as Natural Gas Liquids (NGLs)

NBP National Balancing Point. An imaginary point on the UK Transco pipeline which is the 'delivery point' for natural gas futures contracts

Netback A measurement of the value of any given LNG sale at any point in the value chain. This takes the price of LNG at the end market and calculates the transportation and liquefaction costs, thus netting a price in the supply basin

Neutron log Normally synonymous with a neutron porosity log, however, the term is sometimes broadened to include an activation log. Guide to rock porosity

NFPA National Fire Protection Association

NGL Natural Gas Liquid, mixture of hydrocarbon liquids which include ethane, propane, butane and pentane condensed from natural gas

NGO Non-Government Organisation

Nodding Donkey The colloquial name for conventional onshore wellhead production beam pumps

NOC National Oil Company

Nominal Money of the day or current value. This is the money, which as coins, bank notes and cheques, changes hands all over the world in exchange for goods and services. Its purchasing power will change with time

NOX Oxides of Nitrogen

NPI Net Profit Interest

NPS Nominal Pipe Size

NPSH Net Pump Suction Head

NPV Net Present Value

Obligation Well Well required to be drilled as part of a concession agreement

OD Outside Diameter

O&G Oil and Gas

Oil and gas separator Production equipment used to separate liquid and gas components as well as water from oil

Oil Column/Gas Column The vertical distance between highest and lowest known oil or gas in a reservoir.

Oil/Water Contact The lower end of the column in a reservoir with underlying water

Oligocene Rock formed in the third epoch of the Tertiary period. See Tertiary

Open Hole An uncased section of well borehole.

Operator The company or organisation responsible for conducting operations on a concession

OPEX Operating expenditure

Organic Substances derived from living organisms, such as oil in the natural state.

ORV Open Rack Vaporizer

Outcrop The appearance of a rock formation at the surface.

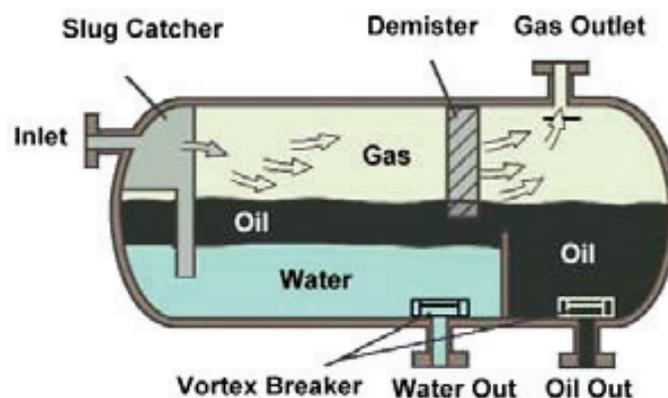
OWC Oil-water contact

P&A Plug and abandon



Beam Pump/Nodding Donkey

Oil and Gas Separator



PAR Pre-assembled Rack. Describes a piperack which has been constructed in a modular fashion to minimise on-site construction hours

Paraffin Any member of the Alkane series. See Alkanes

Passive Margin Offshore continental Plates, a tectonic boundary where two plates are moving away from each other

PAU Pre-assembled Unit. Describes a Process Unit, eg a liquefaction or gas treatment module, which has been constructed in a modular fashion to minimise on-site construction hours

Pay Zone/Horizon A formation containing producible hydrocarbons

Payback The point at which all costs of leasing, exploring, drilling and operating have been recovered from production of a well or wells as defined by contractual agreement

PCHE Printed Circuit Heat Exchanger

PDQ Production Drilling and Quarters platform, see also Production Platform/Facility

Peak Shaving Facilities at which LNG is stored during periods of low natural gas demand. When it is needed, it is warmed back to gas and shipped to end users

PERC Powered Emergency Release Couplings

Perforate Pierce casing wall and cement by using a perforating gun charged with explosives

Perforating Gun tool loaded with explosive charges which are shot into the pay zone

Perforation Holes shot through the casing in the pay zone (producing zone)

Permeability The ability of fluid to flow through a rock

Petroleum Literally 'rock oil'. A complex mixture of naturally occurring hydrocarbons found in rock

Petrochemicals Petrochemicals are chemical feedstocks and intermediates derived from petroleum

Petroleum Engineer Specialist in properties and behaviour of hydrocarbons in reservoirs and under production conditions. A geologist will provide estimates of hydrocarbons-in-place, whereas a petroleum engineer will make an estimate of how much can be produced (recoverable reserves) and under what conditions, and rate

Petrology/Petrophysics The study of rocks, their origin, chemical and physical properties and distribution

PF Productivity Factor. A comparison of the number of manhours required to carry out a specific task in a specific location. USGC has PF=1.0

PFD Process Flow Diagram

PFHE Plate Fin Heat Exchanger. Also referred to as a Braze Aluminium Heat Exchanger (BAHX). A cryogenic exchanger

Phase One of two or more fluids as in a production fluid (i.e. oil, gas or water)

PI Productivity Index

Pig Bullet-shaped, cylindrical or spherical capsules which are inserted into pipeline flow, with the primary purpose of scraping clean wax and other build-ups to prevent blockages

PIP Pipe In Pipe

Pipeline A system of connected lengths of pipe, buried or surface laid for the transportation of fluids

PJ PetaJoules. A unit of energy used in LNG projects, particularly in Australia. The petajoule (PJ) is equal to 10¹⁵ joules. 1 PJ~18,000 Te of LNG

Plate tectonics Study of the formation and movement of the "plates" of which the earth's crust is formed

Platform Immobile offshore structure from which development wells are drilled and produced

PLEM Pipeline End Manifold



Production Platform

PLET Pipeline End Termination (usually a skid or sled)

Plug/Plug and Abandon To seal a well with cement, e.g. before producing from a higher formation, sidetracking, or leaving the well permanently sealed and abandoned

POOH Pulled Out Of Hole

Polymer Combination of two or more molecules of the same kind which form a compound of differing physical properties – e.g. Polyethylene

Porosity Free space volume between rock grains capable of holding fluid, (gas or liquid), expressed as a percentage of total gross rock volume

ppm Parts per million

Present Value Also known as present discounted value, is a future amount of money that has been discounted to reflect its current value, as if it existed today

Pressure Maintenance Process of maintaining reservoir pressure during production by water/gas injection

Pressure Vessel Vessel built to hold fluids under pressure

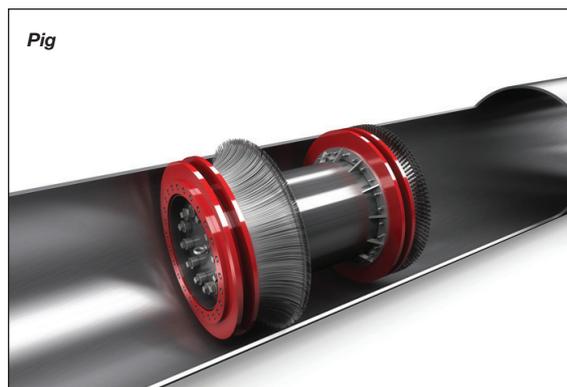
Produced water Formation water removed from the oil and gas

Production Extraction of hydrocarbon reserves

Production Casing String Innermost steel lining of a well cemented in place and perforated for production in the pay zone, note the production tubing is inserted inside this casing. (See production tubing string)

Production Plateau Period during which field is producing at its maximum production rate

Production Platform/Facility Production platforms are of varying types depending on environment (water depth etc. and reservoir needs). The production facility allows the oil and gas to be processed and exported or reinjected as required



Pig

Production Separator Main process vessel used for the separation of oil, gas and water, see also oil and gas separator

Production Sharing Contract (PSC) Contract in which part of the return to the host government is delivered as produced hydrocarbons, which is calculated after deduction of production and other agreed costs

Production Testing Production test looks at the capability to produce (productivity) of a well and its effects on the reservoir produced, this may be undertaken prior to final commitment of development expenditures etc.

Production Tubing String Pipe installed inside the production casing of a well

Productive Horizon A pay zone. See also Horizon

Productivity Index (PI) A mathematical means of expressing the ability of a reservoir to deliver fluids to the wellbore

Proppants Sand, gravel or other particles or “beads” used in hydraulic fracturing of a formation, the proppant allows fluid to flow by wedging into the fractures/cracks created by fracking

PSA Production Sharing Agreement

PSC Production Sharing Contract

psi pounds per square inch - pressure

psia pounds per square inch, absolute - pressure

psig pounds per square inch gauge - pressure

PU Polyurethane foam insulation used in some types of LNG tanks

PUQ Production Utilities Quarters, see also production platform/Facility

QC/DC Quick Connect/Disconnect coupling

QFlex A large LNG carrier commissioned by Qatargas capable of carrying approximately 210,000m³ of LNG, designed for long distance transport. In service since 2007

Qmax The largest LNG carrier type currently in use. Commissioned by Qatargas capable of carrying approximately 260,000m³ of LNG, designed for long distance transport. In service since 2008

QRA Quantitative Risk Assessment – includes calculations to assist with the identification of risks and to determine the frequency, magnitude and consequence of hazardous events

Qualitative risk assessment Assessment based on operational experience, engineering standards and judgement

RAM Reliability, Availability and Maintainability. A measure of the annual uptime of the plant, important for production guarantees

Raw Gas Natural gas prior to processing

RC Reinforced Concrete

Real (Real Terms, RT) Constant value of money (imaginary money), this was introduced to overcome the varying purchasing power of money of the day, which keeps the purchasing power the same at different moments in time

Recovery Factor The ratio between the volumes of oil and/or gas produced and producible from a reservoir and the oil and/or gas originally in place

Reef Reservoir, usually limestone which was deposited in marine conditions, usually elongated

Regasification is the process of warming LNG until liquid gas returns to a gaseous state. Carried out in marine or waterfront facilities in which LNG carriers deliver the LNG. LNG is then stored before undergoing regasification, which converts the LNG back into its gaseous form

Reservoir Subsurface porous & permeable rock body in which oil and or gas is stored

Reservoir Pressure The pressure at reservoir depth in a shut-in well

Resistivity log A log of the resistivity of the formation made by an electrode device such as a laterolog, in this sense the term is used to distinguish the log from an induction measurement, which responds more directly to conductivity

Rig Term describing the equipment needed for drilling a well, see also drilling rig

ROI Return On Investment

Rollover mixing LNG of different densities can result in rapid vapour generation at the interface in a phenomenon known as rollover

ROP Rate Of Penetration (drilling)

Rotary table Principal component of rotating, or rotary machine, which turns the drill stem and supports the drilling assembly, see also drilling rig

ROV Remotely Operated Vehicle

RPT Rapid Phase Transition. This is a phenomenon which happens when LNG is released on water and is quickly warmed up to form natural gas leading to a large white vapour plume

RV Relief Valve for Pressure Protection of Equipment, Tanks and Pressure Vessels

RVP Reid Vapour Pressure

SALM Single Anchor Leg Mooring; a compliant monopod version of the SBM tanker-loading buoy, used in deeper water



Semi Submersible Drilling Rig

Salt dome A dome that is caused by an intrusion of rock salt into overlying sediments

Satellite well Usually a single well drilled offshore to produce from the fringes of a reservoir or adjacent small reservoir

SBM Single Buoy Mooring, a single point buoy mooring for loading and unloading tankers

SBV Standby Vessel

Scf Standard cubic feet

Scf/bbl Standard cubic feet per barrel

Scf/d Standard cubic feet per day

Scf/Stb Standard cubic feet per stock tank barrel. See GOR

SCM Subsea Control Module

Scrubber Separator for removing liquids/solids from gas stream

SCS Subsea Control System

SCU Surface Control Unit

SCV Submerged Combustion Vaporizer

Scuff Standard cubic feet **SDU** Subsea Distribution Unit

Seal Impermeable fault/stratum of rock beneath or behind which hydrocarbons can accumulate. See also reservoir

Secondary recovery Production of fluids from a reservoir by water/gas injection used for pressure maintenance

Sedimentary rock Rock composed of weathered materials transported by wind or water that have undergone lithification, e.g. sandstone, shale and limestone

Seep Fault or pathway where hydrocarbon migrates to the surface/atmosphere

Seismic survey Exploration method in which strong, low-frequency sound waves are generated on the surface or in the water to find subsurface rock structures that may contain hydrocarbons

Semi-submersible Floating offshore production and/or drilling unit, which can include living quarters, storage space, etc. They can be either self-propelled or towed to a site and either anchored or dynamically positioned. Semi submersibles are more stable than drill ships and used extensively to drill wildcat wells in rough waters such as the North Sea

Separator Cylindrical vessel used to separate the components in streams of mixed fluids. See also oil and gas separator

Service contract Duration often fixed, company does not receive any of the oil produced, but gets a fixed fee per barrel, above the reimbursement of the costs it incurs

Service well See injection well

SG Also sg. Specific Gravity. For natural gas this is the ratio of its molecular weight to that of air (typ 0.6). For LNG this is the ratio of density to the density of water (typ 0.42-0.48), 420-480 kg/m³ density

Shale Fine-grained, muddy sedimentary rock with low porosity

Shale shaker Vibrating screen used to remove cuttings from the circulating fluid (mud) in rotary drilling operations

SHEQ Safety, Health, Environment and Quality

SHI Samsung Heavy Industries

Shut-in pressure The pressure in a shut-in, non-flowing well or the static pressure

Shuttle tanker Oil tanker used to transport oil from larger vessels to port

SI System Internationale (International System of Units)

Side-tracked well Well that has been re-drilled from an intermediate depth

Sidewall coring Coring samples taken from the side walls of a well bore using a special tool

SIGTTO Society of International Gas Tanker and Terminal Operators

Single point mooring system Offshore system to which stabilised oil can be routed and an export tanker can moor for the oil to be offloaded for export

Skid Steel framework used to contain equipment or mount equipment on for transport

Skimmer Equipment for removing the surface layer of oil from an oil spill, or from an effluent water separator tank.

Slop tank Tank for the temporary storage of water that is contaminated with oil

Slug A large quantity of gas or liquid in a 2-phase pipeline. **Terrain slugging**, is caused by elevation changes in the terrain or seabed. Liquid can accumulate at low points until sufficient pressure builds up and pushes it out of the low point forming a slug.

Hydrodynamic slugging is caused by gas flowing at a faster rate over the liquid phase, leading to the gas forming waves on the liquid surface, which may bridge the cross section of the pipeline, creating a blockage on the gas flow, which travels as a slug through the pipeline.

Riser-base slugging, associated with subsea pipeline risers. Liquid accumulates at the bottom of the riser until sufficient pressure builds behind it to overcome the static head. The slug of liquid is followed by a slug of gas, until sufficient liquids have accumulated at the riser base to form the next liquid slug. **Pigging slug**, is caused by pigging operations in the pipeline. The pig pushes all or most of the liquid content to the pipeline outlet, which creates a liquid slug.

Slug Catcher A vessel which provides buffer volume to accommodate the largest slug expected from the system upstream. Usually located between the outlet of a pipeline and processing equipment

SMR Single Mixed Refrigerant Liquefaction Cycle

SOLAS Safety of Life at Sea

Sonic log A type of acoustic log that displays travel time of P-waves versus depth. Sonic logs are typically recorded by pulling a tool on a wireline up the wellbore. The tool emits a sound wave that travels from the source to the formation and back to a receiver

Sour oil/gas Oil or gas with a relatively high content of sulphur compounds such as hydrogen sulphide

Source rock Sedimentary rock with organic deposits that form into hydrocarbons

SOX Oxides of Sulphur

SPA Sales and Purchase Agreement. Lays out the terms and conditions of LNG trading

SPAR A cylindrical/partially submerged offshore drilling/production platform, well adapted to deepwater

SPB IHI prismatic type B independent tank

Splash zone The part of an offshore structure that is regularly exposed alternately to atmosphere and water or spray and therefore highly prone to corrosion

SPMT Self-propelled multiwheel trailer

Spontaneous potential A log of the natural difference in electrical potential, in millivolts, between an electrode in the borehole and a fixed reference electrode on the surface. The most useful component of this difference is the electrochemical potential since it can cause a significant deflection opposite permeable beds

Spot market A public financial market in which financial instruments or commodities are traded for immediate delivery. Spot markets can operate wherever the infrastructure exists to conduct a transaction

Spread Any complete set of equipment and ancillary vessels or vehicles for a designated task e.g. diving spread

Spud To begin drilling

SRU Sulphur Recovery Unit

SRV Shuttle Regas Vessel

SSIV Subsea (safety) isolation valve

SSV Surface safety valve

SSSV Surface controlled subsurface safety valve OR Subsea safety valve

Stab To make a connection by inserting (stabbing) one device into another

Stabilised crude oil Crude oil which has had the volatile gas (at normal surface conditions) removed from it to meet commercial sale specifications. Also known as stock tank oil

Start up Production from a commissioned and tested installation

Static head Sometimes referred to as the pressure head. It denotes the static pressure in a pipe due to the height of liquid

Steam injection/flooding Used to lower the viscosity of residual/heavy oil in the reservoir and aid it in flowing to the well

STL Submerged Turret (un)Loading

STOIP Stock Tank Oil Initially In Place

STP Standard Temperature and Pressure

STS Ship to Ship transfer/offloading



SPAR Facility

Subsea blowout preventer Blowout preventer placed on the seabed for use by a floating offshore drilling rig, see also BOP

Subsea template Template placed on seabed to facilitate drilling of wells, the wells are drilled through the template and completed by mounting the subsea Xmas trees

SUDU Subsea Umbilical Distribution Unit

SUTA Subsea Umbilical Termination Assembly

SUTU Subsea Umbilical Termination Unit

SV Support Vessel

Swab Valve Subsea tree mounted valve used during workover

Sweet Pertaining to crude oil or natural gas lacking appreciable amounts of sulphur or sulphur compounds

SWHE Spiral Wound Heat Exchanger. A Cryogenic Exchanger manufactured by winding tubes onto a mandrel

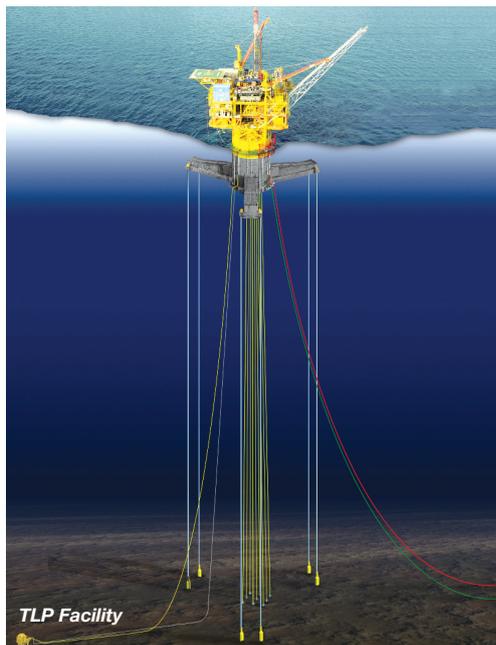
Syncline A downward, trough-shaped configuration of folded, stratified rocks. Compare with anticline

Tanker Any mobile storage unit for the bulk transport of crude oil, gas or products

Tar See Asphalt

Tariff Volume-based or tonnage-based rental charge, e.g. pipeline tariff, processing tariff

Tar sands Sands impregnated with oil in the form of asphalt or bitumen which are mined



Tcf Trillion cubic feet

TD Total Depth i.e. the drilled depth in a well at any one time

Tectonics The process of formation and evolution of the earth's solid surface crust. (See also Plate tectonics.)

TEG TriEthylene Glycol

Template Structural framework where subsea wellheads are grouped

Tension-leg platform A compliant offshore drilling or production platform which resembles a semisubmersible and is attached to the seabed with tensioned steel hawsers or tubes. The buoyancy of the platform applies tension to the hawsers or tubes

Tertiary Period or rock system divided into Palaeocene, Eocene, Oligocene, Miocene and Pliocene epochs or series

THFP Tubing Head Flowing Pressure

THP Tubing Head Pressure

Tie-in Connecting one pipeline to another or to equipment, also known as tie-back

TJ Tera Joule

TLP Tension Leg Platform

Topsides Installation on substructure consisting of the decks, accommodation and process equipment required for production, see also production Platform/Facility

Train An LNG Production Unit consisting of pre-treatment and liquefaction. Most baseload LNG plants consist of 2 or more trains that can operate independently of the others

Trap Rock strata that are arranged so that petroleum accumulates in them

Trunk lines Long distance pipelines, as distinct from field, gathering or branch lines

TSA Tolling Services Agreement

TUA Terminal Use Agreement

Tubing Small-diameter pipe that is run into a well to serve as a conduit for the flow of oil and gas to the surface

Tubing head The tubing head is installed at the wellhead on the production tubing, sealing off the annulus between the casing and the tubing, and carries the connections for production flowlines

Tubing hanger Incorporated in a tubing head (similar to a casing hanger)

Turnkey contract Fixed price contract for construction, drilling a well, etc., contractor takes on risk for non-completion

Turret moored A production turret (a cylindrical buoy) is built into a cavity similar to a moon-pool in a floating ship-shaped production facility, this is connected to the wells by flexible pipelines and then moored in place, the ship/facility is free to rotate or “weathervane” around the turret maintaining an optimum profile to wind and sea. The turret can also be externally attached

TUT Topside Umbilical Termination

TUTU Topside Umbilical Termination Unit

TVD True Vertical Depth; the vertical distance below surface datum reached by a deviated well

TVDSS True Vertical Depth Subsea

UFL Upper Flammability Limit. The highest concentration of a substance that will burn in air, usually expressed in vol %. 15% for Natural Gas

Ullage Unused/available storage in a tanker, pipeline or plant

Unconventional Currently refers to oil and gas resources whose porosity, permeability, fluid trapping mechanism, or other characteristics differ from conventional sandstone and carbonate reservoirs. Coalbed methane, gas hydrates, shale gas, fractured reservoirs, and tight gas sands are considered unconventional resources

Upstream Exploration, development and production

USG United States Gallons

USGC United States Gulf Coast Location

UTA Umbilical Termination Assembly

UTM Universal Transverse Mercator. A worldwide grid system of rectangular coordinates that uses metric (SI) units

Vapour pressure The pressure exerted by the vapour of a substance, and also the pressure required to prevent a liquid from vaporising

Vent Pipe/fitting on a vessel that can be opened to atmosphere

Vent stack Open pipe and framework for discharging vapours into the atmosphere at a safe location without combustion

VFD Variable Frequency Drive

Viscosity Property of fluids/slurries indicating their resistance to flow, defined as the ratio of shear stress to shear rate

VIV Vortex Induced Vibration

VLCC Very Large Crude Carrier

VOC Volatile Organic Compounds

Volatility Readiness with which a liquid converts to its gas state

VP Vapour Pressure

VSD Variable Speed Drive

WAAC Weighted Average Cost of Capital – is the average rate of return a company expects to compensate all its different investors. The weights are the fraction of each financing source in the company’s target capital structure

WAP Wax Appearance Point

WAT Wax Appearance Temperature

Water drive Hydrocarbon reservoir in contact with underlying water table, the formation pressure will drive the water into the rock pores vacated by produced oil, thus maintaining reservoir pressure and aiding production

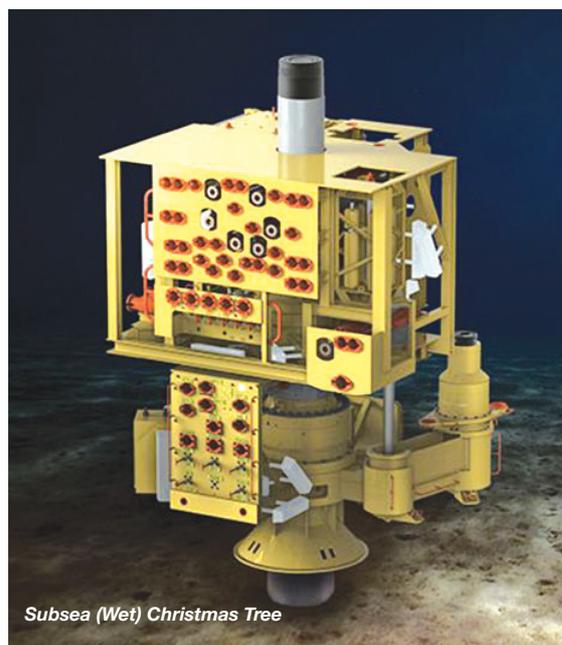
Watering out When the proportion of water in production from a well is so high that it must be shut in (up to 95%)

Water injection The injection of water in order to maintain reservoir pressure and boost production

Water re-injection Disposal of produced water into a disposal well as opposed to dumping to the environment (not for boosting the reservoir pressure)

Water saturation Proportion of water in the pore spaces of a reservoir. See Porosity

Water separation Removal of water from oil or gas,



Subsea (Wet) Christmas Tree

techniques available are e.g. settling (gravity), heating and electrostatic precipitation (especially for breaking water-oil emulsions)

Water table The level in the earth below which rock pores are saturated with water

Wax Paraffin waxes are found in crude oil, sometimes making up a significant proportion of it and require special treatment to allow the oil to flow freely at surface conditions

WBS Work Breakdown Structure. Used to define individual responsibilities by project phase and area

WD Water Depth

Weathering an increase in the density and 'richness' of stored LNG over time, as heat in-leak into the tank leads to boil-off of more volatile components such as nitrogen

Weather window Period of relatively good weather when operations can take place

Well Steel-lined boreholes drilled to search for, exploit and produce hydrocarbon reservoirs

Well completion Preparing a well for the production of oil and gas

Wellhead The "Wellhead" is descriptive of a location or function (including the Xmas tree and hang offs) rather than a specific item of equipment. Permanent equipment used to secure and seal the casings and production tubing and to provide a mounting for the Xmas tree

Wellhead platform Offshore platform designed to support only wellheads (including Xmas trees) and associated piping, production fluids are then transferred to a nearby production platform or onshore for processing

Wellhead separator The first process vessel in a production operation, operating at or near wellhead pressures

Well logging Recording of information of subsurface formations. Logging includes records kept by the driller and records of mud and cutting analyses, core analyses, drill stem tests, and electric, acoustic and radioactivity logging

Well permit Regulatory permission to drill a well

Well program The engineering design and technical/operational plan for drilling, completing and testing a well

Well testing Testing of an exploration or appraisal well to aid the estimation of reserves in communication with the well and well productivity. Testing in a production well also monitors the effects of cumulative production on the formation

Wet gas Natural hydrocarbon gas containing significant amounts of natural gas liquids

Wet tree Xmas tree installed on seabed and exposed to water, see also Christmas tree

WHRU Waste Heat Recovery Unit

WI Wobbe Index. A measure of gas heating value per unit flow of gas through an orifice

WI Water injection

Wildcat Well drilled in an area where no oil or gas production exists. With modern exploration methods and equipment, about one wildcat out of every seven proves productive, but not necessarily economic

Wireline Small-diameter metal line used in wireline operations; also called slick line. A system in which a flexible cable and reel is used to lower a log or maintenance equipment into a well, rather than a rigid drill string, offering considerable savings of equipment, manpower and time

WO Workover

Workover Maintenance job on a well to replace equipment and or stimulate production

Workover rig Usually a smaller portable version which can be used on installations which do not have a permanent rig

WOW Waiting on weather

Xmas tree See Christmas tree

Zone Interval between two depths in a well containing reservoir or other distinctive characteristics

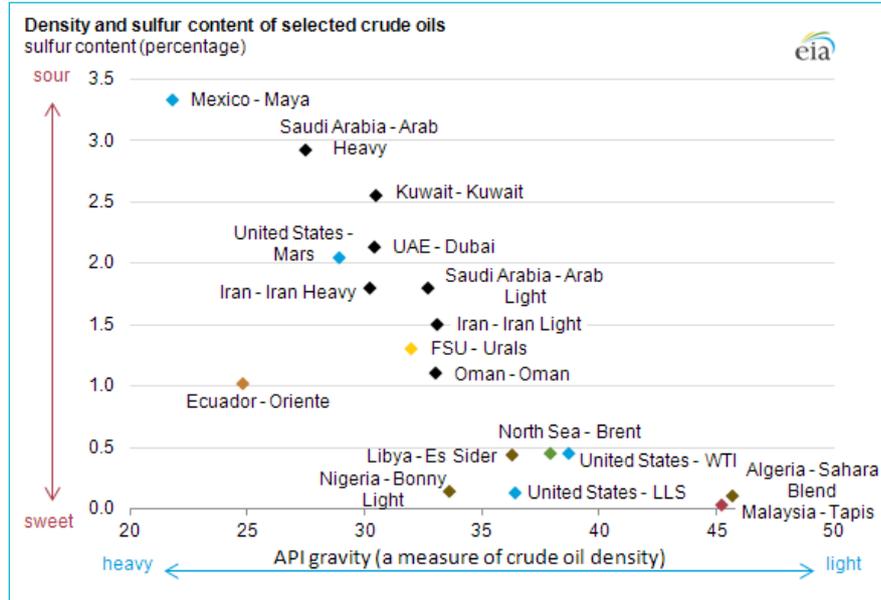
Petroleum Chemistry

Normal Paraffins (Alkanes)			Branched-Chain Paraffins (Alkenes)		
	● = Carbon Atom	Boiling point			Boiling point
CH_4	 Methane	-161°C	C_4H_{10}	 Isobutane	-12°C
C_2H_6	 Ethane	-89°C	C_6H_{14}	 2,2-Dimethylbutane	50°C
C_3H_8	 Propane	-42°C	C_6H_{14}	 2,3-Dimethylbutane	58°C
C_4H_{10}	 Butane	-0.5°C	C_6H_{14}	 2-Methylpentane	60°C
C_5H_{12}	 Pentane	36°C	C_7H_{16}	 2-Methylhexane (Isoalkane)	90°C
C_6H_{14}	 Hexane	69°C	C_7H_{16}	 3-Methylhexane (Anteisoalkane)	92°C
C_7H_{14}	 Heptane	98°C	C_8H_{18}	 2,2,4-Trimethylpentane (Iso-octane)	99°C

Petroleum Chemistry

Naphthenes (Cycloparaffins)			Aromatics		
		Boiling point			Boiling point
C_6H_{12}	 Methylcyclopentane	72°C	C_6H_6	 Benzene	80°C
C_6H_{12}	 Cyclohexane (Side View)	81°C	C_7H_8	 Toluene	111°C
C_8H_{16}	 Ethylcyclohexane	132°C	C_8H_{10}	 Paraxylene	138°C
C_9H_{18}	 1,1,3-Trimethylcyclohexane	137°C	C_9H_{12}	 Isopropylbenzene	152°C
$C_{10}H_{18}$	 Decalin Trans form	187°C	$C_{20}H_{12}$	 3,4-Benzopyrene	>500°C

Oil Categories



Crude API	Range
i Light Crude	31.1 – 45.1
ii Medium	22.3 – 20.2
iii Heavy	10.0 – 21.5
iv Extra Heavy*	0.1 – 6.5

*also referred to as bitumen

$$\text{API gravity} = \frac{141.4}{\text{SG}} - 131.5$$

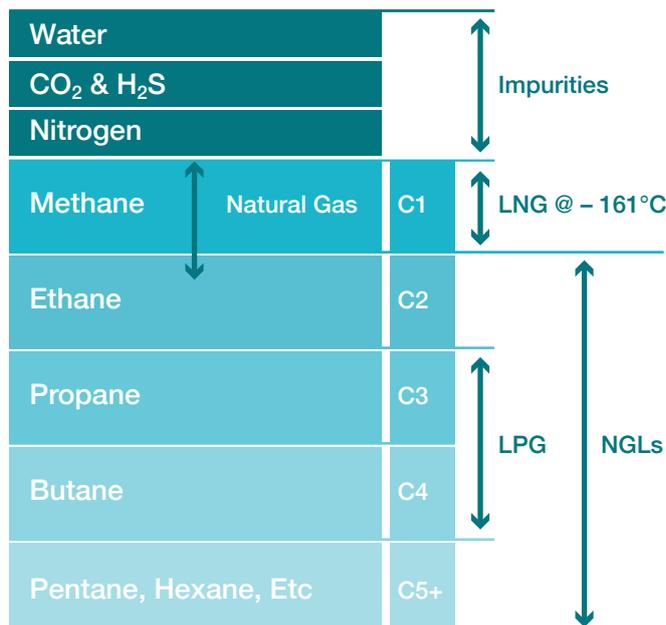
$$\text{Specific Gravity (SG)} = \frac{\text{density of oil}}{\text{density of water}}$$

Sweet Crude Contains little or no sulphur

Sour Crude Contains free sulphur, hydrogen sulphide (H₂S), or other sulphur containing compounds in amounts greater than 1%

http://estliving.com/style-hunter-juliette-arent-2/?utm_source=Est+Magazine+%7C+Subscription&utm_

Gas and Gas Condensate Categories



Sour Gas: Natural gas or any other gas that contains more than 4ppmv of hydrogen sulphide (H₂S) is commonly referred to as “sour”. This is because the odour of H₂S gas in air at very low concentrations is similar to that of rotten eggs. Sour gas can be difficult to produce due to its tendency to cause corrosion and sulphide stress corrosion cracking, particularly in pipelines.

Source: Petrowiki

A Brief History of Oil and Gas

- 40,000 BC** Natural bitumen found on stone tools from Neanderthal sites in Syria
- 5,000 BC** Ancient Egyptians use bitumen to create their mummies – mumiyyah Arabic for bitumen
- 2,000 BC** Herodotus claims that asphalt was used in the tower of Babylon with bitumen recovered from the banks of local rivers
- 600 BC** Ancient Greeks observe the “eternal fires” in Absheron peninsula (in modern Azerbaijan)
- 350 AD** Chinese use bamboo drill strings to drill oil wells up to 300 m
- 1,000** Arabic geographer, Al-Mas’udi observes oil seeps in southern Europe and the Middle East. He dubs the Absheron peninsula bilad al-naftata (the land of the naphtha fountain)
- 1,000** 15,000 inhabitants of Baku mostly involved in the extraction and export of oil. A primitive industry with hand dug wells at natural seeps collected in simple containers. Persian chemists facilitated the extraction by the technological breakthrough of distillation of the crude to separate Kerosene. Such technology was not available to Western Europe until 1,200 AD
- 1,200** Oil production in Azerbaijan reaches almost 100 bbl/day creating an export market for oil
- 1,632** Natural oil springs found in New York
- 1750s** Industrial revolution takes hold and powered by coal
- 1753** Seneca Indian trading oil seep products
- 1790** Nathaniel Carey skims oil from seeps near Titusville, Pennsylvania
- 1846** Abraham Gessner develops process to refine liquid fuel from coal, bitumen and shale – kerosene. A cleaner and cheaper alternative to whale oil
- 1848** Well drilled to 21m at Bibi-Heybat in Azerbaijan
- 1853** Ignacy Lukasiwicz invents the modern kerosene lamp, a boon for the modern oil industry
- 1855** Ignacy Lukasiwicz opens first industrial refinery in the world in Ulaszowice
- 1859** Colonel Drake drills the first oil well for George Bissell’s Rock Oil Company and strikes oil on August 27 at a depth of 21m at Oil Creek where there were natural oil seeps. This was one of the first rotary drilled wells. The phrase Creekology referring to the exploration methods of the day, basically looking for and following oil seeps in creeks
- 1861-1865** American Civil War. 1 Modern barrel of oil is equivalent to around 23,000 human energy slave hours
- 1865** Civil war is over and oil costs 59 cents per gallon
- 1870** John D Rockefeller sets up Standard Oil. Kerosene costs 26 cents per gallon
- 1873** Nobel brothers enter Baku and are in the Russian oil business
- 1877** Whaling industry is in disarray
- 1878** Thomas Edison invents the incandescent light bulb, now the oil industry is in disarray
- 1890** Royal Dutch was formed by Henri Deterding and Jean Baptist August Kessler to focus on the Dutch East Indies
- 1892** Samuel Samuels, of Shell fame, commissions the Murex, the world’s first oil tanker
- 1895** Oil is 7 cents a gallon
- 1896** First known offshore (saltwater) oil well is drilled at the end of a 300 ft wharf in Summerland, California
- 1896** Model T Ford is put into production and due to its popularity creates a new dawn in the oil industry
- 1900** In the United States there were 8,000 registered automobiles, by 1920 there were 8,500,000
- 1901** Jan 10 Spindletop drilled to a depth of 347m produces a gusher of 100,000 bpd
- 1901** William Knox D’Arcy acquires a Persian concession
- 1907** Shell Transport and Trading Company and The Royal Dutch Petroleum Company merge to create Royal Dutch Shell
- 1908** Oil discovered in Persia leading to the creation of Anglo-Persian, later to become BP
- 1911** Standard Oil ordered to be broken up into 34 smaller companies under the Sherman Antitrust Act
- 1914** Oil asserts itself for the allies and in the mechanisation of the battlefield. The shortfall in German supplies hindered their war efforts
- 1922** Venezuela - Los Barroso discovered
- 1929** Onset of the Great Depression
- 1932** Oil discovered in Bahrain
- 1932-1933** Anglo-Iranian concession cancelled
- 1933** Standard of California (SOCAL, now known as Chevron) wins concession in Saudi Arabia
- 1938** Oil discovered in Saudi Arabia and Kuwait
- 1939** World War II
- 1940** United States limits oil supplies to Japan
- 1941** United States embargo oil to Japan. Japan attacks Pearl Harbour
- 1945** WWII ends Germany and Japan basically run out of fuel
- 1951** Iranians nationalise Anglo Iranian – First post-war oil crisis
- 1956** Suez crisis – Second post-war oil crisis

- 1956** Nigeria and Algeria discover oil
- 1958** Iraqi revolution
- 1959** Groningen natural gas field discovered and developed in the Netherlands.
- 1960** OPEC is founded
- 1967** Six Day war, closes Suez Canal – Third post-war oil crisis
- 1968** Alaskan North Slope, oil is discovered
- 1968** Ba'athists seize Iraqi power
- 1969** Gaddafi seizes power in Libya
- 1969** North Sea oil discovered
- 1969** Santa Barbara oil spill
- 1973** Yom Kippur War – Fourth post-war oil crisis. Oil rises from \$2.90 to \$11.65 in 3 months.
- 1974** International Energy Agency (IEA) founded
- 1975** First oil production from North Sea fields
- 1975** Saudi, Kuwaiti and Venezuelan concessions come to an end
- 1977** Alaskan North Slope oil comes to market
- 1979** Three Mile Island nuclear plant accident
- 1979 – 1981** Iranian hostage crisis. Oil rises from \$13 to \$34 – Fifth post-war oil crisis
- 1980** Iraq goes to war with Iran
- 1982** OPEC quotas
- 1983** OPEC cuts price to \$29/bbl
- 1983** Crude oil futures floated on NYMEX
- 1986** Oil price collapse
- 1986** Chernobyl (USSR) nuclear accident
- 1988** Iraq Iran war ends
- 1988** Piper Alpha oil rig disaster, 167 oil rig workers died
- 1989** Exxon Valdez tanker oil spill
- 1990** Iraq invades Kuwait – Sixth post-war oil crisis
- 1998** Oil price \$10/bbl
- 2003** Iraq war
- 2007** Oil price \$147/bbl
- 2010** Deepwater Horizon oil spill, 11 fatalities, 16,000 miles of coastline affected and over 8,000 animals reported dead
- 2016** Oil price drops below \$30/bbl

A Brief History of Oil and Gas References

1. Penn Museum website - www.penn.museum
2. The View from the Mountain, grandemotte.wordpress.com
3. Anglopolish.com
4. Wikipedia
5. The Prize – Daniel Yergin

Useful Conversions

Volume

- Barrel of Oil (bbl) = ~42 US Gallons
- = ~ 159 litres
- = ~ 0.159 m³
- = ~ 0.136 Tonnes of oil equivalent (toe)
- = ~ 5,660 SCF natural gas

Energy

- Tonne of oil equivalent = ~ 10,000,000 Btu
- SCF natural gas = ~ 1,025 Btu

Natural Gas

- Essentially >90% Methane
- Calorific Value ~ 1,000 Btu/SCF

Conversion of Gas to Liquid Products

- 100 MMSCFD = ~ 730,000 tonnes/y of LNG
- = ~ 2,100 t/d of LNG
- 1 million tonnes LNG = ~ 2.2 million m³ LNG
- = ~ 140 MMSCFD gas

Conversion of Gas to Energy

- 100 MMSCFD = ~ 4,200 MMBtu/h

“The estimation of petroleum resource quantities involved the interpretation of volumes and values that have an inherent degree of uncertainty. These quantities are associated with development projects at various stages of design and implementation. Use of a consistent classification system enhances comparisons between projects, groups of projects, and total company portfolios according to forecast production profiles and recoveries. Such a system must consider both technical and commercial factors that impact the project's' economic feasibility, it's productive life and its related cash flows.”

Source: SPE - Petroleum Resource Management System

LNG History

1914 Godfrey L Cabot patents a river barge for handling and transporting liquid gas

1917 LNG was proven viable when the first LNG plant went into operation in West Virginia

1941 Storing concentrated energy in commercial "Peak shaving plants" in the USA (Cleveland)

1959 First LNG cargo delivered by ship. Methane Pioneer transports a cargo of 2,000 tons of natural gas from Louisiana across the Atlantic to Canvey Island on the Thames estuary

1960 Conch International Methane conducts pioneering series of experiments involving small-scale LNG spills on land at Lake Charles, LA for U.S. Bureau of Mines

1964 First baseload LNG plant (Camel) in operation in Arzew, Algeria. 1.2 MMTPA (3X0.4MMTPA Trains) using TEAL Cascade process. Steam turbine driven

1964 International LNG shipping (part of the "LNG chain") between Algeria and Europe. First purpose built LNG ships (LNG Princess and LNG Progress) built using Conch tanks

By 1969 three more trades (Algeria - France, Libya - Italy and Spain, Alaska - Japan)

1969 1.5 mmtpa export plant in Kenai, Alaska applies the three refrigerant Phillips Cascade cycle. GT-driven. First use of Aluminum Plate Fin Heat Exchangers

1970 First APCI SMR export plant built at Marsa El Brega, Libya 2*0.75MMTPA trains, using SWHE technology

1971 Kvaerner develops 88km³ Moss spherical containment system

1971 First US Import terminal established at Everett, MD. Cove Point and Elba Island terminals follow in 1978

1972 First propane-precooled mixed refrigerant cycle (APCI C3MR) constructed for Shell Brunei (5x1.1 MMTPA capacity)

1975 100 km³ LNG Carrier size exceeded with delivery of French built Ben Franklin, 120km³

1977 first Middle East project got underway with the 2 x 1.25 MMtpa train Das Island project in Abu Dhabi. Plant size increased further later that year when Indonesia joined the ranks of LNG exporting countries with the start-up of the 2 x 2 MMtpa trains in Bontang

1979 Formation of Society of International Gas Tanker and Terminal Operators (SIGTTO) to promote safe and reliable operation of gas tankers and terminals

1983 First Malaysia LNG export, MLNG Satu. This was last ever steam-turbine driven Greenfield plant, 3 x 2.1 MMTPA trains. Little other Greenfield activity in 1980's, mainly expansion of existing terminals

1991 First LNG deliveries from Australia's North West Shelf arrive in Japan and South Korea

1993 Polar Eagle and Arctic Sun, 83.5km³, with IHI prismatic containment system (SPB) begin service from Alaska to Tokyo

1995 MLNG Dua is first LNG Plant to use large Frame 7 GT drivers, leading to significant reduction in fuel consumptions and increase in train size

1999 Atlantic LNG plant in Trinidad becomes first baseload LNG plant since Kenai to use Cascade liquefaction process, adopting two trains in one approach. Further trains in Trinidad and elsewhere follow using the "Optimised Cascade" process

2000 Joint Industry Project Azure to assess feasibility of Floating LNG (FLNG)

2004 APCI SplitMR technology used for first time on RasGas Train 3. This meant same GT driver to be used for both propane and MR compressors. It allowed a LNG production capacity close to 5 mmtpa

2004 Explosions and fire destroy a portion of the LNG liquefaction plant in Skikda, Algeria, killing 27 people

2005 Excelsior Energy commission Gulf Gateway Deepwater Port, offshore Louisiana using Excelsior SRV

2007 Excelsior Energy commissions Teesside Gas Port using regas vessel with dockside connection and unloading

2007 First Q-Flex (Qatar-Flex) LNG Carrier (210km³) delivered by Hyundai Heavy Industries to QatarGas in late 2007. Includes Hamworthy BOG re-liquefaction system

2007 Statoil start up 4.4 MMTPA Snohvit LNG terminal in Melkoya Island, Norway which uses Linde's proprietary MFC refrigeration technology and Linde SWHE's

2008 First Q-Max LNG Carrier (266km³) delivered by Samsung Heavy Industries to QatarGas in 2008

2008 World's first LNG ship to FSRU conversion, Golar Spirit, a 129km³ Moss carrier, carried out by Keppel Singapore and in service for Petrobras, Pecem, Brazil

2009 World's second LNG ship to FSRU conversion, Golar Winter, a 138km³ membrane carrier, carried out by Keppel Singapore and in service for Petrobras, Guanabara Bay, Brazil

2008-2010 Start-up of 6x7.8MMTPA LNG trains for Rasgas and QatarGas, using APCI AP-X technology and Frame 9E drivers

2011 Shell sanctions Prelude development, first FLNG development, using Shell DMR process, 3.6 MMTPA, offshore Australia

Further reading

Handbook of Liquefied Natural Gas

ISBN: 978-0-12-404585-9

Saeid Mokhatab, October 2013, Elsevier

GPSA databook, 2013 Edition

An authoritative source of gas properties and other technical data.

Useful Videos

LNG – Fundamentals, including LNG Safety

<http://www.youtube.com/watch?v=2LD3jkSL8mM>

FLNG – Shell Prelude Construction Video

<http://www.youtube.com/watch?v=XOf4yDkHI50>

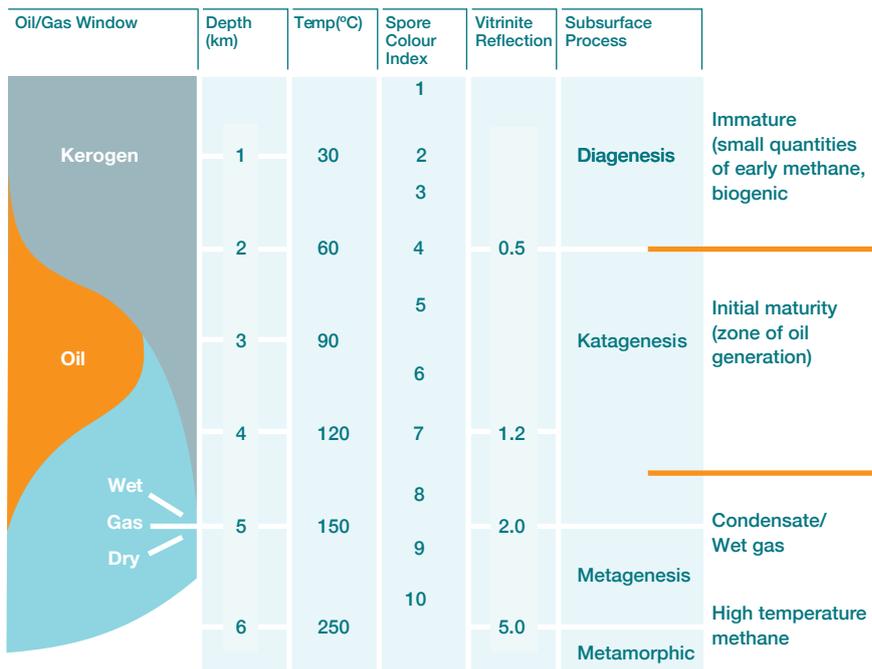
Petroleum Chemistry

Selected Energy Densities

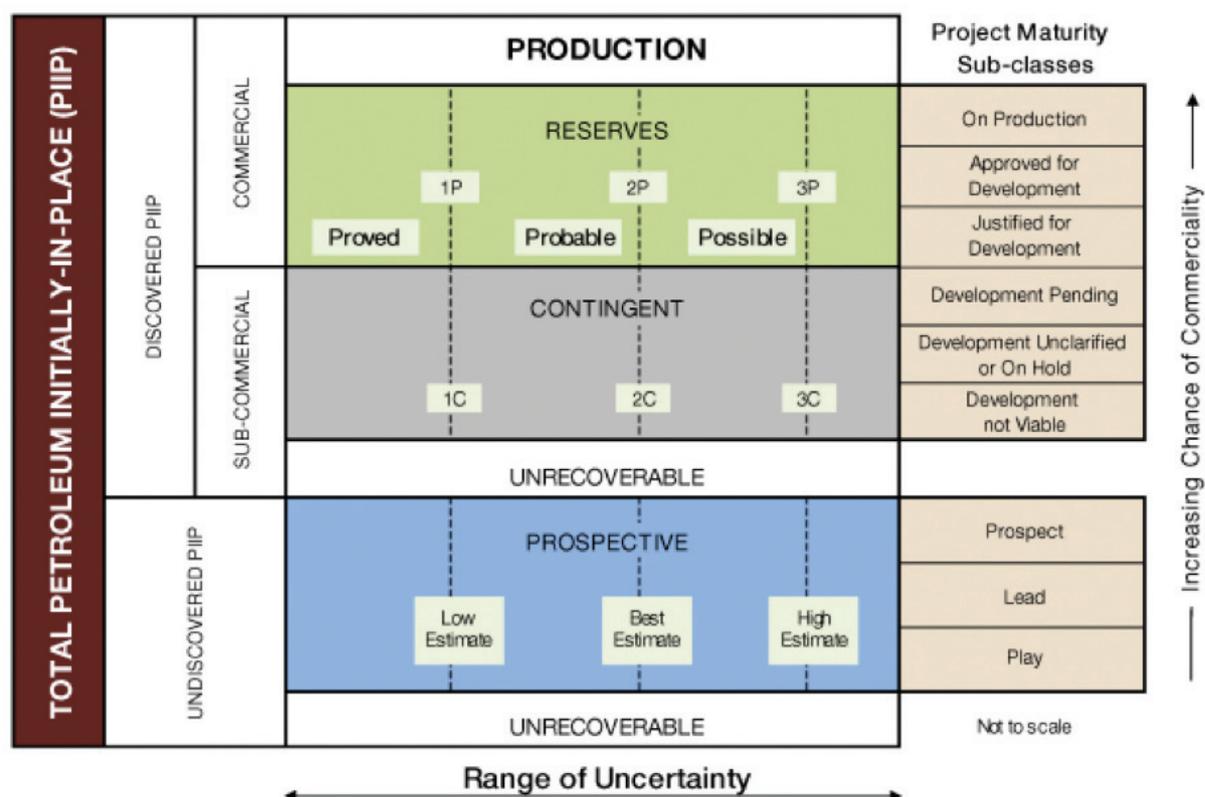


"Energy density" by Scott Dial - Own work Data Source: Energy density, Lithium-ion battery. Licensed under Public Domain via Commons https://commons.wikimedia.org/wiki/File:Energy_density.svg#/media/File:Energy_density.svg

The Oil and Gas Window



SPE Reserves Categorisation



Reserves are Like Fish Analogy

Proved Developed: The fish is in the boat. You have weighed him. You can smell him and you will eat him.

Proved Undeveloped: The fish is on your hook in the water by the boat and you are ready to net him. You can tell how big he looks (they always look bigger in the water).

Probable: There are fish in the lake. You may have caught some yesterday. You may even be able to see them, but you have not caught any today.

Possible: There is water in the lake. Someone may have told you there are fish in the lake. You have your boat on the trailer but you may go play golf instead.

However, these humorous definitions do not recognize the impact of the price of fish.



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Fundamentals of LNG and the Value Chain

Oil and Gas Overview

Upstream Familiarisation for Administration Staff

Introduction to Hydrocarbons - An overview of Oil and Gas

Introduction to Petroleum Engineering

Economics, Financial, Commercial & Accounting

A View of Where the Oil and Gas Industry is Heading

Designing a Corporate Strategy and Assessing its Effectiveness

Introduction to International Petroleum Economics

Petroleum Economics

Petroleum Economics and Risk Analysis

Decision Making in the Upstream Oil and Gas Sector

Establishing International Joint Venture and Strategic Alliances in the Oil & Gas Industry

Upstream Oil and Gas Production Forecasting and Economics

New Ventures Management

International Oil & Gas Joint Operating and Profit Sharing Agreements

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Accounting in the Oil and Gas Industry – Intermediate

Accounting in the Oil and Gas Industry – Advanced

Accounting in the International Oil and Gas Industry

Accounting Workshop

Financial Management in the Oil and Gas Industry

Financial Statements & Methods of Payment

Letter of Credit Opening Methods

Design and Implementation of Computerised Financial Systems

Accounting for Upstream Energy & Joint Ventures

Authorisation for Expenditures

Well Costing AFE Development

Budgeting Process for E & P Companies

Capital Expenditure and AFE Controls - Intermediate

Managing in the Current Oil Price Environment

Oil and Gas Contracts and Negotiations

Petroleum Project Analysis and Economics - Advanced

Risk Analysis, Prospect Evaluation and Exploration Economics

Upstream E&P Accounting Intermediate

Well Costing and Cost Control - Advanced

Costing

Upstream Oil and Gas Development Lifecycle Costing

Cost Engineering

IHS QUE\$TOR Oil and Gas Cost Analysis – IHS Specialist Course

Strategic Opex Management

Geology

Fundamentals of Stratigraphy and Sedimentology

Fundamentals of Global Tectonics

Fundamentals of Petroleum Geology (with and without Field Trips)

Basin Evaluation

Practical Techniques of Geological Modelling: A Geostatistical Approach

Advanced Structural Geology in the Field

Basic Geoscience

Basic Geodynamics

Mapping Techniques

Basic Field Geology

Clastic Sedimentology and Facies Analysis

Carbonate Sedimentology and Facies Analysis

Foredeep Migration

Basin Analysis Workshop: An Integrated Approach

Production Geology

Sequence Stratigraphy

Petroleum System Modelling

Operations Geology

Introduction to Dataset Evaluation and Regional Interpretation

Play Fairway Analysis

Prospect Generation and Risk Analysis

GIS and GPS Data Visualisation and Input

Multidisciplinary Approach in the Field - Walking along a crustal profile across the Sicily Fold and Thrust Belt

Basic Geology - Northern Apennines - Stratigraphy & Tectonics

A complex intertwining of palaeographic domains and multiple thrust belts across the Southern Apennines

Deformed Foreland Basins: Migration of Apenninic Foredeep Through Space and Time

Well Site Geology
 Applied Biostratigraphy for Petroleum Systems
 Applied Stratigraphic Concepts
 Carbonate Reservoirs
 Clastic Sedimentology
 Geodynamics and Structural Styles in Exploration
 Reservoir Characterisation
 Petroleum Exploration
 Petroleum Geology
 Petroleum Geology, Exploration, Risking and Economics
 Play Assessment and Prospect Evaluation
 Structural Geology

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Introduction to Petroleum Geophysics
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 AVO and Seismic Inversion
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 Seismic Interpretation
 Seismic Acquisition and Processing
 Seismic Interpretation - Practical
 Potential Field and SCEM applied to Hydrocarbon Exploration
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 Integrated Seismic Interpretation in the Field
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 Cased Hole Logging and Formation Evaluation
 Reflection Seismic Survey

Petrophysics

Introduction to Petrophysics
 Sedimentary Petrology
 Rock Lab - Thin Sections
 Capillarity in Rocks
 Open Hole Log Interpretation
 Special Core Analysis (SCAL)
 Formation Evaluation by Means of Log Analysis
 Well Log and Mud Log Analysis
 Mud Logging
 Basic Well Log Interpretation
 Well Log Interpretation
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 Introduction to Formation Evaluation
 Cased Hole Formation Evaluation - Advanced
 Facies Analysis and Rock Typing
 Pore Pressure and Well Control
 Log Analysis Fundamentals
 Shaly-Sand Petrophysics
 Formation Evaluation and Log Analysis
 Nuclear Magnetic Resonance Petrophysics (NMRP)
 Pore Pressure Prediction
 Integration of Petrophysics and Core Analysis

Reservoir Engineering

Basic Reservoir Engineering for Production operations Staff
 Fundamentals of Reservoir Engineering
 Reservoir Management
 Reservoir Simulation
 Reservoir Model Design
 Enhanced Oil Recovery
 Artificial Lift – Well Optimization and Diagnostics
 IOR with emulsified polymers
 EOR with gas lift
 Applied Reservoir Engineering
 Integrated Production Modelling
 PVT
 Reservoir Appraisal & Development
 Artificial Lift Methods
 Well Performance (NODAL) Analysis
 Introduction to Integrated Production Modelling,
 Unconventional Integrated Asset modelling
 Advanced Integrated Asset Modelling
 Practical Reservoir Simulation, history matching best practices
 PVT and EOS modelling workshop
 Advanced Wellbore modelling
 Effective Use of Relative Permeability Data
 Digital Field Setup & Management
 Reserves Estimation
 Field Development Planning

Field Development Planning

Field Development Planning
 Facilities Field Development Planning
 Marginal Fields' Development Strategies

Drilling & Well Engineering

Wellhead Operations
 Well Testing Operations
 Well Production Control and Management
 Well Servicing
 Directional Drilling, Horizontal and Side-tracking
 Introduction to Drilling & Completions Operations
 Drilling Fluids
 Advanced Drilling Technology
 Primary Cementing
 Fishing Operations
 Drilling Methods and Equipment
 Well Equipment (Casing, Tubing, Wellhead)
 Pumps (Rig/mud pumps, cementing units)
 Drilling Calculations
 Stuck Pipe Prevention
 Casing Cementing - Current Leading Practice and New Techniques
 Directional Drilling
 Drilling Fluids and Solids control
 Fundamentals of Well Control
 Advanced Hydraulic Fracturing
 Advanced Stimulation
 Stimulation & Sand Management
 Well Test Design & Analysis
 Hydraulic Fracturing for Shale Oil & Gas
 Hydraulic Fracture Design and Analysis with 3D Simulators
 Completions Design for FDP
 Formation Damage Prevention, Remediation, and Control
 Matrix and Fracture Acidizing
 Horizontal Well Completions and Fracturing
 Advanced Well Cementing
 Practical Well Test Interpretation
 Advanced Well Test Interpretation
 Production Logging Tools
 Asphaltene, Paraffin and Scale Control
 Coil Tubing (CTU) Operations
 Nitrogen Engineering for O&G Operations
 Advanced Sand Control
 Advanced Hydraulic Fracturing with 3D Models
 Advanced Well Completions
 Damage Control - The Neglected Part of Drilling and Operating Safely

HPHT Drilling Operations
 Offshore and Deepwater Drilling Operations
 Pore Pressure and Fracture Gradient Prediction
 Well Control and Associated Surface Equipment
 Well Stimulation: Matrix and Fracture Acidising

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 FPSO Fundamentals
 Subsea Facilities Fundamentals
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 Oil Processing
 Gas Processing
 Production Facilities - Design Engineering
 Production Facilities - Process Engineering
 Process and Project Drawings - PDFs, P&IDs and Mechanical Drawings
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 Surface Production Operations
 Plant Shutdown, Commissioning and Start-up
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 Flare, Blowdown and Pressure Relief Systems
 Heat Exchangers
 Oil and Gas Process Troubleshooting
 Xmas Tree Inspection, Maintenance and Pressure Testing
 Water Treatment and Disposal
 Chemical Injection - Oil and Gas Process
 Applied Water Technology in Oil and Gas Production
 Corrosion Management in Production/Processing Operation
 FSRU Project Development and Operation
 Gas Processing and Conditioning
 Means of Personnel Transfer
 Oil Production and Processing Facilities
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 Tanker Familiarisation

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 HSSE Basics
 Introduction to Safety Case

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 Presentation Skills
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 Introduction to the Petrochemicals Industry
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 Introduction to Condensate Fractionation Plant
 Basic Principles of Catalytic Reforming Process, Chemical Reactions and Thermodynamics
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 Catalytic Reforming Plant Design
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 Pumps - Design, Application and Operation
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Perugia 06123

Dubai, UAE
Building 5 E, Block B
Office 144
Dubai Airport Freezone

Cairo, Egypt
340 Third Sector, City Center
Five Assembly, New Cairo

Atyrau, Republic of Kazakhstan
68 Old Motorway
Atyrau 060011

Erbil, Kurdistan Region Iraq
Dream City
Villa 1115

Basra, Iraq
Safwan Road
Opposite Petrochemical
Factory Zubair

Tehran, Iran
Floor 2, Building 162
MirzaBabaei Avenue
Pounak

APAC: Asia Pacific

Melbourne, Australia
Hornby Street
Windsor 3181

Perth, Australia
Level 15
251 Adelaide Terrace

Kuala Lumpur, Malaysia
No. 1, Jalan Utarid U5/13
Section U5, 40150
Selangor

Jakarta, Indonesia
Haery 1 Building
No. 151, 4th Floor
Jelang Kemang Selatan

Bangkok, Thailand
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