

Glossary

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Accelerated depreciation—Any of a number of forms of depreciation which allow the write-off of capital investments more rapidly than straight line depreciation. Straight line depreciation consists of depreciating an equal fraction each year over the useful life of the asset. With accelerated depreciation, larger fractions are depreciated in earlier years and smaller fractions in later years.

API gravity—The standard American Petroleum Institute (API) method for specifying the density of oil:

$$\text{degrees API} = \frac{141.5}{\text{specific gravity}} - 131.5$$

Barrel—A liquid volume measure equal to 42 U.S. gallons.

Brine—Water saturated with or containing a high concentration of sodium chloride and other salts.

Btu—British thermal unit; the amount of heat needed to raise the temperature of 1 pound of water 10 F at or near 39.2° F; a measure of energy.

Capitalized cost—A cost which is capitalized is not deducted from taxable income in the year it is incurred; rather it is depreciated over the useful life of the investment.

Cash bonus leasing—The leasing system currently being used for most offshore lease sales by the U.S. Government. A fixed royalty, usually .1667, is used, and the winning bidder on each tract is the one with the highest offer of an advance cash payment (bonus) for rights to explore and develop the tract.

Centipoise—A unit of viscosity equal to 0.01 poise. A poise equals 1 dyne-second per square centimeter. The viscosity of water at 20° C is 1.005 centipoise.

Connate water—Water that was laid down and entrapped with sedimentary deposits, as distinguished from migratory waters that have flowed into deposits after they were laid down.

Constant 1976 dollars—Dollars with the purchasing power of the U.S. dollar in the year 1976. This term is used to provide a measure of comparability to project costs, revenues, rates of return, and capital requirements which might otherwise be distorted by varying estimates of the unpredictable factor of inflation or deflation in future years.

Core—A sample of material taken from a well by means of a hollow drilling bit. Cores are analyzed to determine their water and oil content, porosity, permeability, etc.

Darcy—A unit of permeability. A porous medium has a permeability of 1 darcy when a pressure of 1 atm on a sample 1 cm long and 1 sq cm in cross section will force a liquid of 1-cp viscosity through the sample at the rate of 1 cu cm/sec.

Depreciation—A deduction from the taxable income base each year to account for wear and tear and obsolescence of capital equipment.

Depreciation-double declining balance—A form of accelerated depreciation in which twice the normal straight line depreciation rate is applied each year to the remaining depreciation base.

Depreciation-unit of production—Depreciation based upon the fraction of total estimated reserves that are produced each year.

¹Sources: Energy Research and Development Administration and the National Petroleum Council, with additions.

Discounted cash flow rate of return—A particular measurement of investment profitability that accounts for costs, revenues and the time value of money.

Emulsion—A suspension of one finely divided liquid phase in another.

Enhanced oil recovery (EOR)—That recovery of oil from a petroleum reservoir resulting from application of an enhanced recovery process.

Enhanced recovery process—A known technique for recovering additional oil from a petroleum reservoir beyond that economically recoverable by conventional primary and secondary recovery methods. Three such processes are discussed in this assessment:

Thermal recovery process: Injection of steam into a petroleum reservoir or propagation of a combustion zone through a reservoir by air injection into the reservoir.

Miscible flooding process: Injection of a material into a petroleum reservoir that is miscible, or nearly so, with the oil in the reservoir. In this assessment, carbon dioxide (CO₂) is the only such material considered.

Chemical flooding process: Injection of water with added chemicals into a petroleum reservoir. In this assessment, two chemical types are considered:

- a. surfactants
- b. polymers

EOR--Enhanced oil recovery.

Evolution of technology-Presumed future improvements in EOR techniques as a result of research and experience.

Expensed cost—A cost item which is expensed is written-off (deducted from the taxable income base) in the year the cost is incurred.

Fireflooding—A synonym for in situ combustion.

Forward combustion—Air is injected and ignition is obtained at the well bore in an injection well. Continued injection of air drives the combustion front toward producing wells.

Fracture—A general term to include any kind of discontinuity in a body of rock if produced by mechanical failure, whether by shear stress or

tensile stress. Fractures include faults, shears, joints, and planes of fracture cleavage.

Injection well—A well in an oil field used for putting fluids into a reservoir.

In situ—in the reservoir, or, in place.

In situ combustion—Heating oil to increase its mobility by decreasing its viscosity. Heat is applied by igniting the oil sand or tar sand and keeping the combustion zone active by the injection of air.

Interracial tension—The contractile force of an interface between two phases.

Investment tax credit—A credit on taxes payable for capital investment. The credit is a fraction of the cost of the capital investment (currently .1) and is received for the year the investment is placed in service.

Known oil fields-Oil fields in the United States that have produced petroleum before 1976.

Lease—A part of a field belonging to one owner or owner group; an owner commonly "leases" the (mineral) rights to an operator who produces oil, and normally gas, and pays for the "lease" with part of the production (royalty). On occasion, the owner (lessor) and the operator (lessee) is the same person.

Micelle (and micellar fluid)—A molecular aggregate, generally of molecules that have an oil-seeking end and a water-seeking end. An oriented layer of such molecules on the surface of a colloidal droplet stabilizes oil-in-water or water-in-oil emulsions, making oil and water quasi-miscible.

Miscible—Refers to liquids and their ability to mix. Liquids that are not miscible separate into layers according to their specific gravity.

Miscible agents—A third substance that promotes miscibility between water and oil, such as natural gas, hydrocarbon gas enriched with LPG, or compounds that are miscible with oil and with water.

Miscible displacement—When oil is contacted with a fluid with which it is miscible, they dissolve each into the other and form a single phase. There is no interface between the fluids and hence there are no capillary forces active.

Miscible displacement recovery—The use of various solvents to increase the flow of crude oil through reservoir rock.

Mobility—A measure of the ease with which a fluid moves through reservoir rock; the ratio of rock permeability to fluid viscosity.

Monte Carlo simulation—A method for estimating the extent to which uncertainty about the input variables in a complex mathematical model produces uncertainty in the outputs of the model. The model is operated using values selected at random from estimated distributions of the likely values of each input variable. This process is repeated many times (several hundred or more), giving a large sample of output values based on a wide range of combinations of values of input variables. These calculated results are then combined to give an estimate of the mean value and range of uncertainty for each output variable.

Oil recovery—A procedure whereby petroleum is removed from a petroleum reservoir through wells. Three kinds of oil recovery are referred to in this assessment:

Primary recovery: Oil recovery utilizing only naturally occurring forces or mechanical or physical pumping methods.

Secondary recovery: Oil recovery resulting from injection of water or natural gas into a petroleum reservoir.

Enhanced recovery: See separate entry.

Oil saturation—The extent to which the voids in rock contain oil, usually expressed in percent related to total void.

Original oil-in-place (OOIP)—Petroleum existing in a reservoir before oil recovery.

Permeability—The permeability (or perviousness) of rock is its capacity for transmitting a fluid. Degree of permeability depends upon the size and shape of the pores, the size and shape of the interconnections, and the extent of the latter. The unit of permeability is the darcy.

Petroleum—A naturally occurring material (gaseous, liquid, or solid) composed mainly of chemical compounds of carbon and hydrogen.

Pilot test—An experimental test of an EOR process in a small part of a field.

Polyacrylamide—A type of polymer.

Polymer—A type of organic chemical, characterized by large molecules, that is added to water for polymer flooding.

Polysaccharide—A type of polymer.

Porosity—The fraction of the total volume of a material that is made up of empty space, or pore space. It is expressed in terms of the volume of pore space per unit volume of the material. Porosity is a measure of the material ability to absorb liquids, since it measures the empty space available to hold liquids.

Present value—The current worth of a flow of income. Income in future periods is discounted by the interest between the current period and each future period. Present value is the sum of the discounted values for all future periods as shown below:

$$PV = \sum_{t=1}^T \frac{V_t}{(1+r)^t}$$

where V_t is the income (or loss) in year t and r is the rate of interest.

Price elasticity of supply—The responsiveness of quantity supplied to changes in price. Specifically, elasticity is the percentage change in quantity divided by the percentage change in price.

Primary recovery—See oil recovery.

Rate of return—The rate of interest yielded by investments in a project. Specifically, the rate of return is the rate of interest which equates the stream of revenues and costs to zero as shown below:

$$0 = \sum_{t=1}^T \frac{V_t}{(1+i)^t}$$

where V_t is after tax value in year t and i is the rate of interest which equates the time stream of values to zero. V_t may be positive or negative—usually it will be negative in early years during investment and positive during later years.

Reserves—The amount of a mineral expected to be recovered by present day methods and under present economic conditions.

Reservoir—A discrete section of porous rock containing an accumulation of oil or gas, either separately or as a mixture.

Reservoir fluids—Fluids contained within the reservoir under conditions of reservoir pressure and temperatures; because of this fact their characteristics are different from the characteristics of the same fluids existing under normal atmospheric conditions.

Residual oil—The amount of liquid petroleum remaining in the formation at the end of a specified production process.

Resource base—Total petroleum in place which may be subjected to attempted oil recovery.

Resources—The estimated total quantity of a mineral in the ground.

Reverse combustion—in this process, the formation is ignited at the producing well and the combustion zone moves countercurrent to the injected air and reservoir fluid stream. Because the oil flows into a zone already heated, there is no tendency for it to congeal and decrease permeability.

Royalty—A share of production from a lease reserved for the mineral rights owner.

Saturation—Ratio of volume of pore fluid to pore volume, expressed as percent and usually applied to water, oil or gas separately. Sum of the saturations of each fluid in a pore volume is 100 percent.

Screen—A list of conditions that need to be met if a process is to qualify for oil recovery.

Screening process—The steps of determining if a process passes or qualifies under a screen.

Secondary recovery—see oil recovery.

Steamflooding—Steam displacement (or steam drive) follows, the same basic principle as the waterflood. Steam under pressure is fed into special injection wells, both to heat the oil in place and to drive it to producing wells.

Steam soaking—Steam is used as a stimulation medium to heat the area of the reservoir

around the well bore (also called steam stimulation, huff-and-puff, or cyclic steam injection). Steam under pressure is injected down the casing or tubing of a producing well. A typical steam injection lasts for 5 to 8 days. Following the injection period, the well is returned to production.

Sulfonates—Surfactants formed by the reaction of sulfuric acid (or sulfur trioxide) with organic molecules. The sulfonate group in its acid form is SO_3H , and the sulfur atom is linked directly to a carbon. In use, sulfonates are neutralized with bases and used in the ionic form.

Surface tension—The tension forces existing in the extreme surface film of an exposed liquid surface due to unbalanced cohesive forces within the body of the liquid.

Surfactant—A material which tends to concentrate at an interface, used to control the degree of emulsification, aggregation, dispersion, interracial tension, wetting, etc.

Sweep efficiency—The ratio of the volume of rock contacted by the displacing fluid to the total volume of rock subject to invasion by the displacing fluid.

Tertiary-Refers to a recovery process that is implemented following secondary recovery; a third recovery phase following primary recovery and secondary recovery. All tertiary recovery is enhanced recovery, but the reverse does not always hold.

Thermal recovery—See enhanced recovery process.

Ultimate recovery—The quantity of oil or gas that a well, pool, field, or property will produce. It is the total obtained or to be obtained from the beginning to final abandonment.

Viscosity—The internal resistance offered by a fluid to flow.

Waterflooding—A secondary-recovery operation in which water is injected into a petroleum reservoir to create a water drive to increase production.

Well logging—The detailed record of the rocks passed through in drilling.