

Work in Progress: Glossary to Accompany.

International Energy Markets: Understanding Pricing, Policies, and Profits.

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Glossary.

°C – degrees Celsius.

°F – degrees Fahrenheit.

100-year flood – An unusually large overflow or flood from a body of water large that is only expected to occur one in 100 years or has only a 1% chance of occurring in any year.

100-year floodplain – The area submerged under water by a 100-year flood.

2SLS – An econometric technique to estimate an equation that is part of a multi-equation system. Variables on the right hand side of the equation that are not exogenous are replaced with variables estimated using exogenous variables in the whole system.

Abatement of pollution – Cleaning up pollution.

Abatement subsidy – A payment from the government to induce firms to reduce pollution.

Absorber – Dark colored heat absorbing material used in thermal solar collectors.

Access charge - A fixed electricity tariff to cover costs not included in the price of electricity.

Achievement culture – A culture that awards status by what an individual achieves or contributes to the group.

Acid hydrolysis – A chemical process using acid to convert cellulose or starch to sugar.

Acquisition – Mineral lease, concession, or purchase that gives lawful rights to explore for and produce minerals.

Acquisition costs – Costs of mineral acquisition including direct costs such as any direct lease or land purchase as well as any indirect transaction costs including commissions, legal costs and filing fees.

Acreage: Acres of land owned or controlled by companies holding a working interest in the oil and gas operations or potential operations.

Ad valorem tax – A tax that is a percentage of the price of a good or service.

Additive cost – If costs are the same when all bundles of two goods are produced together as when they are produced separately, costs are additive. If costs are less when all bundles of two goods are produced together as when they are produced separately, costs are sub-additive.

Aerobic – A biological process needing oxygen.

Aesthetic culture – A culture that values beauty and harmony.

Affective culture – A culture that displays emotions in public.

Affiliate – An individual or legal entity, such as a corporation or partnership, that is owned or directed by another person or legal entity.

AFRA – Average freight rate assessment.

Aframax – American Freight Rate Association's term for a tanker of approximately 80,000 - 105,000 dwt, which can serve most world ports.

AGR – Advanced gas cooled reactor. A British nuclear reactor design that replaced the Magnox class. It uses graphite as a moderator and heated CO₂ is circulated to boil the steam to spin the turbines.

Alcohol – An organic compound of the hydroxyl group (OH). Its general formula is C_nH_{2n+1}OH. (e.g. methanol (C₁H₃OH), ethanol (C₂H₅OH), propanol (C₃H₇OH)).

Alkylation – A chemical process that combines shorter hydrocarbons into longer ones. High-octane gasoline can be created by reacting alkanes and alkenes.

Alpha particle – A positively-charged piece of matter from the nucleus of an atom, emitted during radioactive decay. It is a helium nuclei containing 2 protons and 2 neutrons.

Alternating current – Electric current, which changes directions. The alternation is measured in cycles per second called hertz (Hz) and is 50 - 60 Hertz in most countries.

Ambient air quality – Condition of air in a surrounding area.

American option – An option is the right to buy (call) or sell (put) an underlying asset at a given price (strike price) that expires on a specific date. An American option can be exercised any time up to expiration.

Amorphous semiconductor – A non-crystalline semiconductor material (also called thin film) deposited on the surface of photovoltaic cells. It is cheaper, less efficient, and wears out faster than a crystalline semi-conductor surface.

Amortization – Allocating the cost of intangible assets over time.

Ampere (A) or amp – Measure of electron flow or current. One amp is one coulomb per second or one amp is one volt acting against a resistance of one ohm.

Anaerobic – A biological process occurring without oxygen.

Anaerobic digestion – A biochemical process in which bacteria decompose organic material into methane and other materials in the absence of oxygen.

Analog data – Continuously measurable data as in light waves or electrical current rather than digital data of zeros and ones.

Ancillary services – Services to maintain the security and quality of the electricity grid including spinning reserves, non-spinning reserves, voltage control, and black start capability.

Angle of incidence – Angle between the surface of a solar collector and the solar radiation. New solar collector tolerate changes in incidence of +/- 15 degrees with only a small loss of power.

Annual rate of return – The annual interest rate that makes the stream of future net revenues for a project equal to zero. Also called the internal rate of return.

Anthracite – A shiny hard black coal with high carbon and low sulfur content. If it contains low volatile matter its flame provides little light.

Anticline – A geologic structure with a convex fold putting the oldest strata in the center.

API – American Petroleum Institute. (<http://www.api.org>).

API gravity – A measure of the weight of crude oil equal to $(141.5/\text{specific gravity}) - 131.5$. Specific gravity is the weight of a compound divided by the weight of water. The API gravity of water is 10. The higher is the API gravity, the lighter the oil.

Arbitrage – An investment strategy that guarantees a profit with no net investment by simultaneously buying at a lower price in one market and selling it in another market at a higher price. Such behavior helps markets allocate goods and services efficiently.

Arbitration – A method to settle contract disputes without court proceedings through a third party.

Arbitrator – A person who settles disputes between parties by collecting the facts, trying to get the parties to agree, and coming to a resolution. In binding arbitration, the disputing parties must accept the arbitrator's solution.

Arm's length transaction – A transaction between two unrelated parties in which each is acting on its own behalf independently of the other.

Array – Connected photovoltaic modules or cells that produce a single electrical current.

Ascription culture – A culture that bases status and power on characteristics or qualities often ascribed at birth such as family or tribe.

Ash – Non-combustible and inorganic components of coal with no heat value and requiring post combustion disposal.

Asian option – A more complicated option with a price based on the average price of the underlying assets over some period of time.

Ask – The price someone is asking or willing to sell a contract at. (See Bid.).

Asphalt – A solid petroleum product made of heavy long hydrocarbon molecules. It is used for roads, roofs, and water proofing. It is produced from solid natural accumulations as well as a refinery byproduct.

Asset specificity – An asset is something of value that can be used to offset liabilities on a balance sheet. It might be physical capital, human capital, cash, or property. Asset specificity measures how particular the good is to specific transactions. For example, a pipeline that can only carry gas from one gas field to a particular market is a very specific asset, whereas a general purpose truck has all sorts of alternate uses and is a very general asset. The more specific the asset, the more the owner is subject to hold-up by the other side of the market.

Associated natural gas – Gas contained in a reservoir with oil with as a gas cap or dissolved in the oil.

ASTM – American Society for Testing and Materials. It has systems to classify coal and other material.

ASY – Average sustainable yield.

At the money – When the underlying asset for an option is at the strike price of the option.

Atom – A particle of matter non-breakable by a chemical process. It has a nucleus in the center with positively charged protons and uncharged neutrons. The positive charge on the protons is balanced by the negative charge of electrons that are moving around the nucleus.

Atomic bomb – A mechanism receiving its explosive energy from the fission of heavy elements such as uranium or plutonium.

Attainment area – A geographic region where the concentration of a specific air pollutant is within the U.S. federal legal environmental standards.

Autonomous system – A PV system without grid back-up generation, although it may have storage batteries for inadequate insolation periods.

Average revenue – The money received per unit of sales equal to total revenue divided by sales. For a whole market where there is no price discrimination, the average revenue is the demand equation $P(Q)$ times sales Q divided by Q equal to $P(Q)*Q/Q$, which is $P(Q)$ the demand equation.

Average sustainable yield (ASY) – Equals the volume of timber in a tree at harvest divided by the age of the tree at harvest, also called mean average increment.

Aversch Johnson effect – A higher level of capital stock than is socially optimal resulting from rate of return regulation that only allows a return on capital and not on other inputs.

Avoided costs – The amount avoided for the incremental purchase or production of a good. In the US, utilities were required to buy incremental power from qualifying independent power facilities (QF) if the utility's avoided electricity costs were higher than the prices of the qualifying facility.

b/cd – barrels per calendar.

b/d – barrels per day.

b/sd – barrels per stream day.

Back spread – A spread is buying more than one derivative in a trading strategy. A back spread is going long (buying) more options than shorts (selling) all with the same expiration date. With a put back spread, buy at a lower strike price and sell at a higher strike price. With a call back spread, buy at a higher strike price and sell at a lower strike price.

Backfill – Restoring formerly removed coal mining overburden by refilling and grading.

Background level – The natural average amount of a substance present. It is often used as a comparison for measuring toxic substance emissions.

Backstop fuel – A higher priced fuel with high availability that we can transition to as currently cheaper fuels run out or become too expensive. Solar and other renewable energy sources are backstop fuels.

Backup electricity, backup services – Reserve power or service available to fill in for occasional demand spikes or disruptions such as the failure of generation equipment.

Backward market – A market in which the futures prices are lower than the current spot prices. A backward market typically indicates that a market has a short-run shortage or tight market. Also referred to as a market in backwardation.

BACM/BACT – Best available control measures/Best available control technology for abating pollution.

Bagasse – Cellulosic waste from sugar cane and sorghum left after juice removal, which can be burned as a biofuel.

Baghouse – A container with fabric filter bags to remove particles greater than 20 microns from furnace stack exhaust gases.

Balancing energy supply – Unscheduled energy needed to meet energy imbalances in real-time.

Ballast – A ship voyage without cargo using seawater in ballast tanks to maintain the ship's stability.

Barrel of oil equivalent – A unit of energy equal to the amount of energy contained in a barrel of crude oil. Approximately 5.78 million Btu or 1,700 kWh. A U.S. barrel used in measuring oil is a liquid measure equal to 42 gallons.

Barriers to entry – Factors that prevent other firms from entering a market. They can include cost and size advantages of existing firms, product differentiation, network effects, brand names, access to low cost reserves, and certain government regulations.

Baseload – Electricity output that is needed continuously. Often it is around 30-40% of a utility's peak load and is supplied by high efficiency conventional steam generators, nuclear, and large hydroelectric that run continuously and are designed for high efficiency.

Basis differential – The difference between the current futures price and the spot price.

Baton signals – Body movements, particularly with the hands, that give rhythm and emphasis to speech.

BAU – Business as usual.

Bayesian estimation – A methodology for estimating model parameters that combines data with knowledge of the probability distributions of the estimated parameters.

bbf – Barrel.

BCE – Before the current era or before the year one.

bcf – Billion cubic feet.

bcm – Billion cubic meters.

Bear – One who expects prices to fall.

Bear market – A weak market in which prices are falling. Thought to have been named such because a bear typically makes a downward movement with its head.

Bear spread – A spread is buying more than one derivative in a trading strategy. A bear spread is buying one option with strike price above the current spot market price and selling another one with strike price below the current spot market price. With a bear spread call, you buy and sell a call and with a bear spread put, you buy and sell a put.

Benefits of pollution – Any costs foregone by being able to pollute rather than having to abate or clean up. Benefits of pollution are then equal to the costs of abatement.

Bertrand duopoly – A market with two producers in which each has market power and maximizes profits by setting price taking the other producer's price as given. It is expected that this market will degenerate into competitive solutions with price equal to marginal cost.

Best available control technology (BACT) – The current technology that eliminates the most pollution. Some pollution laws require that firms use BACT irrespective of the costs.

Beta particle – A small particle, either a negative (electron) or positive (positron) charge, emitted by an atom during radioactive decay.

Bid – The price market participants have bid or have offered to pay.

Big bang – Currently the most popular theory to explain the development of the Universe, which is thought to have started with a hot dense singularity. Such a point of condensed matter as might occur in the center of a black hole is then thought to have generally expanded and cooled to the present day Universe.

Big crunch – Theory to predict the collapse of Universe. With enough matter in the Universe, gravity will counteract the current expansion and the Universe will eventually collapse in the Big Crunch. Alternatively without enough matter, the Universe will keep expanding until the stars burn out, contract into black holes, and all matter evaporates into protons, electrons, neutrinos, and photons.

Bilateral contract – An agreement between two parties for the purchase and the sale of energy products or services.

Bilateral governance – Governance relates to how transactions are organized. Bilateral governance is controlling transactions by long-term contracts between two transactors.

Bilateral monopoly – A market characterized by one buyer (monopsonist) buying from one seller (monopolist).

Binomial pricing model – A model in which the probability that an underlying asset will increase or decrease in a given period and the amount of change are computed from historical data and used to price options.

Bioaccumulants – Contaminants that increase in living organisms over time because they are not metabolized or excreted quickly enough.

BioC&W: Bio-combustible energy and waste.

Biochemical conversion process – A technique that requires living organisms to convert organic matter to a fuel.

Biochemical oxygen demand – (BOD) The oxygen needed for microorganisms to decompose organic matter in water. Higher pollution creates a higher BOD.

Bio-combustible energy and waste (BioC&W) – Energy from living organisms as well as industrial and municipal waste burned to generate heat or electricity.

Biodegradable – Naturally easy to decompose.

Biodiesel – A diesel fuel from the combination of organic oils with ethanol or methanol (alcohols) into ethyl or methyl ester. Sources of the oil for feedstock include soybean oil, rapeseed oil, animal fats, waste vegetable oils, and microalgae oils.

Biodiversity – A measure of the variety of biological species in a particular habitat.

Bioenergy – Renewable energy originated from living matter that is burned directly for heat, light, and electricity or converted to liquids and gases.

Biomass – Renewable solid matter derived from organic sources including trees, agricultural crops and waste, and animal wastes.

Bioremediation – Using living organisms to remove environmental pollutants.

Bituminous coal – A hard, black, combustible material formed from decomposed vegetable matter subjected to pressure, temperature, and moisture for millions of years.

Black and Scholes model – A mathematical model for valuing financial options using binomial lattices.

Blackouts – Nontrivial power loss for an extended time and place from a capacity shortage. Causes include peak loads above available capacity and equipment failure.

Blow out – Uncontrolled high pressure emissions of oil and/or gas from a well.

Blowout preventers (B-O-P) – Apparatus used to shut in a well to prevent a blow out.

BOD – Biochemical oxygen demand.

BOE – Barrels of oil equivalent. Approximately 5,800 cubic feet of natural gas equals one BOE.

Boiler – Any fuel burning device to heat water for generating steam.

Boiling-water reactor (BWR) – A light-water nuclear reactor in which water is the coolant, moderator, and boils in the core to produce steam to drive a turbine.

Bonds – A financial instrument that represents corporate or government debt governed by the payment mechanism, borrowed amount, and interest at specified future dates.

Bonus bidding – An auction with upfront payment for the right to explore for crude oil or natural gas. Economists believe that competitive bonus bidding is typically the best way for owners to acquire the rents from their petroleum resources.

BOOT – Build – own – operate – transfer.

B-O-P – Blow out preventer.

BOT – Build – operate – transfer.

Bottom ash – Non-combustible material that is left after a solid fuel has been burned.

Bottom dump unloading – Process of quickly unloading top loading coal rail cars through a bottom grate.

Bounded rationality – Making rational choices or optimizing one's objective function constrained by cognitive limits and lack of complete information.

Brainstorming – A problem solving technique where group participants shout out possible solutions, which are noted down for a specified period of time. Then, the group indicates the solution criteria, ranks the possible solutions, and picks the best.

Branded product – A refined petroleum product with the right of the purchaser to resell the product under the refiner's brand name.

Breakeven pricing – Charging a price for which revenues exactly equal all costs including opportunity cost or a normal rate of return).

BREEAM – A method for assessing and rating green energy buildings.
(<http://www.breeam.org/>).

Breeder reactor – A nuclear reactor that burns fissionable fuel such as U-238 with a byproduct of more fissionable fuel such as Pu-239.

Brent forward market – Over the counter market for buying Brent crude oil at some future date.

BRICS – An acronym for five large major emerging national economies: Brazil, Russia, India, China and South Africa.

British thermal unit (Btu) – A non-metric measure equal to the amount of energy needed to increase one pound of water one degree Fahrenheit at sea level. One Btu equals 0.252 kilocalories or 1.055 kilojoules.

Broker – An agent performing transactions for others such as buying and selling energy services.

Bronze age – The age between the stone age and the iron age when bronze was discovered and used as a basic material. It varied by region but was roughly 4000 to 1200 BC.

Brownouts – An extended voltage drop over a significant region from a power shortage or equipment failure.

BTL – biomass-to-liquids.

Btu – British thermal unit equal to 1,055 Joules.

Bulk cargo – Cargo that does not need to be packaged such as coal, ore, grain, and other commodities.

Bull – One who expects prices to rise.

Bull market – A strong market in which prices are rising. Thought have been named after a bull because it tosses its head up.

Bull spread – A spread is buying more than one derivative in a trading strategy. A bull spread is selling one option with strike price above the current spot market price and buying another one with strike price below the current spot market selling price. With a bull spread call, you buy and sell a call. With a bull spread put, you buy and sell a put.

Bunkers – Fuel oils used to fuel ships (marine) or aircraft (aviation). Marine bunkers include heavy fuel and diesel. Aviation bunkers include kerosene jet fuel.

Butane – C_4H_{10} is a gaseous hydrocarbon extracted from natural gas, or a product from an oil refinery. Sometimes abbreviated C4.

Butanol, butyl alcohol – An alcohol, $CH_3(CH_2)_3OH$ created by anaerobic fermentation.

Butterfly Spread – A spread is buying more than one derivative in a trading strategy. A butterfly spread is buying one option at a high strike price and one at a low strike price, and selling two options at an intermediate price. If the options are calls, it is called a butterfly spread. If the options are puts, it is a put butterfly spread.

Buy on close – To buy at the end of a trading session at the closing price.

Buy on open – To buy at the beginning of a trading session at the opening price.

Bypassed footage – A section of well hole that is abandoned when drilling sidetracks around it to solve a well drilling problem.

Byproduct – A valuable joint product, but of lesser value than the main product.

Byproduct recovery (uranium) – Uranium recovery in conjunction with other commodities such as copper or phosphoric acid.

C&F – Cost and freight. Selling price includes all costs as of loading plus cost of ocean freight, while seller retains ownership of goods until they are loaded on the vessel.

C.I.F – Cost, insurance and freight. Selling price includes all costs as of loading plus cost of ocean freight and insurance, while seller retains ownership of goods until they are loaded on the vessel.

C2-C5 – Alkanes (C_nH_{2n+1}) with two to five carbon atoms.

C₂H₆ – Ethane.

C₃H₈ – Propane.

C₄H₁₀ – Butane.

C₅H₁₂ – Pentane.

CAC – Central Asia-Center pipeline system. A system of gas pipelines that go from Turkmenistan through Uzbekistan and Kazakhstan to Russia.

CAFE – Corporate automotive fuel efficiency standard. A U.S. automobile efficiency standard first passed in 1975.

CAISO – California independent system operator.

Call option – A contract that gives the right, but not the obligation, to buy an underlying asset at a strike price with a fixed expiration date. There are two types of options: a European is executable only at the option expiration date while an American option is executable anytime between purchase and the option expiration date.

CalPX – California Power Exchange.

Canadian deuterium-uranium reactor (CANDU) – A reactor with heavy water or deuterium oxide (2H_2O) as a coolant and a moderator. Because deuterium (2H) can absorb more neutrons than ordinary hydrogen this reactor does not need enriched uranium to maintain a chain reaction.

Canvey LNG terminal – The first liquid natural gas terminal (LNG) on Canvey Island, United Kingdom. It received experimental shipments of LNG from Louisiana in 1954 and regular commercial shipments from Algeria starting in 1964.

Capacity constraint – The maximum amount of goods or services that a piece of equipment or a firm can safely and sustainably produce.

Capacity costs – The cost of putting in more equipment to produce an energy product or service.

Cape size – Cargo ship carrier with capacity $\geq 80,000$ dwt.

Capital expenditures (CAPEX) – Capital costs or expenditures to buy and install fixed assets that are taken on by a firm to create future benefits. CAPEX may also include expenses incurred to extend the life of a current fixed asset.

CARB – California Air Resource Board.

Carbohydrate – A chemical compound made of carbon, hydrogen, and oxygen, which include sugars, cellulose, and starches.

Carbon capture and storage (CCS) – A process to capture, transport, and trap (CO₂) so that it will not return to the atmosphere. This will most likely begin with power plants and storage in sealed underground geological formations.

Carrying costs – Costs incurred for holding inventory. Alternatively it can be the cost to hold the right to exploration after the lease acquisition but before production has begun.

Cartel – Agreement between nations or producers producing similar energy products to influence the market, such as the OPEC cartel.

Cash commodity – Physical commodity for immediate rather than future delivery.

Catalytic cracking – Heating oil or oil products under pressure in the presence of catalysts to break larger molecules into smaller molecules. It is an important refinery process for increasing the amount of gasoline produced from a barrel of oil. Often referred to as cat cracking.

Cathodic protection – Using an electric voltage to keep pipelines and other metal structures from rusting (oxidizing).

CBM – Coal bed methane.

CC – Capacity charge.

CCGT – Combined cycle gas turbine.

CCS – Carbon capture and storage.

CDD – Cooling degree days. The number of degrees above 65 degrees F for a specified period. More formally let $(T)_i$ = the average temperature as measured by the average minimum and maximum temperature on day T_i . Let D_i = the number cooling degrees for day i , where $D_i = ((T)_i - 65)$ if $(T)_i > 65$, $D_i = 0$ if $(T)_i \leq 65$. Then $CDD = \sum_{i=1}^{365} D_i$.

CDM – Clean development mechanism.

CE – The current era or since year one.

CEGB – Central Electricity Generating Board. Government generator and transmitter of electricity in England and Wales from 1957 until restructuring and privatization started in 1990.

Cell – The smallest unit of a photovoltaic panel.

Cellulose – A carbohydrate in living plants that maintains the structure of the plant cell wall.

Cenozoic – The Age of Mammals starting around 65 million years ago and continuing to the present.

Central Asia–China Gas Pipeline – Natural gas pipeline from Saman-Depe, Turkmenistan to Kazakhstan–China border at Khorghos, where it is connected to the second West–East Gas Pipeline. It is expected to be commissioned in 2014 with a capacity of 15 billion cubic meters per year.

Centrifuge–Rapidly spinning cylinders using gaseous uranium hexafluoride (UF₆) separate the fissionable U-235 isotope from more common nonfissionable U-238. The process enriches uranium to fissionable levels for use in nuclear power plants.

CEO – Chief executive officer.

Certified emission reduction (CER) – A permit to emit 1 tonne of CO₂ arising from a certified reduction in CO_{2e} from developing countries under the Clean Development Mechanism (CDM).

Cetane (C₁₆H₃₄). This clear liquid ignites well in diesel engines and diesel fuel ignitability are rated relative to cetane, which has a rating of 100. Diesel fuels typically have cetane ratings of 45 to 55.

Ceteris paribus – The technique in economics of holding all exogenous variables constant except the one under analysis.

cf – Cubic feet.

CFC – Chlorofluorocarbons. Chemicals containing carbon, hydrogen, chlorine, and fluorine used as refrigerants and industrial cleansers. They are being phased out as they damage the ozone layer of the Earth.

CFL – Compact fluorescent lamp.

cfm – Cubic feet per minute.

CFO – Chief financial officer.

CFTC – The Commodity Futures Trading Commission was established in 1974 to regulate the U.S. commodity futures industry.

CH₄ – Methane.

Chain reaction – A reaction sustained as neutrons freed from a previous reaction set off additional fission reactions until externally stopped or there is no longer enough fuel to sustain the reaction.

Change in demand – A movement in the whole demand function that occurs because of a change in a variable other than the own price.

Change in quantity demanded – A movement along the demand curve as the result of a change in the own price caused by a change in supply.

Change in quantity supplied – A movement along the supply curve as the result of a change in own price caused by a change in the demand curve.

Change in supply – A movement in the whole supply function that occurs because of a change in a variable other than the own price.

Char – Solid biomass remains from incomplete combustion. (e.g. Charcoal incompletely burned woods).

Charterer – One who hires a ship to carry their cargo or passengers.

Chemical energy – Energy produced as the result of a chemical reaction, such as burning a fossil fuel.

Chemical tanker – A vessel designed to transport specialty liquids including chemicals, lube oils, bio oils and petroleum products (also called a parcel tanker).

Chips – Small pieces of wood used for paper and paperboard production or for burning as biomass fuel.

Chlorofluorocarbon – Compounds once used as refrigerants and in aerosol sprays. They were banned in the 1990s in industrialized countries and are increasingly being banned in developing countries because of their damage to the ozone layer. They are also greenhouse gases.

CHP – Combined heat and power.

Christmas tree – A mechanism with valves placed at the top of a well to control and direct the fluids flowing out of the well.

CIA – U.S. Central Intelligence Agency. (<http://www.cia.gov>).

Clean cargo – Oil product cargoes, also called white cargoes, that have a narrower product specification requirement and lower tolerance for contamination, such as gasoline and kerosene. Pipelines and tankers may need to be cleaned when changing from one white cargo to another or from a dirty or black cargo (crude oil and heavy fuel oil) to a white cargo.

Clean coal technology – Technologies to improve the environmental effects of coal by reducing emissions of pollutants and increasing the efficiency of the combustion process.

Clean development mechanism (CDM) – A program under the Kyoto Protocol that allows for Certified Emission Reduction units (CERs) to be generated from certified projects in non-Annex I countries that reduce greenhouse gas emissions. These CERs are tradeable in emissions trading schemes.

Clearcut – Cutting an entire stand of trees for commercial purposes. Stand regeneration by requires planting the site or waiting for natural seeding from adjacent stands.

Clearinghouse – An institution that is part of an organized exchange that guarantees each transaction and matches buyers to sellers when contracts come due.

Close – The end of the trading session or the closing price.

Closing Price – The price of the last trade of the day on an organized exchange.

CO – Carbon monoxide.

CO₂ – Carbon dioxide.

Coal – Solid fossil fuel including all ranks of coal – anthracite, bituminous, subbituminous, and lignite.

Coal gasification – Chemical process for converting coal into a gaseous hydrocarbon. The coal is crushed and heated in the presence of steam and oxygen.

Coal liquefaction – Chemical process for converting coal into a liquid hydrocarbons (also called coal to liquids [CTL]). Coal can be dissolved in a solvent and upgraded to a liquid or gasified and condensed over a catalyst to produce liquids.

Coal seam – A layer of coal large enough to be commercial.

Coal washing – Settling coal in a fluid to remove rocks and soil and divide it by size and density.

Coases's Theorem on Externalities – In the absence of transaction costs and market power, private markets will arrive at an optimal allocation in the presence of market externalities no matter how property rights are originally distributed.

Coases's Theorem on Transaction Costs – The likely form of market governance to evolve is one that minimizes transaction cost.

Cogeneration – The production of electric power and heat in the same process. Waste or surplus heat from an industrial process might power an electric generator (bottoming cycle).

Alternatively waste heat from an electric generating plant might be used for industrial processes or to heat space or water (topping cycle).

Coke (petroleum) – A high carbon solid product from petroleum refinery coking processes that convert heavy products to lighter products and coke. It is burned as fuel or further cleaned for use in iron, steel, and aluminum manufacture.

Coking Coal – Low ash, low sulfur bituminous coal that can be used to make coke for iron and steel production. It is baked at high temperatures to eliminate the volatile elements. It is used as a fuel and to reduce the oxygen content in iron oxide to make pig iron.

Collectivist culture – A culture in which the group is more important than any individual member. The individual receives value from being a member of the group.

Collier – Relates to coal mining. It could be a coal miner, a person that sells coal, or a bulk cargo ship that carries coal.

Combination carrier – Ship for a variety of bulk products including liquid and dry. It is sometimes designated as OBO (oil, bulk, ore).

Combined collector – A photovoltaic producing both electricity and useful heat.

Combined heat and power (CHP) –Plants that produce heat and electricity in the same process (also called cogeneration).

Combined cycle – Generation processes organized in series or in parallel increase energy efficiency.

Combined-cycle power plant – The combination of a gas turbine and a steam turbine in an electric generation plant. The heat from the gas turbine provides the energy for the steam turbine.

Combustion – Burning or the chemical combination of the hydrogen and carbon of organic material with oxygen to produce heat, chemicals, and gases.

Combustion efficiency – Actual heat produced by combustion divided by the total heat contained in the fuel consumed.

Combustion gases – The gases that are a result of a combustion process.

Combustion turbine – See gas turbine.

Come hell and high water clause – A contract clause that binds both parties by their contractual rights and obligations, no matter what happens.

Command and control pollution policies – Policies that order reductions in pollution and sometimes even mandate the technology to be used. They differ from market based policies which offer economic incentives by increasing the economic cost of pollution or increasing the economic benefit of abatement.

Committed load – Electricity load that has been accepted for either the day ahead or hour ahead wholesale market.

Common carrier – A business that transports energy products and services, allowing equal access to all clients. This access is also called open access and third party access. In a regulated industry, common carriage may be mandated by law. Electricity and pipeline transmission services are increasingly open access as these markets are restructured.

Common pool resources (CPR) – A resource that is customarily open access to all or to a specified group of users or for which it is difficult to exclude users. Such resources are often over-used from an economic efficiency point of view.

Common stocks – Financial assets that represent equity ownership in a business. They provide voting rights, a share in dividends and capital appreciation, and a share of liquidation assets after bondholders and other creditors have been paid.

Commonwealth of Independent States (CIS) – A political federation formed in 1991 from eleven states of the former Soviet Union. It includes all former Soviet Republics except Estonia, Georgia, Latvia, and Lithuania.

Competitive fringe – In a market where only one firm has market power, the remainder of firms without market power is called the competitive fringe.

Compounded Interest – Interest paid on interest already earned. If interest is compounded annually, you receive interest on your interest payments after a year. If interest is compounded monthly, you receive interest on your interest in a month. If interest is compounded continuously, you receive interest on your interest immediately as it accrues. The value of an asset worth A dollars now after t years with annual interest rate r compounding i times a year is $A(1+r/i)^{it}$ or if interest is compounded continuously the value of A after t years is Ae^{rt} .

Concentrator – A device that tracks the sun and concentrates solar insolation onto a bank of photovoltaic cells.

Concession, oil/natural gas – A license agreement from a host country to allow a company to explore for, develop, and gain ownership of oil and gas produced. Payments for this right may include bonuses, royalties, and taxes.

Condensate (lease condensate) – The liquid recovered from natural gas in the field by lease separators.

Condor Spread – A spread is buying more than one derivative in a trading strategy. Buying one option at a low price and one at a high price and selling two options at two intermediate prices. If the options are calls, it is a condor spread with calls and if the options are puts, it is a condor spread with puts.

Confucian dynamism – A cultural trait that takes a long-run view and values tradition, thrift, and group values.

Congestion – When a facility cannot provide the market's desired flow of product or service (e.g. pipeline, power line, highway, railroad).

Conservation (energy) – Improving the efficiency of energy use, production, transmission, or distribution. You conserve energy if the same level of product or service is delivered using less energy.

Constant tax per unit – The same tax is charged on each unit sold (also called a unit tax).

Constrained optimization – Finding the choice variables in a constraint set that maximizes or minimizes an objective function.

Constraint – Something that restricts a desired activity such as a limit on a piece of equipment or facility.

Consumer surplus – The excess value a consumer obtains from a good equal to the area below the demand and above price.

Consumption per capita – Average consumption per person equal to total consumption divided by population.

Contango market – A market in which the futures price is greater than the current spot price of the underlying asset (also called a normal market).

Contestable market – Market that allows other firms to freely enter or one that has low barriers to entry.

Contingent valuation – A technique for valuing non-market goods and services, such as better health and clean water, by surveying users of these goods and services.

Continuous compounding – If interest is compounded continuously, you receive interest on your interest immediately as it accrues. Computing the value of an asset worth A dollars after t years with interest compounding continuously at rate r is Ae^{rt} .

Continuous miner – A self propelled electrical mechanical device with a cutting head, coal-gathering equipment, a conveyor, and a loading boom, It continuously cuts and loads coal onto shuttle cars or other conveyance for continuous production.

Contract – A legal agreement between parties. In futures or options markets, a contract is the trading unit and an agreement between buyers and sellers as defined by the exchange.

Contract for difference – An agreement for the purchase of electricity at a fixed price without a requirement to notify the ISO.

Contract or delivery month – The month when the futures must be offset or delivery must be arranged.

Contract-specified price – The delivery price stipulated in the contract, which can be a fixed amount or determined by a formula.

Convenience yield – The value received from holding an inventory of a product. This can be positive if the market is strong and prices are increasing, or it can be negative if the market is weak and prices are falling.

Conventional mill (uranium) – A facility for extracting uranium and any other valuable materials from uranium ore.

Conversion (uranium) – A chemical process creating uranium hexafluoride (UF₆) from uranium oxide. UF₆ further processed for enriched uranium.

Conversion efficiency (cell or module) – The electric energy produced by a photovoltaic device divided by the energy in sunlight falling on the cell (also applies to other devices).

Conveyor – A mechanical equipment for moving bulk material over relatively short distances. (e. g. From a loading dock onto a ship or a coal pile to a power plant.).

Cooperative – A legal business form owned by its members, who receive its products and services rather than profits.

Core – The central part of a nuclear reactor, which contains the fuel and moderator, where fission takes place.

Corporate tax – Taxes the government places on corporations. A corporation is a legal entity that has been granted a charter distinct from the individuals of which it is comprised. Owners of corporations have liability that is limited to their stock ownership but have to pay taxes on top of the personal income taxes of the individual owners of the corporation.

Cost for the mining industry – Includes capitalized and operating costs related to acquisitions of mineral rights, leases, or properties; costs for exploration; development, production, conversions, and transportation to market.

Cost for the oil and gas industry – Includes capital and operating costs of all activities in oil and gas operations: exploration, discover, development costs, producing, gathering, field processing, transportation, refining, and marketing of products.

Cost of carry – Is the cost of holding a commodity or asset over time and includes any costs for storage, insurance, and financing.

Cost of pollution – Any damage to living organisms and physical property as the result of pollution.

Cost shifting – Transferring costs from party to another including transfers across customer classes or across utilities.

Cost, fixed – A cost incurred that is not related to output. Fixed costs have to be paid whether the firm produces or not. Also called sunk cost if they are non-recoverable. In the long run, there are no fixed costs.

Cost, total – What someone has to pay for something. Total cost for a firm is the payment for all factors of production needed to produce its output of goods and services including a normal rate of return. Total cost for a firm equals fixed plus variable cost.

Cost, unit – The average cost to produce one unit of good. The total cost divided by the quantity produced.

Cost, variable – A cost that is related to output. If you only pay for electricity that you use to run your production line, the cost will stop if you stop production.

COT – Commitment of traders.

Coulomb (coul or C) – Unit of electric charge. The amount of charge transferred in one second by a current of one ampere (i.e. one ampere-second).

Council on Environmental Quality – (CEQ) A U.S. advisory council to the President mandated by the National Environmental Policy Act of 1969. It reviews the environmental effects of U.S. federal programs, conducts environmental studies, and advises the President on environmental issues.

Cournot Duopoly – A market with two producers, each with some market power and maximizing profits assuming that the other producer holds its quantity constant.

Covered Call – Writing or selling a call option while holding the underlying asset.

CPC – Caspian Pipeline Consortium.

CPR – Common pool resources.

CPUC – California Public Utility Commission.

Crack spread – A spread is buying more than one derivative in a trading strategy. Buying a crack spread is buying a crude oil future and selling gasoline and distillate futures to lock in a refinery margin. A common crack spread is 3-2-1, buying oil and selling gasoline and distillate in the ratio of 3-2-1, respectively.

Credit risk – The possibility that a party to a financial contract may default. For example, there is a possibility that a party buying a Brent future may fail to make payment.

Critical habitat – Environment essential for a species to survive.

Critical mass – The smallest amount of fissionable material required for a self-sustaining chain reaction.

Criticality – Self-sustaining and constant fission rate of a nuclear reactor.

Cross price elasticity – The percentage change in quantity of one good (Q) that results from the percentage change in price of another good (P_o) (often written as $(\partial Q/\partial P_o)(P_o/Q)$). If the quantity is the supply, it is a cross elasticity of supply; if the quantity is demand it is the cross price elasticity of demand. A positive cross price elasticity of demand suggests that goods are substitutes in demand, and a negative cross price elasticity of demand suggests that goods are complements in demand. A positive cross price elasticity of supply suggests that goods are complements (one is a by-product of the other or they are produced together). A negative cross price elasticity of supply suggests that goods are substitutes in supply.

Cross subsidization – Charging a higher price in one market to be able to subsidize or charge a lower price in another market. For example, in some electricity markets, business customers subsidize the residential market.

Crude assay – An analysis of crude oil to determine its component parts. It typically includes API gravity, percent sulfur, percent nitrogen, pour point, and the percentages of various products defined by their boiling points, along with other information.

Crude oil – An unrefined mixture of liquid hydrocarbons at atmospheric pressure produced from underground formations through wells.

CTL – Coal to liquids.

Culture – Shared attitudes, values, and customary ways of doing things for a group.

Cumulative effects – The sum of environmental effects added up over time.

Cumulative production – The sum of production over time.

Current – A flow of electrons through a wire or appliance measured in amps. One amp is a flow of 6.241×10^{18} electrons (one coulomb) per second.

Curtailed demand – Load that can be legally interrupted to manage utility load during real-time dispatch.

Cutoff grade – The lowest grade of a mineral that can be mined at specified costs. (e.g. For uranium it would be determined by percent U_3O_8 and thickness of the ore body.)

Cycle life – Number of charge-discharge cycles for a battery after which it no longer meets required operating standards.

Cyclone separator – An apparatus that removes particulate matter from exhaust gases.

Dam – A barrier constructed across a waterway to control the water flow rate or water level.

Dated Brent (also called 21 day Brent) – Brent crude oil that has been purchased forward with a specific loading date, usually within 21 days. Such Brent is considered to be on the spot market and its price is used as a benchmark in numerous oil contracts worldwide.

Day order – An order to be executed during a single trading day or else cancelled if unexecutable.

Day trading – Opening and closing positions in one trading sessions with no open positions at market close.

Day-ahead market – The forward market for electricity with at least 24 hours for delivery.

DC to DC converter – Electronic circuit that converts DC electricity voltages.

DCF – Discounted cash flow alternatively called net present value (NPV).

DD&A – Depreciation, depletion, and amortization.

Dead weight tonness (dwt) – Ship carrying capacity in metric tonnes including cargo, fuel, and provisions.

Deadweight loss – The social optimum in a market is the amount of output that maximizes social welfare (total social benefits minus total social costs). If a market is producing at a sub-optimal output because of market failures such as monopoly power, externalities, or market-distorting government policies (taxes, subsidies, and price controls), the deadweight loss is the difference between social welfare at the optimum and social welfare at the sub-optimum. Deadweight loss is also called social loss.

Deaeration – Extracting gas from a liquid.

Decay – The emission of alpha or beta particles or gamma radiation from the nucleus of an atom. Such decay reduces radioactivity in a substance.

Decibels – (dBa) A scale to measure sound levels.

Decline rate – The percentage decrease in production each period. Production with a constant decline rate can be represented by $Q_t = Q_0 e^{-at}$, where Q_t is production in period t , Q_0 is initial production, and a is the decline rate.

Decommissioning – Permanent shutdown of an industrial operation in a safe and systematic manner.

Decoupling – Breaking a tie between two objects or activities. (E.g. Decoupling the link between a public utilities energy sales and revenues to spur utility investment in conservation.

Deep discharge – Discharging a battery to less than 20 % of a full charge.

Deep in/Out of the money – When the spot price for an underlying asset is way below the strike price for a put, the option is worth a lot and is deep in the money. When the spot price is way above the strike price for a put, the put is deep out of the money. When the spot price for an underlying asset is way above the strike price for a call, the call option is worth a lot and is deep in the money. When the spot price is way below the strike price for a call, the call is deep out of the money. The spot price is equal to the strike price, the option is said to be at the money.

Deepest total depth – Distance from the wellhead to bottom of the wellbore.

Deepwater Horizon – The deepwater semi-submersible drilling rig involved in the 2010 blow-out in the U.S. Gulf of Mexico.

Deferred taxes – Taxes accrued but payable at a later date.

Degree Celsius (°C) – A metric measure of temperature. At sea level, water freezes at 0 °C and boils at 100 °C.

Degree Fahrenheit (°F) – A non-metric measure of temperature equal to 5/9 °Celsius. At sea level, water freezes at 32 °F and boils at 212 °F. To convert a temperature from °C to °F, use the formula $°F = 32 + 9/5°C$.

Degree Kelvin – A metric measure of temperature. A degree Kelvin equals a degree Celsius. Zero degrees Kelvin is absolute zero, the temperature at which all molecular activity ceases. Zero degrees Kelvin equals -273 degrees Celsius.

DEIS –Draft environmental impact statement.

Delay rental – Annual payment to lessee (granter of the lease) before oil or gas production.

Delivery – The handover of an actual commodity for settlement of a futures contract. Very few derivative contracts are settled by delivery.

Demand-side management (DSM) – Programs electric utilities use to manage the demand for power, often in the form of peak load reduction to avoid having to put in new capacity. Examples include peak load pricing and subsidizing energy efficient appliances.

Demurrage – A fee paid to the ship owner by the charterer if loading/discharging is not completed within the contracted period.

Denature – Adding a poisonous substance to ethyl alcohol to make it undrinkable.

Densification – Mechanically compressing biomass, such as wood waste, into pellets, briquettes, or other forms.

Depletable – Something that is finite, does not regenerate and can be used up. Fossil fuels are depletable, whereas wood plantations, if properly managed, are renewable.

Depleted uranium – Uranium waste from the enrichment process with less than 0.7% of U-235 (natural rate). Reactor fuel can be created by blending it with highly-enriched weapons grade uranium.

Depreciation – Allocating tangible asset costs to when they are used for accounting purposes. For tax purposes, it is the amount of asset costs deductible according to the tax code.

Deregulation – Removing government regulations.

Deuterium – A hydrogen isotope with one proton and an added neutron. This heavy hydrogen is relatively rare with a natural ratio of deuterium to normal hydrogen at 1 to 6500 atoms.

Development – Preparing an energy deposit (e.g. oil and natural gas) for commercial production. It requires access to the deposit along with the legal right and facilities to produce and sell the production.

Development costs – Costs incurred for development including access rights, by ownership or lease purchase, depreciation on equipment installed and any waste disposal costs.

Diesel engine – An ignition piston engine in which fuel is ignited by compressing the fuel while injecting hot air, unlike gasoline, which is ignited by a spark.

Diffuse culture – A culture in which individuals' public spaces are small but private spaces are larger and not compartmentalized. It is harder to enter someone's public space in a diffuse culture because it allows easier entrance into her private space. It is the opposite of a specific culture where individuals have an easily entered public space that is quite compartmentalized from their private space.

Diffuse insolation – Sunlight hitting a collector indirectly after being scattered by clouds, fog, haze, dust, or other matter in the atmosphere. Opposite of direct insolation.

Digester – An airtight container or space where bacteria breakdown biomass in water to produce biogas.

Digital information – Information that is stored and transferred as the digits zero and one.

Dioxin – A family of chemical compounds that result from combustion of carbon materials. Some are dangerous with the most toxic being 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin.

Direct access – Allows a generator to sell power directly to a buyer.

Direct current – Direct current or DC electricity is the continuous movement of electrons from an area of negative (–) charges to an area of positive (+) charges through a conducting material.

Direct insolation – Sunlight directly hitting a collector without being scattered or reflected off of other objects. Opposite of diffuse insolation.

Direct tax – A tax on a person or other legal entity, as opposed to an indirect tax on goods and services such as a sales tax.

Directional drilling – Drilling wells that are deviated from the vertical to expose more hydrocarbons to the well bore and increase the potentially recoverable reserves.

Dirty cargoes – Ship cargoes that leave residues in a tanker, which must be cleaned before a clean cargo can be transported. Residual fuel oil and crude oil are dirty cargoes.

Dirty tricks in negotiating – Unethical behavior intended to gain the upper hand in a negotiation. They include limited agendas, bait and switch, delaying tactics, escalating demands, zone defense, low-ball gambit, high-ball gambit, good cop/bad cop routine, verbal and nonverbal attacks, guilt trip, take it or leave it, and renegeing on an agreement.

Discharge rate – The rate at which electrical current is used from a battery.

Discharged fuel – Waste nuclear taken from a reactor during refueling (also called spent fuel).

Discount rate – The interest rate for converting or discounting future cash values to present values.

Discounted cash flow (DCF) – The present value of future flows of income. To compute discounted cash flow, discount each future income back to the present and add up the present values of receipts and subtract the present values of outlays.

Discounting – A method of converting future dollars into present values, accounting for interest costs or forgone investment income. Used to convert a future payment into a value that is equivalent to a payment now.

Dispatch – Controlling production and distribution in an energy system. For example, electricity dispatch would include deciding which generating units produce when, along with scheduling transmission and other electricity transactions.

Dispatching – Order which indicates when a generating plant will be required to supply electricity to the system.

Distillate – Petroleum products in the mid-point boiling range including kerosene, heating oil, and diesel fuel. The boiling range is around 350 – 662 °Fahrenheit or 175 – 350 °Celsius.

Distillation – Heating crude oil in a tall column to separate out products with different boiling ranges. At the top of the column, the gases are taken off, while heavier products with higher boiling points are taken off lower down.

Distribution – Moving a product from the transmission network to the end consumer. (e.g. electricity, natural gas, oil products).

Distribution pipelines – Smaller pipelines that distribute gas locally to smaller customers.

Distribution power lines – Power lines and accessories that carry power from the transmission network to the end-use consumers.

Distributive networks – A network is a system of interconnected channels. Distributive networks, such as a pipeline system or the Internet, moves goods, services, and information to final customers.

District heating or cooling – A central system that produces and distributes hot water, steam, or chilled water to heat or cool buildings.

Diversity – The variety of different plants and animals within an area or ecosystem.

Dividends – The profits paid out to owners of a corporation.

DOD (Depth of discharge) – Percent of discharge in a battery or system. It is 1 minus the percent of charge left (state of charge (SOC)).

Dominance submissions signs – Signals, often body language, which indicate which group members are dominant and which are submissive.

Dominant firm – A firm in an industry that has more market power, while the other firms may be competitive.

Double dividend – A tax policy that corrects two market inefficiencies. (e.g. reducing taxes on labor where they cause distortion and increasing taxes on energy to offset negative externalities).

Double screened coal – A process to size coal for minimum and maximum dimensions by passing coal through one screen and over another screen.

Double-sided market – Both sides of the market are bidding.

Downside risk – In finance, risk is the variability of investment returns. Downside risk is the probability and size of negative returns on an investment.

Draft environmental impact statement (DEIS) – A draft statement of environmental effects of a proposed federal activity required by the U.S. National Environmental Policy Act (NEPA). It must be made publically available for comment and review.

Dragline – A large piece of equipment to remove overburden in strip mining coal.

Dried Coal – Coal with moisture removed to improve combustion properties, for easier handling in cold weather, and to reduce transport weight. It can be air dried or in the case of metallurgical coals hot gases may be circulated in and around the coal.

Drilling – Boring a hole in the ground to look for (**exploratory wells**), produce (**development wells**) fossil fuels, or inject fluids (**injection wells**) to increase well pressure and production.

Drilling, directional – Drilling that deliberately and significantly divert from the vertical.

Drilling, exploratory – Wells drilled to search for mineral deposits or to learn more about underground geological structures.

Dry cargo carrier – A ship carrying a non-liquid bulk cargo.

Dry docking – Taking ship out of the water and into a dry dock for inspection, repair, painting and maintenance usually done in one to two year cycles.

Dry natural gas – Natural gas that does not contain any water or natural gas liquids, such as propane, butane, or natural gasoline.

Dry ton – 2,000 pounds of material dried to a constant weight.

Dry-hole charge – Expensing of a previously capitalized cost when drilling has not found a commercial grade of hydrocarbons.

DSM – Demand side management.

Duopoly – A market with two producers selling to competitive buyers.

Duopsony – A market in which there are two buyers buying from a competitive market.

Dutch auction – An auction in which the price is successively lowered until a buyer bids. The first bidder will be the high bidder and wins the bid.

Dutch disease – The economic phenomenon that occurs when a natural resource exporting country's exchange rate increases making non-resource sectors less competitive on world markets.

DWCC – Deadweight cargo capacity.

DWT (deadweight tonne) - a ship's carrying capacity including bunker oil, fresh water, crew and provisions. Expressed in metric tonnes (1,000 kilos), it is the most common commercial measure of ship capacity.

EBRD – European Bank for Reconstruction and Development.

ECNZ – Electricity Corporation of New Zealand.

Ecology – The branch of biology that studies the interrelationships between living organisms and their environment.

Econometric models – Economic models that have been estimated by fitting functions to real world data.

Economic culture – Culture that values wealth and satisfying economic needs.

Economic cycle – The natural fluctuation of the economy between periods of expansion (growth) and contraction (recession).

Economic profit – Total revenues minus total costs, including a normal rate of return. An economic profit is an amount above that required to keep the firm producing goods and services.

Economic sector – A subdivision of economic activity based on economic actors or activity (e.g. commercial sector, private sector, industrial sector).

Economically efficient – An activity is economically efficient if it is at the level that maximizes the net benefits, which are total benefits minus total costs.

Economies of scale – A firm has economies of scale, if its average cost falls as its production increases. A firm has diseconomies of scale, if its average cost increases as production increases. A firm has constant returns to scale, if its average cost is constant as production increases.

Economies of scope – A firm has economies of scope, if it is cheaper to produce more than one product together than for separate firms to each produce a single product. When costs are sub-additive, there are economies of scope.

Ecosystem – The system of interactions between living organisms and their environment.

ECSC – European Steel and Coal Community.

EdF – Électricité de France.

EEC – European Economic Community.

EECT – European Energy Charter Treaty.

Efficiency in investments – Paying the lowest cost for required investments in productive assets.

Efficiency in pricing – Pricing at marginal social cost.

Eiffel Tower culture – A task-oriented, rule-based hierarchical business culture with a bureaucratic division of labor. Tasks at each level are clearly defined, and rewards and advancement proceed from accomplishments and learning new skills.

EIS – Environmental impact statement. A statement indicating the environmental effects of proposed federal activities. It is required for all relevant major federal activities by the U.S. National Environmental Policy Act (NEPA).

Ekofisk oil field – First Norwegian oilfield discovered by Phillips Petroleum in 1969.

Elastic – An elasticity (the percentage change in one variable divided by the percentage change in another causal variable) is elastic, if it is greater than one in absolute value.

Electric capacity – The rated continuous power-carrying ability for generation, transmission, or other electrical equipment.

Electric circuit – Path of electric current from a power source through an external line (including devices that use the electricity) and returning through another line to the source.

Electric current – A flow of electrons.

Electric energy – The attracting force between electrons and protons and the repelling force between electrons and between protons. It causes current to flow through wires, creating electricity over time expressed in kilowatt-hours (kWh) and its multiples. (megawatt hours (MWh), gigawatt hours (GWh) and terawatt hours TWh.

Electric power grid – The network of electric power lines and substations for delivering electricity to final users.

Electrical cable – An underground or a submarine set of wire conductors and peripheral equipment for conveying electrical energy between two points of a network.

Electrical grid – An integrated system for electric power distribution.

Electrolyte – A liquid electricity conductor used in batteries. In lead acid batteries, it is usually sulfuric acid (H_2SO_4).

Electromagnetic radiation – Energy moved between electric and magnetic fields. Its basic component is the photon and it includes radio waves, infrared waves, light waves, ultraviolet radiation, microwaves, x-rays, and gamma rays.

Electron – Subatomic particle that has a negative charge and circles the nucleus of an atom.

Element – A chemical object that cannot be chemically divided into a simpler object. Each element has a unique number of protons and electrons. Variations in number of neutrons in the nucleus result in different isotopes.

EMCO – Electricity Market Company. Operator of the competitive power pool in New Zealand.

Eminent domain – A government or government-granted legal right to acquire property for public use at prices determined by the court. Pipeline, electricity, and rail rights-of-way have at times been acquired under eminent domain.

Emission – An unwanted substance discharged into the environment as the result of human activity.

Emission offset – Reducing air pollution emissions from an existing source to compensate for new source emissions.

Emission reduction unit (ERU) – A permit to emit one tonne of CO_{2e} under the European Union carbon trading scheme (EU ETS) arising from a certified reduction in CO_{2e} from another Annex I country under the Kyoto Joint Implementation Program.

Emissions – Waste substances released into the environment (air, water, land).

EMU – European Monetary Union.

Endangered species – A species under threat of becoming extinct.

End-use customer – A customer who uses rather than resells electricity (e.g. residential, commercial, agricultural, or industrial customer).

End-use models – Models that compute energy consumption by summing up the energy using equipment times energy use per unit of equipment.

Energy – The ability to do work. Stored energy called kinetic energy becomes working energy when used.

Energy balance – An accounting framework which follows the supply of energy from production through to conversion to the end-use customer. For the model to balance all conversions and losses between production and end-user must be accounted for.

Energy balance model – Models that estimate total energy demand and supply and balance the two by changing scenarios or using some sort of backup energy source.

Energy conservation – Decreasing the amount of energy used in a given economic activity.

Energy crops – Crops grown for fuel rather than for food. They can include food crops such as corn and sugarcane used for ethanol and soybeans, rape seed, and palm oil for biodiesel fuel. They can include second generation nonfood crops under development for biofuels such as switchgrass for ethanol and algae for biodiesel.

Energy density – The ratio of energy from a battery to its volume: watt hour per liter (Wh/l) or mass watt hour per kilogram (Wh/kg).

Energy engineering or process model – A model that represents some sort of energy processing such as refining or electricity generation.

Energy forward contracts – Bilateral over-the-counter contracts to buy or sell an energy product in the future. Delivery is usually taken on forward contracts.

Energy futures – A standardized contract offered and guaranteed on an organized exchange to buy or sell an energy product in the future. Such contracts are used to lock in future prices and normally do not take delivery.

Energy management system (EMS) – A computer-controlled system allowing operators of electric utilities to monitor and control real-time performance of generation and transmission facilities.

Energy market – Where demanders and suppliers of energy products and services make exchanges. The market gives the results of the sum total of all transactions.

Energy payback time – Time needed for an energy producing apparatus to produce the amount of energy used in its manufacture. (e.g. Energy payback for solar electric panels in 2005 was around 16-20 months.)

Energy subsidy – A government payment for the production or use of an energy product.

English auction – A public sale in which bidding starts from a low price and continues until the item is sold to the highest bidder.

Enhanced oil recovery (EOR) – Techniques for increasing the amount of crude oil that can be extracted from an oil field after primary and secondary recovery have been employed. It changes the properties of the reservoir increasing source rock permeability or properties of the oil by reducing its viscosity. It includes steam injection, CO₂ injection, and fracking. Employing all three recovery techniques may yield a total oil recovery rate of up to 75%.

Enriched uranium – Uranium in which the ²³⁵U isotope concentration by weight has been increased to greater than the natural rate of 0.711 percent ²³⁵U. Lowly enriched uranium (LEU) contains up to 19 percent U-235, highly enriched uranium (HEU) contains at least 20 percent U-235. Nuclear weapons grade uranium requires more than 90%. Power plants generally require enrichment to 3-5%.

Enrichment – Process to increase the proportion of U-235 to U-238 in uranium. It is measured in Separative Work Units (SWU).

Enrichment tails assay – Measure of the amount of fissile uranium (U-235) in the waste stream after uranium has been enriched. The historical level has been around 0.2 percent.

ENTSOE – European Network of Transmission System Operators for Electricity.

ENTSOG – European Network of Transmission Operators for Gas.

Environment – The surrounding conditions. The quality of the environment affects the well being and survival of biological organisms.

Environmental assessment – (EA) A required public document in the U.S. that studies the environmental impacts of proposed federal actions for the possibility of environmental impacts. If the environmental impacts are found to be significant, the federal agency must provide further information in an environmental impact statement (EIS).

Enzymatic hydrolysis – A technique to break down starch or cellulose into sugar using enzymes (biological catalysts).

EOR – Enhanced oil recovery.

EPEX – European Power Exchange.

Equity cost of capital – Firms can finance activity by borrowing or by selling ownership rights or equity. The equity cost of capital is the rate of return required to attract equity financing.

ERCOT – Electric Reliability Council of Texas.

ESA – Electricity Supply Authority. Distributors of electricity in New Zealand.

ESI – Electricity supply industry.

ESP – electricity service provider.

ESPO – Eastern Siberia-Pacific Ocean oil pipeline.

Ethanol – Ethyl alcohol ($\text{CH}_3\text{CH}_2\text{OH}$) produced by first fermenting sugar by yeast and then concentrating by distillation. Common feed stocks are sugar cane, corn, and sugar beets. Most automobiles can run on gasoline with up to 10% ethanol by volume. Flex fueled vehicles can run on pure ethanol or any gasoline-ethanol blend.

EU – European Union.

Euler equation – The first order condition for the optimal solution of a calculus of variation problem.

European Energy Charter Treaty – A binding treaty signed in 1994 to ensure energy reforms and safe energy supplies from former Eastern Block countries.

European Gas Directive – A ruling passed in 1998 by the European Union to promote the free movement of gas across countries and gas security. It opens up the markets to third party access, which was to be up to a third by around 2008.

European Network of Transmission System Operators for Electricity (ENTSOE). – An international organization of 41 electricity transmission operators tasked with coordinating and maintaining the electricity grid between the member countries. (<http://www.entsoe.eu/>).

European Network of Transmission System Operators for Gas (ENTSOG) – An international organization of 45 natural gas transmission operators tasked with coordinating and maintaining the natural gas network between the member countries. (<http://www.entsoe.eu/>).

European option – An option is the right to buy (call) or sell (put) an underlying asset at a given price (strike price) that expires on a specific date. A European option can only be exercised at expiration.

European single market – Legislation passed in 1992 to create a single market amongst the member states of the European Union in which goods, services, capital, and persons pass freely between countries. Economic rules and regulations are also to be standardized.

European Union (EU) – An organization to provide economic and political cooperation between its 28 European member states. It evolved out of the European Community (EC) and was renamed the European Union with the Maastricht treaty in 1992, which called for monetary union and gave members the right to European citizenship and freedom to live, work, and vote in any of the countries.

European Union allowance (EUA) – A permit to emit one tonne of CO_2e under the European Union carbon trading scheme (EU ETS).

Excel solver – Algorithm in Microsoft Excel to optimize a functions subject to constraints.

Excess annual growth – New forest growth minus harvested wood.

Excess supply – If quantity supplied is greater than quantity demanded at a given price, the unsold goods are called excess supply.

Excise tax – A unit tax placed on a good or service.

Excludable in consumption – Excludability prevents someone from consuming a good. Pure private goods are excludable in consumption, whereas pure public goods are not.

Exercise or strike price – The strike price or the price at which an option allows the owner to buy or sell the underlying asset.

Expected value [E(X)] – For a random variable, the expected value is computed by weighting each value of the variable by its probability and adding together all the weighted values., where X_i is a value assigned to an event and $P(X_i)$ is the probability of the event occurring, and n is the number of events that can occur. Thus, $E(X) = \sum_{i=1}^n P(X_i)X_i$.

Expiration date – Date after which an agreement or offer is no longer valid. (e.g. The last day on which an option may be exercised into the underlying contract. The last day of trading of a futures contract. Such dates are fixed by an exchange' contract.).

Exploration – Looking for new energy deposits or delineating extensions and additions for known deposits usually through geological analysis and drilling exploratory wells (called exploration drilling).

Exploration costs – Costs related to searching for oil and gas including those for equipment depreciation and operation, wages and salaries, access to geological/geophysical studies, property access rights, legal and other transaction costs, and related purchases from service companies.

Externality – A cost or benefit affecting parties outside of a transaction and not included in the price of goods or services. Often "negative externalities" refer to the cost of pollution and other negative environmental impact.

Extractive industries – Industries engaged in exploring and producing non-renewable natural resources (also called wasting or non-regenerative resources).

Extrapolating historical trends – Forecasting a variable by assuming the changes over time in the future will be the same as those in the past. For example, if electricity has been growing at 7% in the past, we assume it will grow at 7% in the future.

Fabricated fuel – Nuclear fuel rods loaded with enriched uranium dioxide and assembled into arrays for insertion into nuclear reactors.

Face – The cultural aspect that is one's outward appearance to the group. To perform poorly and make the group look bad brings shame and causes one to lose face if the group knows about it.

Fair Return – The legally allowed rate or return for a U.S. regulated public utility company.

Family culture – A people-oriented corporate culture that is very hierarchical. It motivates, resolves conflicts, and effects change through personal relationships.

Farm-out arrangement – An agreement in which the owner (lessor) of mineral rights signs over a working interest to an operator for agreed upon compensation. The operator is said to be exercising a farm-in arrangement.

Fast breeder reactor (FBR) – A nuclear reactor in which fast neutrons can sustain the chain reaction with no need for a moderator to slow the neutrons. It produces more fissile material than

it consumes with the most common conversion being the conversion of non-fissile uranium 238 (U238) to fissile plutonium 239 (Pu239).

FCC – Fluid catalytic cracking – A refinery process used to break heavier hydrocarbon molecules into lighter molecules in the presence of a catalyst to increase gasoline production from a barrel of oil.

Federal Water Pollution Control Act – A U.S. federal law regulating pollution discharges into water.

Feedback effects – When some outputs of a model or process are fed back as inputs and affect future outputs.

Feed-in-tariff (FIT) – A policy to promote investment in renewable energy by offering long term contracts at favorable prices.

Feedstock – A material used to produce another product by chemical conversion (e.g. naphtha or ethane used to produce petrochemicals).

FEIS – Final environmental impact statement.

Feminine culture – A more relationship-oriented culture with more flexibility in gender roles.

FERC – U.S. Federal Energy Regulatory Commission.

Fermentation – Biological process using yeast to convert biomass into carbon dioxide and alcohol.

Fertile Material – Non fissionable by thermal neutrons (slow neutrons) but convertible to fissile material by fast neutrons. The two principal fertile materials are uranium-238 and thorium-232.

FFL – British Fossil Fuel Levy.

FID – Final investment decision.

Field – An area with one or more grouped reservoirs holding oil and/or natural gas.

Financial assets – Assets are things of economic value. Financial assets are non-physical assets or debt instruments that facilitate the transfer of funds from lenders to borrowers. They include cash, checking accounts, bonds, stocks, and insurance policies.

Financial derivatives – Financial assets derive their value from the underlying asset upon which they are based. They include futures, options, forwards, and swaps.

Financial risk – The risk or variability of investment returns relating to financing activities.

Firm power – Electric power to be always available over a contracted period (also called firm energy).

Firm transportation – Transportation that is contracted to be available on demand and can't be interrupted. A category of natural gas transportation in the U.S. natural gas industry.

First Law of Thermodynamics – The total amount of energy in an isolated system will always remain the same.

First mover advantage – The competitive advantage gained by an entity by being the first to enter a market or to undertake some activity.

Fissile material – Material able to undergo nuclear fission from capturing a slow moving thermal neutron (e.g. uranium-235 and plutonium-239).

Fission – The splitting of a heavy nucleus into two, accompanied by the release of a relatively large amount of heat and generally one or more neutrons. It may be spontaneous but usually is caused by a nucleus absorbing a neutron.

Fissionable material – Material requiring a low or high energy neutron to fission (e.g. all fissile material as well as including uranium 238 and thorium 232).

FIT – Feed-in-tariffs.

Flag of convenience – A ship's flag is the country's flag where it is registered. Usually the flag is the country where the ship owner's company is incorporated. Sometimes another country is chosen because the country has lower taxes and weaker regulation. Such a flag is called a flag of convenience with Liberia and Panama the most prominent examples.

Flat-plate PV – A PV array or module without a concentrating apparatus.

Flexible generator – An electricity generator that can adjust power generation quickly in response to real-time signals.

FLNG Floating liquefied natural gas vessel – A ship that can extract and liquefy natural gas.

Floating storage and regasification unit (FSRU) – A vessel that can store LNG for offloading into a tanker or regasify it for input into a pipeline system.

Floodplain – Area next to rivers created by sedimentation left by flood waters.

Flow rate – Quantity of liquid or gas moving through space over a specified period of time (e.g. pipeline flows of oil in barrels per day or gas millions of cubic feet per hour).

FLRSU – Floating liquefaction regasification storage unit. A vessel that can gasify LNG, store LNG for offloading into a tanker or regasify for input into a pipeline system.

Fluidized-bed boiler – A device for boiling water in which a fluidized bed of inert super hot particles (e.g. sandstone or limestone) is blown up and maintained in suspension with the fuel to increase combustion efficiency.

Fly ash – Small non-combustible particles carried in the gaseous waste stream from combustion.

FOB - Free on board.

Food vs. fuel – Refers to the trade-off when food crops are used to produce energy raising food prices.

FOR – Free on rail.

Force majeure clause –Exempts contract holders from liabilities caused by acts of God, governmental, institutional restrictions, or any other cause beyond the control of either party.

Forecast feedback – When some outputs of a forecast influence what is being forecasted.

Foreign access – Agreements allowing foreigners access to local fossil resources.

Foreign direct investment (FDI) – Investment allowing the foreign investor managerial control of the investment and resulting productive assets.

Foreign exchange rate – The price of one currency in terms of another currency (e.g. Japanese yen/\$).

Former Soviet Union (FSU) – The 15 countries that were once part of the Soviet Union. They are Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

Fossil fuel – Carbon based fuels (coal, oil, and natural gas) formed from living matter buried under anaerobic conditions and subject to high heat and pressure for a very long period. They are burned with oxygen to yield heat.

Fossil fuel steam-electric power plant – A plant to generate electricity with a turbine rotated by high-pressure steam from a boiler burning fossil fuels (also called a conventional thermal power plant).

FOT - Free on truck.

FPC – U.S. Federal Power Commission.

FR countries – Fossil fuel rich countries.

Frac spread – An indication of the profitability of natural gas plant fractionation equal to the value of the natural gas liquids (NGL) removed minus the price of the wet natural gas.

Fracing – hydraulic fracturing.

Franchise – The right to produce or distribute a good or service. In the past, governments have often given exclusive franchises to electricity utilities to produce, transport, and distribute electricity in a given area. Business may sell franchises to local companies to sell their product (e.g. a franchise that Exxon might sell to a local gasoline station allowing it to sell the Exxon brand).

Francis turbine – A turbine turned by water that converts the vertical fall of water to rotating mechanical energy.

Free rider – An entity that receives benefits from a pure public good without paying.

Freight rate – The amount charged per unit moved. (e.g. Worldscale).

FSRU – Floating storage and regasification unit.

FSU – Former Soviet Union.

ft³ – cubic feet.

Fuel – A material that can be changed to energy such as fossil fuel.

Fuel cell – An apparatus that chemically converts a fuel to electricity and heat without combustion.

Fuel cycle – All the steps taken to produce electricity from fuel acquisition, processing, and transport to electricity generation, waste disposal and decommissioning of the plant.

Fuel fabrication – Making nuclear reactor fuel elements or rods mostly commonly using enriched UO₂.

Furnace – An apparatus used to contain fuel, which is burned to produce space or process heat.

Fusion – Smashing atoms together to make a bigger atom.

Futures – A financial contract to buy or sell a physical commodity for future delivery on a commodity futures exchange. They are used to lock in prices with delivery seldom taken.

Gal/d – Gallons per day.

Game theory model – An interactive situation between a number of players who try to optimize their objective functions. The model includes the players, the set of possible actions, and their pay offs.

Gamma rays – Radioactive decay in the form of high energy electro-magnetic radiation.

Gas shift process – A chemical process that catalytically reacts carbon monoxide and hydrogen into methane and water.

Gas turbine – A device in which hot compressed gases produced by burning fuel push turbine blades converting heat into mechanical power. It is often the technical choice for peaking electricity generation capacity (also called a combustion turbine).

Gas-cooled fast breeder reactor (GCFBR) – A fast breeder reactor, which is cooled by a gas.

Gaseous diffusion process – A process to increase the concentration of U-235 in reactor fuel to a fissile concentration. The uranium is first gasified to uranium hexafluoride (UF₆) and then passed through a number of porous membranes.

Gasification – Process to produce syngas from coal.

Gasification plant – A plant to regasify liquid natural gas.

Gasifier – An apparatus used to convert a solid or liquid to a gaseous fuel.

Gasohol – A motor vehicle fuel that is 90 percent unleaded gasoline and 10 percent ethanol by weight.

Gasoil – A middle distillate with boiling range around 260 – 340 °Celsius (500 – 644 °Fahrenheit), used for diesel and heating oil. Also called number two distillate.

Gasoline retailer – A business which sells gasoline to final customers. It could be company owned selling a branded product, independent lessees buying branded gasoline at the tank wagon for retail sale, independents that own or lease stations from non-refiners and buy non-branded gasoline purchased from refiners or distributors for less than tank wagon prices.

Gathering pipelines – Small pipelines used to move natural gas and crude oil from the well to larger long distance transmission pipelines.

GCC – Gulf Cooperation Council. An organization of the Arab states of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.

GDP – Gross domestic product.

Gel-type battery – Lead-acid battery with a silica gel electrolyte.

Generator – A piece of equipment that converts rotating mechanical energy to electrical energy with coils spun by a magnet.

Genetic mutation – Abrupt change in the chromosomes in DNA of an individual gene. Mutation in some organisms can be made more frequent by exposure to radiation and other toxins. In some cases the change may be inheritable.

Gentailer – An electricity generator that also retails electricity.

Geological and geophysical (G&G) costs – Costs for purchasing or making geological and geophysical studies, which could include salaries for scouts, geologists, and geophysical crews, equipment, and rights of access.

Geothermal energy – Energy from the natural heat of the Earth contained in hot rocks, hot water, hot brines or steam. It can be used to provide heat, or the heat can be used to produce electricity.

GHG – Greenhouse Gases.

Gigawatt – A billion watts. A watt is a measure of electric power equal to one ampere under the pressure of one volt. Watts = volts times amps.

Gini coefficient – A measure of income inequality for a group that represents how far the group is from perfect equality: A Gini coefficient of zero expresses perfect equality indicating each member has the same income. A Gini coefficient of one (or 100%) gives maximum inequality with one member having all the income all others having no income.

Global pollutant – Pollutant that affects the whole globe such as excess CO₂, as opposed to a more restricted regional pollutant such as smog.

Global warming – The rise in temperature resulting from gases such as CO₂ that trap heat in the earth's atmosphere leaving less heat reflected back to space.

GNI – Gross national income.

Gold plating – Unnecessary extravagance built into a project, such as gold-plated bathroom fixtures. Often done when someone else is paying for the project or to artificially increase the profits from building the project.

Golden Rule savings rate – A rule of savings developed in a Solow growth model that maximizes total steady state consumption per capita across time or steady rate growth of consumptions.

Government corporation – A corporation with all shares are owned by the government.

Government regulation – Law created by a government to control an activity.

Government revenues from a tax – The total amount of money collected from a tax.

Government share of the take – The percent of revenue from an energy product that the government receives in taxes.

Graphite – Pure carbon, which acts as a moderator in gas-cooled reactors and in Soviet-designed graphite moderated reactors (The Russian acronym for these reactors is RBMK).

Green certificates – A certificate representing green energy/electricity production that can be purchased to satisfy government regulations for such production. They are also called renewable energy certificates.

Greenfield project – A totally new project, not an addition to a previously operating project.

Greenhouse effect – Increasing Earth temperature because greenhouse gases trap solar heat in the Earth's atmosphere.

Greenhouse gases – Gases that trap solar heat in the Earth's atmosphere producing the greenhouse effect (e.g. water vapor, carbon dioxide, methane, ozone, chlorofluorocarbons, and nitrous oxide).

Grid – The high voltage electric system for transporting electric power.

Grid connection – A pathway allowing electricity to flow to or from the grid.

Grid-connected (PV system) – A PV system connected to the grid, which may be able to both sell and buy power from the grid.

Groningen gas field – The largest gas field in the Netherlands, discovered in 1961.

Gross domestic product – All goods and services produced in a specific geographic region over a specified period of time.

Gross energy production – The gross amount of energy needed to produce electricity. With this definition, the EIA converts primary electricity production to a fossil equivalent requirement for its generation using a heat rate.

Gross generation – The total amount of electric energy output from the generating units at a power plant. Subtracting power plant use yields net generating, which is the amount of electricity sent out from the power plant.

GTL – Gas-to-liquids.

Guide signs – Body movements used to indicate a direction such as pointing with a finger, hand, or head.

Guided missile culture – Task-oriented, egalitarian, impersonal culture often peopled by professionals from across different disciplines. Status comes from performance and evaluation of peers on contributions to the project. Work is organized around projects and change arises as projects come and go and groups regroup in response.

Guilt-based culture – A culture that controls by internalizing bad feeling when someone has violated culture norms. This is opposed to a shame-based culture where bad feelings are only felt when one loses face or when the group knows an individual has violated cultural norms.

GW – Gigawatt.

H₂O – Water.

Half-life – Time needed to decay half of one radioactive element into another.

Hamiltonian – A function used to solve optimal control problems or problems including differential equations.

HDD – Heating degree days. The accumulated number of degrees below 65 degrees F for a specified period. More formally let $(T)_i$ = the average temperature as measured by the average minimum and maximum temperature on day T_i . Let D_i = the number heating degrees for day i ,

where $D_i = (65 - (T))$ if $(T) < 65$; $D_i = 0$ if $(T) \geq 65$. Then the annual number of heating degree days = $HDD = \sum_{i=1}^{365} D_i$.

HDI – Human development index.

Head – The vertical distance water drops from its highest level to a lower body of water.

Heat Rate – The number of Btus a utility plant requires to produce a kilowatt-hour of electricity. It can be computed by dividing the total Btu content of the fuel burned by the net kWh generated.

Heavy water – Water with a higher concentration of heavy hydrogen (deuterium) atoms than common light water. It is the moderator to slow neutrons in heavy water reactors.

Heavy water reactor (HWR) – A reactor using heavy water as its moderator, which allows use of unenriched uranium (e. g. Canadian CANDU reactor).

Hedge ratio – The percent of a product that is hedged.

Hedging – Taking the opposition position in the real market as in the derivative market to lock in a price. Thus, if you are long crude, you would hedge by selling a futures.

Hedonic pricing – Pricing where the total price reflects the sum of the prices of the different attributes of a good. Thus, an automobile would cost more the more comfortable, the better mileage, the higher the performance, etc., with total value determined by the base value and the value of other individual attributes.

Henry Hub – Gas delivery point in Louisiana for NYMEX gas futures and option contracts.

Herfindahl Hirschman index (HHI) – An index that measures how concentrated an industry is. It is equal to the sum of the squared market shares and varies from monopoly with an index of one to perfect competition with an index of zero. Or if measured in percent it varies from 10,000 for a monopoly to 0 for perfect competition.

Hertz – One hertz is one cycle per second. The frequency is the number of times an electromagnetic wave cycles per second. For example, electricity in the United States is 60 megahertz, cycling 60,000,000 times per second, while in Europe it is 50 megahertz.

Heterogeneous – The condition of being non-uniform. A heterogeneous substance is nonuniform throughout.

HFCs – Hydrofluorocarbons, which are molecules consisting of hydrogen, fluorine and carbon atoms. They are used as refrigerants and are potent greenhouse gas.

HHI – Herfindahl Hirschman Index, which is a measure of economic concentration within an industry.

High absorbers – OPEC countries with lower oil reserves and higher populations that have a high short-run need for current revenues.

High context culture – A culture in which there is a lot of shared knowledge and common understanding.

High-level wastes – Highly radioactive fission products from spent nuclear fuel that can be reprocessed or needs to be permanently disposed of.

Highly enriched uranium (HEU) – Uranium enriched to 20% or greater U-235. Weapons grade uranium is enriched to about 90% U-235.

HNO₂ – Nitrous acid.

HNO₃ – Nitric acid.

Holding company – A company that owns controlling interest in another company's shares and is able to manage all aspects of the later company.

Hold-up – Unethically taking advantage of someone in a business transaction by renegeing on an agreement where high sunk costs limit the other party's options.

Horizontal drilling – Drilling wells at a non-vertical angle to increase the well bore and decrease drilling costs per unit of hydrocarbons found and produced.

Horizontal equity – A criteria of fairness for taxation. Horizontally equitable taxes have people with similar incomes paying similar amounts of taxes.

Horizontal integration – When a firm produces more than one good. Often the goods are similar so the firm may be able to take advantage of economies of scope.

Horsepower (hp) – A non-metric unit of the rate of mechanical energy output. It is equal to the power needed to raise 33,000 pounds one foot in one minute, also equal to 746 watts.

Hotelling rent – Rent is reimbursement for the use of something of economic value, which includes labor, land, capital, energy, ideas, and money. Rent for labor is usually called wages or salaries, rent for capital and land is usually called rent, rent for energy and ideas may be called royalties, and rent for money is called interest. Economic rent occurs when the rent payment is larger than necessary to entice the product into the market. The amount of the economic rent on a unit is price minus marginal cost. Rent caused by a fixed resource that is not regenerative is called Hotelling rent. Hotelling rent helps to efficiently allocate a depletable resource across time. Hotelling rent is also called user cost.

Hour-ahead market – Electric power futures market allowing transactions one hour before delivery.

HP – horsepower.

Hubbert curve – A logistic curve of cumulative production fit by the geologist Hubbert, which is used to predict the total reserves of a depletable resource.

Human Development Index (HDI) – An index of measuring human development that includes GDP per capita as well as other factors such as health and education. (<http://hdr.undp.org/en/content/human-development-index-hdi>).

HVAC – High voltage alternating current.

HVDC – High voltage direct current.

Hybrid system – A photovoltaic system with supplemental electricity generation sources (e.g. wind or fossil fuel generators).

Hydraulic fracturing (fracing) – Technique for increasing the permeability of oil and gas source rocks by injecting fluids, usually water, along with a proppant, such as natural or synthetic sand, to maintain the permeability.

Hydrocarbon – An organic chemical compound containing hydrogen and carbon. They vary from light gaseous compounds such as methane to heavier liquids such as pentane to even heavier solid compounds such as wax.

Hydrocracking – Refinery process that heats heavy oil products under pressure in the presence of hydrogen to remove sulfur and increase lighter product yields.

Hydroelectric power – The generation of electricity from falling water spinning a turbine.

Hydropower flow – The amount of water flowing under a dam to generate hydroelectricity per unit of time.

Hydropower head – Distance from the surface of the water to the turbine generating the hydroelectricity.

Hypernova – A very high energy stellar explosion before a massive dying star collapses into a black hole.

IAEA – International Atomic Energy Agency. (<http://www.iaea.org/>).

ICC – U.S. Interstate Commerce Commission replaced by the Surface Transportation Board in 1996.

ICE – Intercontinental Exchange. (<https://www.theice.com/homepage.jhtml>).

Ice clause – A clause inserted to restrict navigating in icy waters when they could damage the vessel.

Identified reserves – Fossil fuel reserves that are known to exist and be producible under current economic conditions.

IEA – International Energy Agency. An international organization within the Organization for Economic Cooperation and Development (OECD). Its mission is to ensure secure affordable and clean energy for its members and the global community. Its members consist of 28 out of 34 of the OECD member countries. (<http://www.iea.org>).

IEW – International Energy Workshop. (<http://www.internationalenergyworkshop.org/>).

Improved recovery – More advanced techniques for increasing crude oil or natural gas recovery than natural reservoir pressure, gas lift, or pumping.

In situ leach mining (ISL) – Technique for recovery of valuable products from ore by chemical leaching rather than physical extraction of the ore from the ground (also called solution mining).

In situ recovery method – Mining a resource while in its original place, such as underground leaching of uranium or steam injection for extracting oil from oil sands.

In the money – When the strike price for a put is above the spot price for an underlying asset, the put is said to be in the money. When the strike price for a call is below the spot price for an underlying asset, the call is said to be in the money.

Incinerator – A device to dispose of wastes. In some cases, the waste heat is sold or used to produce electricity.

Income elasticity of demand – The percentage change in quantity (Q) of a good demanded divided by the causal percentage change in demander's income (Y) (often written as $(\partial Q/\partial Y)(Y/Q)$).

Income tax – Tax paid on an individual's annual income.

Incubator culture – Egalitarian, people-oriented corporate culture often founded by a creative team or entrepreneur. Creativity is encouraged and leads to status. Conflict is dealt with by breaking apart, going separate ways, and experimenting to find the best course of action.

Independent power producer (IPP) – A power producer not owned or controlled by a regulated utility.

Independent system operator (ISO) – An operator of the electricity transmission grid under its jurisdiction regulated by the U.S. Federal Energy Regulatory Commission. It is independent of the utilities and other market players within its jurisdiction, is to provide non-discriminatory open access to the grid, manage congestion, maintain the reliability and security of the grid and provide billing and settlement services.

Indirect tax – A tax on a good or service rather than on a legal entity such as an individual or corporation.

Individualistic culture – A culture where individual initiative and leadership are valued.

Inelastic – An elasticity is inelastic if it is less than one in absolute value.

Information asymmetry – When two sides of a negotiation do not have access to the same information.

Initial performance bond – The initial funds required to open a futures (also called initial margin).

Inner directed culture – A culture whose members believe they have control of their own lives and what happens to them.

Input-output models – A linear system of equations that represents a company, region, nation, or even the entire world. The equation coefficients represent the required inputs to produce each output including outputs that are inputs to themselves and/or other products. For example, electricity is an end-use demand, an input into generating electricity, and an input to a host of other products. The model keeps track of all end-use and intermediate uses as well. If you enter end-use demand to the model, it will compute the required total output for each good, which includes all end-use demands and intermediate goods.

Insolation – Solar radiation. It is equal to about 1000 watts per square meter at noon in Dodge City, Kansas.

Instrumental variables – An econometric technique to estimate an equation in a system of equations that has a right hand side endogenous variable. The endogenous variable in the estimation is replaced with a value estimated from exogenous variables in the system, called instrumental variables.

Intangible drilling and development costs (IDC) – Cost for intangible elements that do not become a physical part of the well. They are intangible costs accrued until putting in the control valves. They can include labor, transportation, drilling mud, tool rentals, and site preparation and can be expensed for tax purposes in the U.S.

Integrated resource planning (IRP) – Public planning for providing energy services with equal weight given to increasing supply or decreasing energy use through improved efficiency. Cost as well as environment and perhaps even income distribution might be taken into account when choosing the best option.

INTERCARGO – International Association of Dry Cargo Ship Owners.

Interconnection – A link between non-synchronized power systems which allows electricity trade between them.

Intercontinental Exchange (ICE) – A prominent network of regulated commodity and financial exchanges including energy derivatives. (<https://www.theice.com/homepage.jhtml>).

InterEnerStat – A project convened under the auspices of the IEA and UNSD to harmonize the definitions in energy data. The first meeting was in 2005 with participation by 24 organizations (African Energy Commission (AFREC), African Petroleum Producers' Association (APPA), Asia-Pacific Economic Cooperation (APEC), Eurelectric, Eurogas, European Commission - Eurostat, European Environment Agency (EEA), Food and Agriculture Organization (FAO), Intergovernmental Panel on Climate Change (IPCC), International Atomic Energy Agency (IAEA), International Energy Agency (IEA), International Energy Forum Secretariat (IEFS), International Monetary Fund (IMF), Latin American Energy Organization (OLADE), Organization for Economic Cooperation and Development (OECD). (http://www.iea.org/interenerstat_v2/).

Interest rate – The rate paid for borrowing money over a period of time.

Interest rate risk – The risk that changing interest rates will change an investment's market value.

Internal pricing within an integrated firm – The prices different parts of a company charge each other for goods and services (also called transfer pricing).

Internal rate of return (IRR) – The interest rate that makes the stream of net revenues for a project equal to zero.

Interruptible load – Electricity consumption contracted to be curtailed when a utility needs to shed load.

Interruptible transportation – Transportation that can be interrupted and given to another customer, who has contracted for firm transportation. A category of natural gas transportation in the U.S. natural gas industry, it is cheaper than firm transportation.

INTERTANKO – International Association of Independent Tanker Owners.

Inverted market – A market in which the futures prices are lower than the current spot price. An inverted market typically indicates that a market is tighter now than it is expected to be in the future (also referred to as a backward market or a market in backwardation).

Inverters – Devices for converting DC electricity into AC electricity.

Investment tax credit – A tax law allowing a percent of qualifying new investments to be subtracted from an income tax bill.

Investor-owned utility (IOU) – A power company privately owned by its shareholders but regulated by a public utility commission.

Ion – An atom that has become electrically-charged when it lost or gained electrons.

Ionising radiation – Particles emitted from the nucleus of radioactive atoms that can break chemical bonds causing ionization and possible health hazards to living organisms.

IOU – Investor owned utility.

IPC – Independent Power Company.

IPCC – Intergovernmental Panel on Climate Change.

IPE – International Petroleum Exchange a futures options exchange in London that is now part of the Intercontinental Exchange. (<https://www.theice.com/homepage.jhtml>).

IPEX - Italian Power Exchange.

IPP – Independent power producer.

IRENA – International Renewable Energy Agency. (<https://www.irena.org/>).

Iron Age – The age in which humans have used iron, roughly 1200 BCE to the present. It started in different areas at somewhat different times.

IRP – Integrated resource planning.

IRR – Internal rate of return.

ISO – Independent system operator.

ISO Control Area – The electrical region operationally controlled by the ISO.

ISO Grid – The electricity transmission assets under ISO control. These assets may or may not be owned by the ISO.

Isomerization – A refinery process that converts straight-chained hydrocarbons into branched-chain hydrocarbons. It is used in the production of gasoline.

Isoperimetric problem: A calculus of variation optimization with an integral constraint.

Isotope – An element that has the same number of protons but a different numbers of neutrons than other isotopes of the element (e.g. U-235, U-238).

IV – Instrumental variables.

Japan's MITI – Japan's Ministry of Trade and Industry. It has been very influential in promoting industry and exports in Japan. MITI was reorganized in 2001 and has been renamed the Ministry of Economy, Trade, and Industry (METI).

Jihad culture – A culture that resists modern capitalism and values religious beliefs, ethnic traditions, and local and national communities.

JODI – Joint Organization Data Initiative. (<http://www.jodi.org>).

Joint Oil Data Initiative (JODI) Database – An international oil database with contributions of 90 countries in six international organization: Asia Pacific Economic Cooperation (APEC), Statistical Office of The European Communities (EUROSTAT), International Energy Agency (IEA), International Energy Forum (IEF), Latin American Energy Organization (OLADE), Organization of Petroleum Exporting Countries (OPEC), and United Nations Statistics Division (UNSD). Monthly data includes production, imports/exports, and consumption of oil, LNG, NGLs, LPG, motor and aviation gasoline, kerosene, jet fuel, gas/diesel oil, and fuel oil. (<http://www.jodi.org>).

Joint venture – An enterprise where two or more investors become co-owners to pursue profitable activities. Profits are typically divided according to ownership shares or contract specifications.

Judgmental models – Informal models that are used to forecast based on the considered opinion of experts in the area.

KACARE – King Abdullah City for Atomic and Renewable Energy. (<http://www.kacare.gov.sa/en>).

Kerogen – A solid material containing hydrocarbon material that is a precursor to oil and gas.

KHNP – Korea Hydro and Nuclear Power.

Kilocalorie (kcal) – A calorie is the amount of energy needed to raise 1 gram of water by 1 degree Celsius. A kilocalorie is 1,000 calories or the amount of energy needed to raise a kilogram of water one degree Celsius. A kilocalorie is the unit for the Calories reported for food usually designated with a capital C. One kilocalorie equals 4.18 kilojoules or 3.968 Btus.

Kilojoule (kJ) –A joule is the energy of one watt of power for one second. A kilojoule is 1000 joules and is equal to 0.245 kilocalories or 0.948 Btus.

Kilowatt (kW) –A watt is a measure of electric power equal to one ampere under the pressure of one volt or one joule per second. A kilowatt is 1000 watts. Watts = volts times amps.

Kilowatt-hour (kWh) – A kilowatt operating for one hour.

km – Kilometer.

Knot – A measure of ship speed. 1 knot = 1 nautical mile per hour, which equals 1,850 meters/hour.

LAER – Lowest achievable emission rate.

Lagrangian multiplier: A variable used in calculus to find local maxima and minima of a function subject to equality constraints. The solution for the Lagrange variable represents the shadow value of relaxing the constraint.

Landfill gas – Gas from the decomposition of organic material at landfill waste sites. It is usually about half methane.

LCA – Life cycle assessment is a technique to assess environmental impacts associated with all the stages of a product's life from-cradle-to-grave (i.e. from raw material extraction through materials processing, manufacture, distribution, use, repair, maintenance, and disposal or recycling).

LCP – Least-cost planning.

LDCs – Local distribution companies.

Lease bonus – An upfront payment by a lessee to the mineral right owner for the right to search for and develop reserves.

Least-cost planning – Procedure that finds the lowest cost of energy supply giving equal weight to demand reduction and capacity increase. It is narrower than integrated resource planning because it does not include wider societal objectives.

LEED (Leadership in Energy and Environmental Design) – A rating system for green buildings by the U.S. Green Building Community. (<http://www.usgbc.org/leed>).

Legal risk – Legal risk relates to losses from failures to comply with the law or adverse regulatory changes.

Leontief production function – A function where output is related to inputs, but inputs are required to be used in certain fixed proportions to produce output. Thus, if at an efficient output level increasing one input without increasing all others in the same proportion will not increase output.

Levelized unit cost – Allocating capital and operating costs over output production. This cost will reflect the cost per unit produced at the time it is produced.

License agreement – A contract made by one company with another to use a brand name, trade mark, patent, or copyright of a product for a specified period of time.

Life-cycle costing – A method of comparing discounted costs of equipment or structures including original costs plus all operating and maintenance costs over the useful life of the equipment.

Lifting costs – The operating costs of bringing oil or gas up to the well head.

Light tight oil – Oil with API gravity higher than 31.1 degrees. It flows freely at room temperature and is produced from tight sedimentary rock, such as shale, that needs to be fraced to increase permeability. Although light tight oil is popularly called shale oil, that term is misleading because shale oil has been traditionally used for non-conventional heavy oil that has been extracted from the kerogen trapped in oil shale.

Light water – Ordinary water (H₂O) rather than heavy water or deuterium oxide (D₂O).

Light-water reactor (LWR) – A nuclear reactor with ordinary or light water used as coolant and moderator, but requiring slightly enriched uranium as fuel. The two primary types are the boiling-water reactor (BWR) and the pressurized-water reactor (PWR).

Lignin – The plant product that keeps cellulose and cells bonded together in plants.

Limit pricing model – A model in which the price charged is the highest price that could be charged without attracting new entrants into the market. It would be a price and quantity such that an entering firm would drive the price down so much the new entrant could not cover their costs.

Linaburg Maduell transparency index (TI): Rating system for the transparency of sovereign wealth funds. (<http://www.swfinstitute.org/statistics-research/linaburg-maduell-transparency-index/>).

Linear algebra – A branch of mathematics used to compactly write and solve systems of linear equations.

Linear programming – An optimization model in which the objective function and the constraints are all linear.

Liquefaction – The process of converting solids or gases to a liquid.

Liquefied natural gas (LNG) – Natural gas that has been changed to liquid by cooling to minus 161.5 °Celsius or minus 258.7 °Fahrenheit.

Liquid metal fast breeder reactor (LMFBR) – A nuclear breeder reactor requiring fast neutrons for fission and cooled by molten sodium.

Liquidation – A transaction to offset a long or short position in an asset.

Liquidity risk – Liquidity risk relates to the lack of market activity or to a failure to meet a cash flow obligation.

Liquified petroleum gases (LPG) – Propane and butane, which are gases at normal atmospheric temperature, but are bottled under pressure as liquids.

LMP – Locational marginal pricing. Different market prices are charged at different locations depending on market conditions such as supply, demand, and congestion.

LNG – Liquefied natural gas.

LNG vessel – A specially designed tanker that maintains a constant temperature for LNG.

Load – The power taken from an electrical system. Load shedding is reducing load when generation is not adequate.

Load curve – The amount of power consumed at different times over a specified period. A daily load curve would show power consumption over a 24-hour period, perhaps by increments of an hour or less. Annual load curves might show consumption by day, week or month.

Load factor – The ratio of average load to maximum load.

Load following – Capability of an electrical generator to change output as the consumption of electricity from the grid or load fluctuates.

Load management – Method or devices to help even out electric power demand by reducing peak usage and/or shifting power consumption from peak time to off-peak time.

Loading jetty – A structure that extends into the water where a ship can pull along side for loading and unloading.

Local distribution company (LDC) – Retailing companies that take power from transmission lines and distribute it to local customers. Also called distribution companies (Distcos).

Local pollutants – Pollutants that do not travel over long distances.

Local publicly owned electric utility – An electric utility owned by a local government.

LOLP – Loss of load probability.

Long hedge – Purchasing a futures contract to cover an expected actual purchase in the cash market. It provides protection against an increase in the cash price.

Long position – With a long position, you own an asset. It is the opposite of a short position in which you have sold a borrowed asset and, hence, owe it. Going long is to take a long position.

Long ton – Non-metric unit of weight equal to 2240 pounds or 1.016 metric tons. Once commonly used in Great Britain.

Long wave theory – The theory that technical inventions spur economic change and create cycles.

Long-term contracts – Contracts that hold for a long period of time, usually more than a year.

LOOP – Louisiana offshore oil port. The only U.S. deepwater port able to take ULCCs. (<http://www.loopllc.com>).

Loop flow – Electricity, which takes the path of least resistance, may break into different paths or loops on the way from generator to customer. Such loop flow may not be the shortest path and may not be consistent with the contracted path for the power.

Lorenz curve – A measure of income inequality for a group. It is a graph of the cumulative distribution function of the wealth from poor to rich with percentage of households plotted on the x-axis, the percentage of income on the y-axis.

Losses – Electric energy losses in an electric system primarily with heat loss from wires and other equipment. Losses for gases and liquids are typically from leaks and spills.

Low absorbers – OPEC countries that have high reserves and low populations. They can absorb smaller revenues for development than high absorbers and have a longer-term interest in their oil reserves.

Low-context culture – A culture in which there is little shared knowledge and common understanding.

Low-enriched uranium (LEU) – Uranium enriched to less than 20% U-235 with fuel used in reactor typically being 3-5% U-235.

Lowest achievable emissions rate (LAER) – Air emissions control technology that currently achieves the least emissions. LAER may be required by environmental protection agencies.

Low-power testing – Testing a new nuclear power plant at around 5% of capacity during the period of time between when fuel is loaded and when its operating license allows it to increase to full power.

LPG – Liquefied Petroleum Gas.

LPG carrier – Vehicle or vessel that transports liquefied petroleum gas.

Lurgi Process – Chemical process for gasifying coal.

M – thousand in non-metric units (mostly applied to Btus or cubic feet of natural gas), a million in metric units.

m³ – cubic meter.

Maastricht Treaty – The 1992 European treaty that created the European Single Market and the European Monetary Union. With this treaty the EEC came to be called the European Community.

Magnox - First generation of nuclear reactors in the UK, now almost phased out. They used carbon dioxide gas as coolant with graphite as the moderator.

MAI – Mean average increment.

Maintenance performance bond – The required deposit for customers on futures and options exchanges, which is continuously monitored. Whenever a customer's account falls below the requirement, there will be a margin call (performance bond call) to replenish to the required amount (also called maintenance margin).

Make-or-buy decision – If you need a manufactured item, you can go to the market and buy it, or you can vertically integrate and make the product yourself. The decision should be to do whichever is cheaper when all costs including transaction costs are included.

Management styles – Different philosophies for organizing and administering a work place. They vary by whether the focus is on workers or on the task, how centralized the decision-making is, and how change is affected.

Margin account – Money required to be deposited in an account to protect a clearinghouse from default on financial derivatives or stocks bought with borrowed money (also called maintenance performance bond).

Marginal efficiency of investment – The rate of return on the last unit of investment.

Marginal production cost (MC) – The cost of the last unit of production. It is represented by the derivative $\partial C/\partial Q$, where C is cost and Q is production.

Marginal revenue (MR) – The money earned on the sale of the last unit. Can be presented by the partial derivative $\partial TR/\partial Q$.

Marginal revenue product (MRP) – Change in revenue from the addition of one extra unit of a factor input when all other factors are kept constant. It is equal to the price of output times the marginal product of the factor.

Market clearing price – The price at which supply equals demand.

Market distortion – Externalities, market power, or government policies that distort the true costs and benefits in the market or prevent the market from reaching a social optimum.

Market forces – Influences from the activities of producers and consumers and shifts in supply and demand.

Market governance – The customary form of transactions including a spot market, long-term contracts, and vertical integration.

Market participant – Entities which buy and sell energy or energy services.

Market power – When any players in the market are non-competitive or have the ability to influence the price.

Market risk – Uncertainty from price changes.

Marketable permits – Permits to pollute that can be bought and sold in the market place.

Marketed-oriented environmental policies – Policies such as subsidies, taxes, charges and saleable permits that require economic transfers for the right to pollute or to compensate to reduce pollution.

Marketer – An entity which takes ownership of a product and then sells it rather than just brokering a deal to transfer ownership on the behalf of others.

Mark-to-market – The daily adjustment of margin accounts to incorporate profits and losses on a futures position.

Markup pricing – Charging a price that is a constant percent over economic costs. For example, if the markup is 10% and economic cost is C, then the price is 1.1C.

Masculine culture – A culture in which assertiveness, power, and success are valued and male and female roles are narrowly defined.

Maslow's hierarchy of need – The most basic needs for every human being from most basic to higher needs: (1) physiological needs, (2) safety needs, (3) esteem for self and others, and (4) need for self-up fulfillment.

Maturity date – Day when a futures contract must make arrangement for delivery or the day by which an option contract must be exercised or it will expire.

Maximum price fluctuation – The maximum amount a futures contract price can change in given period (also called limit price).

Maximum sustainable yield (MSY) – The largest average sustainable yield from a forest that can be maintained indefinitely.

MC – Marginal cost.

Mcf – Thousand cubic feet.

McWorld culture – A culture that considers the world as one large market connected by information networks moving toward automation and homogenization.

Mean annual increment (MAI) – Equals the volume of timber in a tree at harvest divided by the age of the tree at harvest, also called average sustainable yield (ASY).

Mean-reversion of stock prices – The assumption that both a stock's high and low prices are temporary and that a stock's price will tend to move to an average price over time.

Mechanical energy – Energy of motion such as wind or water.

Mediator – One who helps in a negotiation.

Megawatt (MW) – One million watts.

MENA – Middle East and North Africa.

Merger – A voluntary coming together of two independent corporations combine their equity into one new company. In a takeover, one corporation acquires control of another company without mutual agreement.

Merit order rank – The ranking of generating units by their costs for dispatch purposes.

Mesozoic – The age of dinosaurs from 245 million to 65 million years ago.

Metallurgical coal – High quality coal suitable for use to make coke for iron and steel manufacture (also called coking coal).

Methane (CH₄) – The lightest hydrocarbon molecule and usually the major component of natural gas. It is transparent, odorless, and burns with a relatively clean flame.

Methanogen – An organism able to produce methane.

Methyl tertiary butyl ether (MTBE) – C₄H₉OCH₃ is a transparent, flammable liquid made from a reaction of methanol and isobutylene. It is used to oxygenate gasoline in some places but has been phased out in the U.S. in favor of ethanol.

METI – Japan Ministry of Economy, Trade and Industry. Formerly the Ministry of Trade and Industry (MITI).

Metric tonne – a metric unit = 1000 kilograms = 2,204.62 pounds = 1.023 short tons = 0.984 long tons.

Micro – A metric prefix equal to one millionth of a unit.

Microalgae – One cell plants.

Micron – A metric unit equal to one thousandth of a millimeter.

Microseism – An earth tremor. In the petroleum industry, measurement of such tremors can indicate the volume of a hydraulic fracture (also shortened to frac).

Mill – One-tenth of one cent.

Milling – Separating value products from ore by grinding, concentration, and other treatment. For uranium milling, the ore is typically processed as follows. It is mined from underground or open pit mines. It is delivered to the mill by truck, where it is crushed into smaller pieces. Then the uranium and other heavy metals including molybdenum, vanadium, selenium, iron, lead, and arsenic are leached out of the ore with sulfuric acid (alkaline solutions or peroxide can also be used). The uranium is concentrated into yellow cake, which is typically around 70-90% triuranium oxide (U₃O₈) along with other uranium oxides and other products. The yellow cake is sent for enrichment and conversion into uranium dioxide (UO₂).

Mineral lease – An agreement between a mineral owner (lessee) and a (lessor), which gives the lessor the right to explore for, develop, and produce the mineral. The lessee retains a nonoperating interest or royalty interest while the lessor retains a working interest.

Mineral rights – The ownership of underground minerals. In most countries, mineral rights are owned by the government. In the U.S., mineral rights may be owned by the private sector, although those under government lands and offshore are owned by governments. Depending on the state laws, mineral rights in some cases may be separate from surface rights.

Minimax regrets – A game theoretic criteria for policy choice when there is uncertainty about future states of the world. First, compute the regrets or loses for each policy under each state of the world. Next, consider the maximum regrets for each policy. Then, pick the policy that has the smallest maximum regrets.

Minimum price fluctuation – The smallest price unit for futures, options, and other financial derivatives (also called a tick).

Mining – Extracting solid energy product such as coal and uranium with associated rock from the earth. Strip (open pit) mining is conducted if the energy resource is close enough to the surface to be extracted by removing overburden and mining from the surface.

Mining, underground drift mine – An underground mine where the mining tunnel is level.

MITI – Japan’s Ministry of Trade and Industry. It has been very influential in promoting industry and exports in Japan. MITI was reorganized in 2001 and has been renamed the Ministry of Economy, Trade, and Industry (METI).

Mitigation – Procedures to avoid and reduce pollution emissions and their impacts.

Mixed oxide fuel (MOX) – Nuclear power plant fuel that contains uranium as well as recycled plutonium. The usual mix contains about 5% Pu-239.

MM – Million in non-metric units.

MMBtu – One million British thermal units.

MMBtu/ston – One million British thermal units per short ton.

MMC – Monopolies and Mergers Commission. Competition authority in UK.

Model of competition – Model of a market in which there is a homogenous product, many buyers and sellers with none having market pricing power, and each member of the market pursuing her own self-interest. If it is a perfectly competitive market model, each player has perfect information on relevant economic aspects of the market.

Moderator – Material that slows down neutrons so that fissile fuels can sustain a chain reaction. They include light or heavy water and graphite.

MODU – Mobile Offshore Drilling Unit.

Module – PV cells connected together and sealed into one unit of standard size and electricity output (also called a PV panel). It is the basic building block of a PV array.

Monoculture – Cultivating a crop with only one species.

Monolithic – Fabricated as a single structure.

Monopsony – A market in which there is one buyer of the good.

Moore’s Law – Computer power doubles every 18 months.

MOX – Mixed oxide nuclear fuel.

MR - Marginal revenue.

MRP – Marginal revenue product.

MTBE (Methyl tertiary butyl ether) (CH₃)₃COCH₃ – An oxygenate that can be added to gasoline to ensure complete combustion with no carbon monoxide production. It is created by the chemical reaction of methanol and isobutylene. Both of these inputs are derived from fossil fuels. It has been phased out in the United but is used elsewhere in the world.

Mtoe – Millions of metric tonnes of oil equivalent.

MTPA – Million tonnes per annum.

Multi-period dynamic model – A model of a fixed resource with the net present value of profits as the objective function, which allocates production over more than two periods.

Multipiant monopoly – One producer and seller in a market that produces in more than one plant.

Multivariate time series – A statistical forecasting technique in which a variable is forecast by using historical values of itself and other related variables.

Municipal solid waste (MSW) – Solid trash collected by municipalities that may have potential to produce energy.

Municipal utility – An electric utility owned by a municipality rather than private investors. Such utilities are typically small and regulated under different principals than investor owned utilities (IOUs).

MW – Megawatt.

MWh – Megawatt hour.

N₂O – Nitrous oxide.

NAESB – North American Energy Standards Board.

Naphtha – A fraction of crude oil generally including products from C5-C12. It is used to produce gasoline and as a petrochemical feedstock.

National Ambient Air Quality Standards (NAAQS) – U.S. national standards on criteria pollutants. These controls were authorized by the 1970 U.S. Clean Air Act, which was amended in 1977 and 1990. They are to be set and implemented by the U.S. Environmental Protection Agency (EPA). These are common pollutants, which determine air quality. They include sulfur dioxide (SO₂), nitrogen dioxide (NO₂), volatile organic compounds (VOC), particulate matter, carbon monoxide (CO), and lead (Pb).

National Emissions Standards for Hazardous Pollutants (NESHAPS) – U.S. Federal standards that control toxic pollutants.

National Environmental Policy Act (NEPA) – A 1969 U.S. federal law that requires all federal agencies to analyze the environmental impacts of any proposed activity including creating and making publically available environmental impact statements.

National Forest Management Act – A U.S. federal law passed in 1976 requiring the regulation of exploited forests on U.S. Federal land.

Natural gas – Gaseous mixture of hydrocarbons and nonhydrocarbons found in underground source rock. The most important component is usually methane (CH₄), but it may contain ethane (C₂H₆), propane (C₃H₈), butane (C₄H₁₀), and pentane (C₅H₁₂). The last three, called natural gas liquids (NGL) are typically removed and sold separately. Propane and butane are also called liquid petroleum gases (LPG). Natural gas may also contain inert material, such as helium, that lowers its heating value. Such products that are typically removed before sales.

Natural gas liquids (NGL) –Liquids stripped out of natural gas at gas plants and sold separately: propane (C₃H₈), butane (C₄H₁₀), and pentane (C₅H₁₂).

Natural gasoline – Liquids derived from natural gas and composed of pentane, hexane, and heptane. Some references also include propane and butane. It can be used as blending stock for gasoline.

Natural monopoly – An industry in which average costs fall as the firm gets larger. In such a market, it is more economical for there to be only one producer.

Natural reservoir pressure – The natural energy in an oil or gas reservoir, which pushes oil or gas to the surface in an oil well. It can come from dissolved gas, a gas cap over the oil or water pressure.

Natural uranium – Uranium with the standard isotopic mixture found in nature (99.3% U-238, 0.7% U-235 and a bit of U-234).

Nautical mile – A unit of distance for water travel. One nautical mile, called a knot, is equal to 1.152 land miles or 1.852 kilometers.

Nearby – The closest trading month of an active futures or option on a futures contract (also called lead month).

NEB – National Energy Board of Canada.

Negative externalities – An externality is an effect from an economic activity that involves someone not directly involved in the economic activity. The externality is negative if the effect imposes a cost on the external party.

Negotiating style – The manner in which a negotiation is conducted. It can include whether concessions are made as the negotiation proceeds and whether the strategy is cooperative or competitive.

NEPA – U.S. National Environmental Policy Act.

NEPOOL – New England Power Pool.

NERC North American Electric Reliability Council. (<http://www.nerc.com>).

Net change – The difference in price from one day's closing price for a futures or option contract to the next day's.

Net energy production – The actual amount of electric power produced. Primary energy production is measured as the number of kilowatt-hours output not the amount of energy in the fossil fuels that would be required to produce the electricity.

Net generation – Gross electricity generation minus any electricity energy consumed by the generating station.

Net present value – The amount of money you would need today to be able to replicate a future stream of income at the given interest rate.

NETA – New Electricity Trading Agreement in the United Kingdom.

Netback pricing – Setting a resource price by taking end price and deducting costs of getting it to market. If the product were crude oil, it would mean setting the crude oil price per barrel by taking the weighted average product price per barrel and subtracting transportation costs, refinery margins, and taxes.

Network – A system of channels that interconnect. The interconnection points are called nodes. Often networks are for transportation or communication.

Network model – A simplified mathematical representation of a system of interconnected channels with the interconnection points (nodes). The channels often represent transportation links. The nodes may represent energy transformation processes such as refineries or electricity generation, energy consumption, or energy production.

Neutral culture – A culture that does not display emotions in public.

Neutron – A subatomic particle of neutral charge residing in the nucleus of an atom and composed of an electron and a proton bound together.

New Source Performance Standards – (NSPS) U.S. Federal Standards for very large new sources of air pollution.

New York Mercantile Exchange (NYMEX) – A futures and options exchange that is now part of CME group, one of the largest derivative trading group in the world.

NFFO – Non-fossil Fuel Obligation in the United Kingdom.

NGA – U.S. Natural Gas Act of 1938.

NGC – National Grid Company in the UK. It has now been broken up with one of the resulting company owning and operating the electricity transmission company in England and Wales and another owning and operating the natural gas transmission network.

NGPA – Natural Gas Policy Act.

NHydEl – Non-hydro renewable electricity.

NO – Nitric oxide.

NO₂ – Nitrogen dioxide.

NOC – National Oil Company.

Nonattainment area – A region that does not meet the U.S. Federal Air Pollution Standards for criteria pollutants.

Nonbranded product – Any refined petroleum product without a refinery brand name.

Non-excludable in consumption – Goods for which it is not possible to prevent someone from consuming them. Pure public goods are non-excludable in consumption, whereas private goods are not.

Nonlinear programming – Optimization subject to constraints where some or all of the functions are not linear.

Nonoperating interest – A mineral lease interest, such as a royalty or other cash payment, that does not allow operation of a mineral property.

Non-rivalry in consumption – One person's consumption of a good does not reduce the amount available to another person. I can consume information but it does not reduce the amount of information available for another to consume. A pure public good has this quality and is said to be non-rivalrous in consumption. It also has the quality of being non-excludable. However, private goods are rivalrous and excludable.

Non-spinning reserve – Off-line generating capacity that can be loaded or interrupted in ten minutes and can be run or interrupted for at least two hours.

Nonverbal communication – The exchange of information through body language and other means that do not use words.

NordPool – Nordic Power Pool. (<http://www.nordpoolspot.com/>).

No-regrets policy – If we are uncertain about whether a negative state of the world such as global warming will occur or not, we may not want to undertake policies to offset the global warming. However, if we can design a policy that corrects a second problem, such as local pollution, that would also help offset global warming, that policy would be called a no-regrets policy.

North American Electricity Reliability Council (NERC) – A nonprofit voluntary organization formed in 1968 to promote secure electricity service in the United States, Canada, and parts of Mexico. (<http://www.nerc.com/>).

North American Energy Standards Board (NAESB) – A nonprofit organization that develops, maintains and disseminates voluntary standards and best business practices for competitive, efficient and reliable energy services throughout North America. Prior to 2002, it was the U.S. Gas Industry Standard Board (GISB).

North American National Electricity Reliability Corporation (NERC) – A non-profit international organization charged with maintaining the reliability of the North American bulk wholesale electricity market.

Not in my back yard (NIMBY) – Individual's preferences to not want things built near them, particularly construction that is potentially unpleasant or dangerous (e.g. power plants and waste disposal areas).

Capacity turnback – In the U.S. natural gas industry, long run transportation capacity contracts that were not renewed

Nova – Stellar explosions caused by a fusion reaction when a dying star (white dwarf) attracts enough matter from another star to support nuclear fusion.

NO_x – Nitrogen oxides.

NPV – Net present value.

Nuclear Energy – The force that holds the nucleus of an atom together. Energy may be emitted when an atom is split as in fission, or when atoms are smashed together as in fusion.

Nuclear power plant – A facility in which fissioning nuclear fuel provides the heat to raise the steam that drives a steam turbine to generate electricity.

Nuclear reactor – The mechanism in a nuclear power plant where the controlled chain reaction takes place to heat the steam to produce power.

Nuclear Regulatory Commission (NRC) – The U.S. federal agency that regulates and inspects nuclear power plants to ensure their safety.

Nuke – Slang for nuclear power plant.

NYMEX – New York Mercantile Exchange now owned by CMEGroup.
(<http://www.cmegroup.com/>).

NYMEX Access – NYMEX's after hours trading platform now owned by CMEGroup.
(<http://www.cmegroup.com/>).

NYPP – New York Power Pool.

NZX – New Zealand Exchange.

O&M – Operation and maintenance.

OASIS – Open access same-time information system.

Objective function – The function to be maximized or minimized in an optimization model.

Obligation to serve – A U.S. regulation requiring an electric utility to provide electricity for all customers.

OBO – Oil/Bulk/Ore carrier (also called combination carrier).

Ocean thermal energy conversion (OTEC) – An energy technology that uses the difference in temperatures between different layers of the ocean to produce electricity.

Octane (C₈H₁₈) – A petroleum product, which has very good combustion qualities in 4-cycle gasoline engines. It boils at 124.6 °C.

Octane rating – A measure of the antiknock property (premature ignition) of gasoline. Iso-octane has a rating of 100 and heptane has rating of zero. An octane rating of 90 would have the same knock characteristics as of mixture of 90% iso-octane and 10% heptane.

OECD – Organization for Economic Cooperation and Development. (<http://www.oecd.org>).

Offer – A signal of the willingness to sell an exchange traded contract at a given price (also called an ask price).

Offset – Making an opposite transaction, i.e. selling if one has bought, or buying if one has sold, a futures or an options on a futures contract. This action cancels out the original contract. Pollution offsets would be a reduction in pollution in one activity to allow an increase in pollution from another.

Offshore – Geographic area that is underwater, usually in the ocean or sea.

Off-system natural gas – Natural gas that was outside of the regulated pipeline system in the United States. Hence, pipeline companies did not take ownership of this gas.

Ohm – The unit to measure resistance to the flow of an electric current. One ohm is the amount of resistance required to limit a current flow to one amp when one volt of force is applied. Ohms = volts divided by amps.

Oil above-ground costs – Distributing oil and gas finding, developing, and operating costs over the production of the well. It includes the cost of waiting for the oil to be produced.

Oil and gas reserves – The amount of oil and gas that is known to be economically producible at current prices. Also called proven or known reserves.

Oil and gas resources – The total amount of oil and gas in the earth's crust. All of these resources will never be found and produced.

Oil in-ground costs – The total cost of finding oil reserves divided over all the reserves found.

Oil sands – Heavy oil deposits in which much of the lighter products have evaporated (also called tar sands).

Oil shale – A sedimentary rock that contains kerogen. These rocks can be mined and processed to produce oil, historically referred to as shale oil. Oil shale differs significantly from oil bearing shales, which are currently being fraced, to produce light crude oil. Although this light oil is popularly called shale oil, it is not. It is better called light tight oil.

Oil spill – An accident in which oil escapes containment and leaks onto the ground or into a waterway.

Oil tanker – Ship for carrying crude oil or refined products.

OLEC – Organization of LNG Exporting Countries (not a real organization).

Oligopoly – A market characterized by a few large sellers with market power or some ability to affect market price of their product.

OLS: Ordinary least squares.

On-system natural gas – Natural gas that was purchased and transported by pipelines and so was inside of the regulated pipeline system in the United States. Hence, pipeline companies took ownership of this gas.

OPA – The U.S. Oil Pollution Act of 1990. U.S. federal law designating emission regulations on ship owners trading in U.S. waters.

Opacity – How much air pollutions reduces the transmission of light and the visibility of distant objects.

OPEC – Organization of Petroleum Exporting Countries. An oil cartel whose mission is to coordinate the policies of the oil-producing countries.

OPEC basket of marker crudes – A basket of representative crude oils with one from each OPEC country. The average price of this basket is the price of OPEC marker crude.

OPEC price elasticity of demand – The percent change in quantity of OPEC oil bought as the result of a percent change in price of OPEC oil. In a dominant firm model, it is equal to $\varepsilon_w Q_w / Q_o - \varepsilon_f Q_f / Q_o$, where ε_w equals the world's demand elasticity, Q_w equals world production, Q_o equals OPEC production, ε_f is the supply elasticity of the competitive fringe and Q_f is the oil production of the competitive fringe.

Open – The period at the beginning of the trading session. Sometimes used to refer to the opening or first price of trade (see also closing).

Open access – Allowing non-owners of a facility its use on a nondiscriminatory basis (also called third party access). Open access facilities are called common carriers.

Open interest – The total number of active futures or options on futures contracts. Such contracts have not been offset or fulfilled with delivery. It indicates how many participants are using a particular contract for risk management.

Open order – An order to a broker that is to be filled when the stipulated conditions are met unless otherwise cancelled.

Open outcry (OO) – A method of bidding by verbal signal for financial assets and commodities on organized exchanges.

Open top hopper cars - Open freight cars allowing coal poured into the top. Their floor slopes to hinged doors allowing unloading of the coal.

Opening price – The price of the first trade of the day on an organized exchange.

Opening range – The range of bid and ask prices on an exchange when the first transaction of the day is completed.

Operational risk – Technical problems related to financial trading systems including computer failures and fraud.

Opportunism – Taking advantage of an opportunity without considering the ethical aspects of the consequence.

Opportunity cost – What you forgo by undertaking an economic activity. The value of a resource in its next best alternative.

Opposite position – In a futures market, if you are long in the cash market, you short a future, and if you are short in the cash market, you buy a future.

Optimal level of pollution – That level of pollution that maximizes the net benefits of pollution (total benefits minus total costs). Under normal circumstances the optimal level of pollution is that amount where the marginal benefits of pollution equal the marginal cost of pollution.

Optimization models – Models in which the outputs are choice variables that give your objective function the most favorable value.

Option – The right to buy (call) or sell (put) an underlying asset at a given price (strike price) that expires on a specific date.

Option holder – One who purchases an option.

Option quote – The highest bid (highest price someone is willing to pay) and the lowest offer (lowest price someone is willing to sell for). If the bid and offer are the same a transaction takes place.

Ordinary least squares (OLS) – A popular econometric technique for estimating the parameters of a linear equation using historical data. Parameters are chosen by minimizing the sum of the squared errors, which are the vertical distances from the line and the dependent variable.

Organic – Material created by living organisms.

Organic compounds – Chemical compounds based on carbon chains or rings and also containing hydrogen, with or without oxygen, nitrogen, and other elements.

Organization for the Advancement of Structured Information Standards (OASIS) A nonprofit organization with more than 500 corporations in more than 100 countries as members. The organization started in 1993 as SGML Open. The name changed to OASIS in 1998 and the organization is working with UN/CEFACT on open access ebXML. (<http://www.ebxml.org/>).

Organizational IQ – An organization’s ability to adjust to change.

Oslo City Group – An organization formed by the United Nations Statistical Commission (UNSC) in 2005 devoted to improve energy statistics by developing better international standards and data collection methodology. (<http://oslogroup.org/>).

OTC – Over the Counter. A bilateral transaction not completed on an organized exchange.

OTEC – Ocean thermal energy conversion.

Out of the money – When the spot price of the underlying asset is above the strike price for a put, it is out of the money. When the spot price of the underlying asset is below the strike price for a call, it is out of the money.

Outage – A temporary loss of power from isolated electricity transmission, generation, or distribution failures.

Outer-Directed Culture – Culture that believes members have no control of their own lives but an external force is in control.

Outsourcing – Paying another company to make a product or perform a service for you.

Overburden – Rocks, soil, and other materials that lie on top of a coal seam or mineral deposit.

Overnight capital cost – The capital cost of a project if it could be constructed overnight. This cost does not include the interest cost of funds used during construction.

Over-the-counter market (OTC) – A market where transactions are privately arranged by phone, fax, and other means rather than on an organized exchange.

Own price elasticity – Percent change in quantity (Q) of a good divided by the percentage change in its own price (P) (often written as $(\partial Q/\partial P)(P/Q)$). If it’s a supply elasticity, the quantity is the change in production, and if it’s a demand elasticity, the quantity change is the change in quantity purchased.

Oxide fuels – Uranium dioxide (UO₂), which is made into fuel rods for use in most nuclear reactors. Whether it is enriched (the most common situation) or not depends on the type of reactor.

Oxygenated gasoline – Gasoline containing oxygen for more complete combustion and the reduction of carbon monoxide emissions.

Paleozoic Era – Time period that spans from 544 to 245 million years ago, when most fossil fuel resources were formed.

Panamax – A class of ship from 55,000 dwt and 80,000 dwt that carries most of the oil products. It is the largest size class that can go through the Panama Canal.

Paper barrel – A crude oil futures contract as opposed to an actual barrel of oil, which is sometimes called a wet barrel.

Parallel connection – Hooking two electrical devices together, connecting positive ports together and negative ports together; to increase the current flow.

Partial derivative – A mathematical term that represents the change in the dependent variable (y) as the result of a change in one of the independent variables (x_i) designated by $\partial y/\partial x_i$.

Particularist culture – A culture that believes that norms, values and behavior patterns are determined by the particular circumstances as opposed to a universalist culture that believes norms, values and behavior patterns are valid everywhere at all times.

Particulate emissions – Tiny bits of liquid or solid matter discharged with exhaust gases. Those between the sizes of 2.5 and 10 microns are called PM10 and those less than 2.5 microns are called PM2.5.

Passive solar energy – Designing buildings to minimize the amount of energy needed to heat and cool. For example, in temperate climates southern facing windows with appropriately designed eaves will let in heat in the winter, but not in the summer when the sun is higher.

Payroll tax – A tax on wages and salaries. In the United States, it is used for social security payments.

PCB's – Polychlorinated biphenyls. Organic compounds that are highly toxic to living organisms. They are persistent and accumulate up the food chain. They have been used in insulation for electrical equipment, lubes, paints, adhesives and flame retardants with their disposal now regulated.

PDNP – Proved developed non-producing reserves.

PDP – Proved developed producing reserves.

Peak load pricing – Charging higher prices during peak hours than off-peak hours. With straight fixed variable rates, peak users pay for capital or capacity costs whereas off-peak only pays for the variable costs.

Peak load/peak demand – The maximum load (electricity use) during a given period of time such as a day.

Peak/off-peak demand – Peak demand, also called peak load is the highest level of demand over a given time period. Off-peak is demand the rest of the time.

Performance based ratemaking (PBR) – Regulated rates based on performances objectives, not actual costs.

Petrochemicals – Organic compounds and products most often made from naphtha or natural gas liquids. They include plastics, resins, synthetic fibers, dyes, pigments, detergents, ammonia, and fertilizer.

Petroleum – Hydrocarbon mixtures that include crude oil, refined products, lease condensate, natural gas, natural gas liquids, and refinery blending stocks.

Petroleum coke – A solid carbon residual left after refineries remove the more valuable lighter products in crude oil. The three types of petroleum coke are specialty or needle coke; calcined or anode coke; and green, raw or fuel coke.

PFCs – Perfluorocarbons, potent greenhouse gases containing only carbon and fluorine.

pH – The activity of a hydrogen ion in a solution. It indicates whether a material is acidic or alkaline. Acidic substances have a pH lower than 7 and basic or alkaline substances have higher pH higher than 7.

Photon – A particle of light that acts like an individual packet or unit of energy.

Photosynthesize – Chemical process within plants that creates carbohydrates from carbon dioxide, water, and light.

Photovoltaic (PV) – Mechanism to convert sunlight to DC electricity.

Photovoltaic (PV) array – An interconnected system of PV modules or panels that produce electricity as a single unit.

Photovoltaic (PV) cell – The smallest semiconductor that converts light into DC electricity. Cells are connected into modules or panels, which can be used individually or connected into larger arrays.

Photovoltaic (PV) conversion efficiency – The ratio of the electric energy produced by a photovoltaic device to the energy of sunlight received by the device. This is typically about 9% to 14% for commercially available cells. Higher efficiencies can be attained, but at significantly increased cost.

Photovoltaic (PV) peak watt – Maximum rated output of PV system. Typical rating conditions are 1000 watts per square meter of sunlight at 20 °C.

Photovoltaic (PV) system – The PV and all peripheral equipment required to deliver useable electricity.

Pilot scale – A system size between a small laboratory model size (bench scale) and a full-size commercial system.

Pipeline – Large metal conduit that carries crude oil, oil products, and natural gas under pressure. Liquid pipelines have pumping stations to move the product, whereas gas pipelines have compressors.

PJM – Pennsylvania, New Jersey, Maryland power pool.

Plant products – Natural gas liquids separated out in natural gas processing plants including ethane, propane, butane, and natural gasoline.

Plutonium – A fissile transuranic element with atomic weight of 239. It is formed from uranium U238 in a nuclear reactor. Weapons-grade plutonium is more than 90% Pu-239 while reactor-grade is 70% Pu-239.

PM10 – Particulates emitted from combustion and other sources that are between 2.5 and 10 microns in diameter.

PM2.5 – Particulates emitted from combustion and other sources that are less than 2.5 microns in diameter.

Policy – A plan or course of action to influence an outcome. A government policy is often implemented and enforced by passing a law.

Polluter pays principle – Charging or making a polluters pay to pollute or pay for clean up rather than subsidizing them not to pollute. Economists believe that the polluter pays principle is more likely to give an efficient outcome than subsidizing clean up.

Pollution permits – Legal authorization to pollute. If it is marketable, it can be bought and sold.

Pollution tax – A tax paid to the government for the right to pollute.

Polymerization – Chemical process that bonds monomers together to make polymers. In a refinery, it can be used to make gasoline from refinery gases.

Positive externality – An externality is an effect from an economic activity that bestows a benefit on the external party.

Pound (lb) – A non-metric measurement of mass equal to 0.454 kilograms.

Power culture – A culture that values the control over others.

Power distance – The degree of equality in a group.

Power exchange (PX) – Independent agency facilitating wholesale power sales. It typically holds auctions for electricity that is not traded by bilateral contracts. Trade is typically traded in a day-ahead and hour-ahead markets. It sets market clearing prices and performs settlement and billing services for the PX market.

Power marketers – Economic players that purchase and re-sell electricity but do not have any generation or transmission facilities of their own.

Power pool – An organization that operates an electric utility system in the short term. It economically dispatches power from various generating units and facilitates transactions in the wholesale market. It may or may not own the transportation system.

PP&E – Property, plant, and equipment.

PPP – Purchasing power parity. An index used to convert income in one currency to another currency. It is based on a basket of consumer goods rather than an exchange rate and is more likely to better measure what the income buys a consumer.
(<http://www.imf.org/external/pubs/ft/fandd/2007/03/basics.htm>)

Precambrian – The period from 4.5 to 0.455 billion years ago during which life formed on earth.

Preferred stock – A financial asset that represents equity interest in a company. It gives a right to share in the profits of the company and a right to a share of remaining assets if the company has to be liquidated. Preferred stock stipulates a maximum dividend rate that does not have to be paid but which must be paid if common stock is paid any dividends.

Present value – The worth of future receipts or costs expressed in current value. To obtain present value, an interest rate is used to discount future receipts or costs.

Prevention of significant deterioration (PSD) – A regulation in the U.S. Clean Air Act, which requires that a proposed new source of air pollution in an area will not be permitted unless it does not cause significant deterioration of the air quality.

Price discrimination – Selling goods to different buyers at different prices.

Price elasticity of demand – Percentage change in quantity demanded (Q_d) of a good divided by the percentage change in its own price (P_d) (often written as $(\partial Q_d / \partial P_d)(P_d / Q_d)$). It is a measure of how responsive quantity demanded is to price.

Price elasticity of supply – Percent change in quantity supplied of a good divided by the percentage change in its own price (often written as $[(\partial Q_s / \partial P_s)(P_s / Q_s)]$). It is a measure of how responsive quantity supplied is to price.

Price regulation – Government regulation that limits the price that can be charged for a good or service. This regulation includes rate of return, RPI-X, light-handed, and yardstick regulation.

Primary electricity – Electricity not produced from fossil fuels, it includes nuclear, hydro, and power from other renewables.

Primary energy – The energy contained in fossil fuels, uranium, and renewable energy sources that has not been changed into another form. Secondary energy is the result of the conversion of primary energy such as oil products from refineries or electricity from fossil fuels.

Primary recovery – Recovery of oil from a reservoir comes from natural sources within the reservoir including pressure from natural gas or water; gravity drainage; or artificial lift from a pump. The recovery rate is typically 5-15% of the oil in place.

Private interest rate – The private or non-government rate paid to borrow money.

Process heat – Heat used in an industrial process rather than for space heating or other uses.

Producer surplus – An amount over and above what a producer needs to continue producing at the same level. In a competitive market, it is the area of above the supply curve and below the price (also called Ricardian rents).

Producing Property – A term referring to a property, well, or mine that produces commercial quantities of a wasting natural resource.

Product tanker – Marine vessel that carries refined oil products.

Production profile – How production changes over time.

Production sharing agreements – A legal contract in which a company produces oil for the owner and gets a percent of the production in payment.

Profit tax – Usually a tax on accounting profits or on total revenues minus accounting costs, which do not include opportunity cost. A tax on economic profits would be on total revenues minus economic costs, which includes opportunity cost. A tax on economic profits is seldom passed since it is difficult to measure economic profits.

Propane – Hydrocarbon gas with formula C_3H_8 . It is liquid under pressure and is sold as a liquid petroleum gas.

Prorationing – Government regulations on how much can be produced from a given oil well or a pipeline allocation of line space to shippers.

Proton – Subatomic particle in the nucleus of an atom with a positive charge atomic weight of one.

Proven oil reserve – Known oil reserve that can be economically produced at current prices.

Proximate Analysis – Measurement of components and properties of coal usually including moisture, volatile matter, fixed carbon, ash sulfur content, Btus per pound, ash fusion temperature, and grindability.

PSA – Production Sharing Agreement.

Psi – Pounds of pressure per square inch.

Psia – Pounds force of pressure per square inch absolute (including atmospheric pressure).

Psig – Pounds force of pressure per square inch gauge (excluding atmospheric pressure).

Public good – A good that is non-rivalrous and non-excludable. That is, one person's consumption of it does not reduce the quantity for another and no one can be excluded from its use.

Public utilities commissions (PUCs) – State regulators of public utilities.

Public Utility Regulatory Policies Act (PURPA) – A 1978 U.S. federal law requiring a utility to buy the power produced by a qualifying facility (QF) at a price equal to avoided costs.

PUC – Public utility commission.

PUD – Proved undeveloped reserves.

PUHCA – U.S. Public Utilities Holding Company Act of 1935 providing regulation of public utilities at the federal level.

Pulp chips – Wood cut into small fairly uniform pieces for use in burning or to produce paper.

Purchasing power parity (PPP) – A price index used to convert the values from one currency to another. The index is based on a basket of goods rather than exchange rates.

PURPA – See Public Utility Regulatory Policies Act.

Put option – The right, but not the obligation, to sell an underlying asset at a strike price with a fixed expiration date.

PV – Photovoltaic solar cell or present value.

Pyrolysis – An anaerobic process to decompose biomass at temperatures greater than 200 °C (392 °F). End products include solids (char), liquids (oxygenated oils), and gases (methane, carbon monoxide, and carbon dioxide).

Quad – Quadrillion Btus.

Qualifying facility (QF) – A small producer or co-generator that is allowed to sell electricity to public utilities under the authority of the U.S. Public Utilities Regulatory Policies Act of 1978.

Quasi-rent – Rent is reimbursement for the use of something of economic value, which includes labor, land, capital, energy, ideas, and money. Rent for labor is usually called wages or salaries, rent for capital and land is usually called rent, rent for energy and ideas may be called royalties, and rent for money is called interest. Economic rent occurs when the rent payment is larger than necessary to entice the product into the market. Quasi-rent is excess payment that is larger than necessary in the short run to entice the product into the market. It is equal to price minus variable cost, since in the short run it is only necessary to cover variable costs. Any fixed cost is a quasi-rent in the short run. However, in the long run all costs must be covered as fixed costs become variable and quasi-rents should disappear.

Quaternary – The age of humans from roughly 1.8 million years ago to today.

Quota – A fixed limit on the amount of a product that may be imported.

R&D – Research and development.

R/P – Reserves to production ratio.

Radiant energy – Energy in the form of electromagnetic radiation including light, television, radio, infrared and X-rays.

Radioactive decay – Release of alpha or beta particles or gamma radiation which reduces the nuclei in radioactive elements until they are converted to stable elements.

Radioactivity – The decay particles or radiation of an unstable atomic nucleus losing energy.

Radionuclide – A radioactive isotope of an element.

Ramping – Changing the production level of an electricity generator over a fixed time. Ramping up is increasing electricity production and ramping down is decreasing electricity production. Ramp rate is how quickly this can be done. They tend to range between 10 and 100 MW/minute with a typical ramp rate for an industrial gas turbine of 25 MW/minute.

Rapid discharge car – Open top rail cars with doors opening in the bottom of each car. Loading is accomplished by dumping coal in the top and unloading is accomplished by opening the bottom door. Such a train can be unloaded at speeds of up to 6 m.p.h.

Rate base – In rate of return regulation, the rate base is the value of the capital stock upon which you earn the legal rate of return.

Rate of return – The interest rate that makes the stream of net revenues for a project equal to zero. Also called the internal rate of return.

Rate order – A regulation setting a regulated enterprise's allowed prices or rates.

Ratio vertical spread – A spread is buying more than one derivative in a trading strategy. Ratio vertical spreads are selling more options than you buy all with the same expiration. For a put ratio vertical spread, you buy at the higher strike price and sell at the lower, whereas for a call ratio vertical spread, you buy at the lower strike price and sell at the higher.

Raw coal (Run-of-mine coal) – Coal as extracted from the seam with no further processing, such as washing, crushing, or sizing.

RBOB – Reformulated regular gasoline blendstock for oxygen blending. It is a wholesale non-oxygenated gasoline fuel used for blending with 10% fuel ethanol to form retail gasoline in the U.S.

RCRA – U.S. Resource Conservation and Recovery Act.

Real assets – Physical or tangible assets such as buildings, capital stock, and patents as opposed to financial assets, which represent debt.

Real options – The right, but not the obligation, to undertake certain business initiatives, such as deferring, abandoning, expanding, staging, or contracting a capital investment project.

Real-time market – The immediate or current market for electricity.

Rebound effect – When an energy-using piece of equipment becomes more efficient, less energy is used to produce the same energy service. However, then energy cost for the energy service falls, which might increase the amount of energy service demanded. This increase in energy service demand is called the rebound effect.

Reclamation – Restoring the surface environment to a required level after underground resources have been developed and/or removed such as land fill, equipment removal, well plugging, and restoring vegetation.

RECs – Regional electricity company. Electricity distributors in the United Kingdom.

Rectifier – A device that converts AC to DC electricity (e.g. battery charger or converter).

Redispatch – Changing the dispatch or generation output schedules to balance the market in response to transmission congestion as well as unexpected power needs or generation.

Redrill footage – If a well hole is lost or a portion needs to be abandoned, a second hole called redrill footage may be drilled from the surface close to the first hole. The first hole is reported as a dry hole (exploratory or developmental) and the total footage is reported as dry hole footage and the second is reported according to the ultimate outcome of the drilling (oil, gas, oil-gas, or dry hole).

Re-engineering – Reorganizing production or other processes within a firm to make the firm more efficient and profitable.

Refined petroleum products – Products created from crude oil and other blending stocks in an oil refinery. They vary depending on crude quality and refinery processes but may include liquefied petroleum gases, kerosene, gasoline, distillates and diesel fuel, residual or heavy fuel oil, asphalt, lubricating oils, and petroleum coke.

Reforming – A process in a refinery that uses heat and pressure in the presence of a catalyst to raise the octane of gasoline.

Reformulated motor gasoline – Gasoline that is designed to produce less CO and soot, which are two precursors to smog. It is required in cities with high smog levels by the U.S. 1990 Clean Air Act.

Regasification plant – A plant that changes liquefied natural gas (LNG) back to a gas.

Regional pollutant – Pollutants that are restricted to a local region such as smog, which typically exists over a city. As opposed to a global pollutant that affects the whole globe such as excess CO₂.

Regulatory stability – When regulations are not changed often or in unpredictable ways.

Reid vapor pressure – A measure of how easily a liquid, particularly gasoline, evaporates.

Reliability – The performance of the bulk electric system to deliver electricity to customers within acceptable guidelines. Lack of reliability may be measured by the frequency, duration, and magnitude of adverse effects such as black outs and brown outs.

Religious culture – A culture that values unity with the cosmos.

Remote systems – Systems off of the utility grid.

Renewable energy resource – An energy resource replenished continuously from natural sources. Renewable energy resources include bioenergy, solar energy, wind energy, geothermal power, and hydropower.

Renewable fuels standard (RFS) – Regulations that require some use of renewable fuels. The first U.S. federal RFS program was created under the Energy Policy Act (EPAAct) of 2005, and it required 7.5 billion gallons of renewable-fuel to be blended into gasoline by 2012.

Renewable portfolio standard (RPS) – A requirement for increased production of energy from renewable energy sources, such as wind, solar, biomass, and geothermal. It may also be called renewable energy standard, renewable electricity standard and renewable obligation.

Rent – Reimbursement for the use of something of economic value, which includes labor, land, capital, energy, ideas, and money. Rent for labor is usually called wages or salaries, rent for capital and land is usually called rent, rent for energy and ideas may be called royalties, and rent for money is called interest. Economic rent occurs when the rent payment is larger than necessary to entice the product into the market. The amount of the economic rent on a unit is price minus marginal cost.

Reprocessing – Chemically processing spent nuclear fuel to recovering reusable uranium and plutonium. Reprocessing can reduce nuclear waste by up to 95%.

Reservation price – The price at which an economic entity is willing to make a transaction. For a buyer, it is the highest price he will pay, and for a seller, it is the lowest price she will accept.

Reserve margin – The amount of electrical capacity above the peak or maximum electricity demand.

Reserve over production ratio (R/P) – Current proven reserves divided by current production. It is a measure of how long current reserves would last at the current rate of production.

Reserves, proved – The estimated quantity of unproduced fossil fuels that can be expected to be profitably produced under existing economic conditions and technology. Estimates are made from geological and engineering data.

Reservoir – Underground porous and permeable rock containing trapped oil and/or gas.

Residual fuel oil – A heavy hydrocarbon product with sulfur and metal in it that is left after the lighter more valuable products have been boiled off from crude oil. Also called heavy fuel oil or mazout in Russia, it has a typical boiling range of 104 – 127 °C (220 – 260 °F).

Resource Conservation and Recovery Act – (RCRA) A 1976 U.S. federal environmental law regulating the creation, processing, movement, and disposal of solid and hazardous waste.

Restoration – Repairing damage to an area caused by the energy supply chain.

Retail sales – Electric energy sales to end-use customers.

Retailer – An entity that buys power or other goods or services for end-use customers (e.g. marketer, broker, and local distribution company).

Retrofitting – Changing already operating facilities (e.g. adding conservation equipment or pollution control devices to existing plant). This is typically more expensive than including such equipment in new plants.

Return on investment (ROI) –The interest rate for which the net present value of a project is zero.

Ricardian rent – Rent is reimbursement for the use of something of economic value, which includes labor, land, capital, energy, ideas, and money. Rent for labor is usually called wages or salaries, rent for capital and land is usually called rent, rent for energy and ideas may be called royalties, and rent for money is called interest. Economic rent occurs when the rent payment is larger than necessary to entice the product into the market. The amount of the economic rent on a unit is price minus marginal cost. Ricardian rent arises when some producers have lower cost than others but receive the marginal cost of the marginal producer. Ricardian rent helps allocate fixed quantities of low cost resources over their most valuable uses.

Ring fenced – Keeping the accounting books strictly separate for a non-regulated and a regulated division of a company. This is to prevent the regulated segment from subsidizing the non-regulated segment. A ring fence is sometimes called a Chinese wall.

Risk – Uncertainty or unknown variability in expected economic outcomes.

Risk Averse – A preference for a sure outcome to an uncertain outcome with the same expected value.

Risk lover – A person who prefers an uncertain outcome with the same expected value to a certain outcome of equal value.

Risk neutral – An indifference between a sure outcome to an uncertain outcome with the same expected value.

Risk premium – The amount you have to compensate someone over the risk free rate to take on an investment with a variable return.

Risk-free interest rate – The interest rate on an asset in which there is essentially no possibility of default, such as a bond from a totally reliable government.

Rivalry in consumption – One person's consumption of a good precludes another person from consuming it. A pure private good has rivalry in consumption, whereas a pure public good does not. A pure private good is also excludable in consumption whereas a pure public good is not.

ROI –Return on investment.

Rotary Dump Unloading – A method for unloading bulk open top coal cars with rotary couplers by inverting the car. Such cars can be unloaded without being unhooked from the train.

Rotation – The number of years a forest grows before harvest.

Royalty – When oil, gas, or other mineral is leased by the owner to another party that produces it, the royalty is the share of production or the share of the price that is paid by the lessor to the owner. A common onshore royalty in the United States is 12.5% of the price.

Royalty, Advance – A royalty paid before production has begun.

Royalty, Shut-in – A royalty paid while a well is shut-in or not producing.

RPS – Renewable portfolio standard.

RTOs – Regional Transmission Organizations.

Run of the river – A hydro power plant built on a river with no dam behind it.

RVP – Reid vapor pressure.

Sales tax – A tax based on a good when it is sold.

Salt dome – A geological sedimentary structure formed when salt is forced upwards. Because the salt is impermeable, oil and gas may be trapped beneath a salt dome.

Salutation displays – Cultural rules for greetings, good byes, and life transformations (e.g. handshakes, bows, and kisses).

Satellite images – Pictures taken from satellites circling the earth.

Say's Law – A macroeconomic idea that supply creates its own demand since enough income is generated in producing all goods to buy them all back.

Scenario building – A way of analyzing or planning for the future by building alternative consistent possible future sequences of events and making decisions how to proceed in the case of each alternative.

SCF – Standard cubic foot.

SCFM – Standard cubic foot per minute.

Scheduling market – Creating load schedules for electricity delivery typically done a day in advance but possible modified in real time to balance the market.

Schumpeterian creative destruction – The notion put forth by Schumpeter that the creation of the new destroys the old as humans make economic progress.

SCM – supply chain management.

SCRAM – An emergency shutdown of a nuclear boiling water reactors (BWR). Such a shutdown is called a trip at pressurized water reactors (PWR).

Scrubbers – Devices in power plants to remove sulfur dioxide and fly ash from combustion gases before emission to the atmosphere.

Sealed bid auction – An auction in which bids are secret from other bidders.

Seam – A layer of coal large enough area to be profitable mined.

Second Law of Thermodynamics – When energy is converted, it is reduced in quality and its ability to do work is decreased. This inability to do work is called entropy.

Secondary electricity – Secondary electricity is that produced from fossil fuels.

Secondary energy – Secondary energy is the result of the conversion of primary energy into another form such as the production of electricity from fossil fuels or oil products from crude oil.

Secondary recovery – Techniques to increase oil recovered by artificially increasing reservoir pressure including water and gas injection. On average, the recovery factor after primary and secondary oil recovery operations is between 35 and 45%.

Self discharge rate – How fast an inactive battery will lose its charge.

Self-defeating prophecy – A negative prophecy that causes people to react and prevent something from happening.

Self-fulfilling prophecy – A positive prophecy or prediction that causes people to react and cause something the predicted to happen.

Seller – an entity that sells a good or service.

Semiconductor – A crystal material, such as silicon, that conducts electricity better than an insulator but not as well as a conductor. It conducts poorly in a pure state but becomes a much better conductor when it has impurities. It is a key component in transistors and PV cells.

Separative work unit (SWU) – A measure of uranium enrichment that considers the radioactive content (assays) of the uranium processed, the enriched fuel and the waste stream.

Series connection – Connecting photovoltaic cells or batteries with negative connected to positive which increases the voltage.

Service contract – An agreement to provide work for others. National oil companies may give service contracts to private companies to search for and develop oil. They may be similar to oil production sharing contracts but reimbursement is in money not in kind.

Settle or settlement price – The last price of the trading day for a futures or option contract.

SGX – Singapore Exchange.

Shame-Based culture – Culture where it is important not to bring shame to the group. Causing shame to the group causes a loss of face.

Ship broker – An entity which brokers or negotiates a deal to transport cargo for a ship owner or a shipper. The broker does not take ownership of the cargo.

Short position – Having sold a borrowed asset.

Short rotation energy plantation – Plantations with fast growing vegetation (rotation period from 2 to 10 years).

Short ton – A non-metric unit of weight equal to 2000 pounds or 0.907 metric tons.

Short run – A period short enough so that some factors are fixed.

Shoulder production – Electricity production between peak and base load.

Shut in – Temporarily stopping producible assets for needed maintenance, repair or better market conditions.

Sidetrack drilling – Drilling a new repair well bore to bypass lodged junk, straighten a crooked hole, or recover a lost hole.

Silicon (Si) – An element with atomic number of 14. Since this semi-metallic, excellent semiconductor, is easily producible from quartz sand, it is the most prevalent semiconductor in photovoltaic cells.

Silviculture – The theory and practice of forest stand establishment and management.

SIMEX – Singapore International Monetary Exchange.

Simulation model – Mathematical model that approximates the behavior of an economic system or phenomenon. It can be used for planning and forecasting.

Single sided market – Only one side of the market is bidding.

SIP – See State Implementation Plan.

Slag – Molten or previously molten coal ash.

Slow pyrolysis – Anaerobic thermal conversion of biomass to fuel accomplished by slow heating to less than 450 °C (842 °F).

SMP – special marketing program or system marginal cost.

System marginal price (SMP) – A price paid with some additions to every dispatched generator in the English & Welsh Pool. It is the marginal bid price or the highest bid price of any dispatched unit and changes throughout the day.

SO₂ – sulfur dioxide.

Social culture – A culture that values people.

Social interest rate – The rate to be used to discount public investments. It may be lower than the market interest rate, if public investments are less risky, or higher than the market interest rate if public investments are more risky. It should be between consumers' rate of time preference, or how they will trade off future goods for present goods, and the gross rate of return on investment adjusted for risk.

Social losses – For an economic situation, such as the production of a good, it is the difference between social welfare at an optimal level of production and social welfare at a sub-optimal level of production. Externalities, market power, and government taxation can result in sub-optimal production of a good. In a market with no externalities, social welfare is the sum of consumer and producer surplus.

Social optimum – An economic outcome out of the feasible set of outcomes that maximizes social welfare.

Social security tax – A tax to pay for the U.S. government social security retirement program. It is a transfer payment in which the money is taken from those working and paying in and transferred to those eligible retirees.

Social welfare – Social welfare for any economic situation is the difference between total social benefits and social costs. In a market with no externalities, its simplest formulation is the sum of consumer surplus and producer surplus.

Socio-economic – Relating to social or economic factors or to a combination of both.

SOE – State owned entities.

Solar cell – See 'Photovoltaic cell.'

Solar constant – The energy content of sunlight, which varies across location and time. (e.g. It is about 1350 watts per square meter (W/m²) in space, but about 1000 (W/m²) at sea level on the equator at solar noon.

Solar energy – Energy based on sunshine in the form of either direct heat or electricity generated from constant heat or photovoltaics.

Solar noon – The midpoint in the day between sunrise and sunset. It varies by place and season and is not necessarily the same as noon on the clock.

Solar photovoltaics (PV) – An arrangement of components designed to supply usable electric power using the sunshine as the power source.

Solar spectrum – The range of electromagnetic radiation coming from the sun.

Solar thermal electric – Producing electricity by focusing sunlight to produce steam to turn a generator.

Solar-grade silicon – Silicon used in the manufacture of solar cells that is cheaper and of lower quality than electronic-grade silicon.

Solow growth model – A model of capital accumulation that leads to various trajectories for income per capita.

Sovereign wealth funds (SWF) – A government owned fund that invests in financial and real assets. In the energy context, they are often funded by energy exports.

Spark spread – A spread is buying more than one derivative in a trading strategy. A short spark spread simulates an electricity generator with the sale of electricity futures and purchase of the generator's fuel futures such as coal or gas.

SPE – The Society of Petroleum Engineers. (<http://www.spe.org>).

Specialty ships (LPG/LNG) – Ocean going vessels used for the transport of liquefied gases.

Specific culture – A culture in which the public space and private space are not very compartmentalized. Because it is relatively easy to enter the private space from the public space, the public space is much more restricted to outsiders than in diffuse cultures.

Speculator – A person or institution that trades in the energy derivative markets without dealing in the cash market. They trade in order to take on risk in hopes of making a profit.

Spent fuel reprocessing – Recovering fissile uranium and plutonium out of used nuclear fuel from nuclear power reactors in order to reuse it in mixed oxide fuel.

Spent nuclear fuel – Used fuel removed from a nuclear reactor. Although it can be reprocessed, the majority is temporarily stored at the reactor site to cool off and await provision for removal to a permanent repository. Only a few countries have made provisions for final waste storage.

Spinning reserve – Generating capacity already synchronized with the grid that can be loaded within 10 minutes and capable of running for at least two hours.

Spot market – A place where a good or service is bought or sold by independent parties for immediate payment and delivery. The price charged is called the spot price. Also called the cash market. In electricity, it is often called the real-time market.

Spot price – A price for a transaction conducted on the spot market. It involves a one time immediate transaction as opposed to contracted transaction which usually involve delivery of a product at agreed quantities, frequency and prices.

SPR – Strategic Petroleum Reserve.

Spread – Buying more than one financial asset at a time. See a wide variety of option spreads at <http://dahl.mines.edu/ch19m.xlsx> in the worksheet named SampleSpreads .

Stable element – An element which does not spontaneously radioactively decay.

Stackleberg duopoly – A market with two producers. The non-dominant producer maximizes profits given the dominant producer's production, while the dominant firm maximizes profits given the non-dominant firm's reaction function.

Stand-alone costs – The cost of producing a product when it is produced by itself with no other goods produced at the same time.

Stand-alone PV system – A system that includes electricity from photovoltaic cells and is not connected to the grid. They typically require some form of storage or back up generation for non-interrupted operation.

State implementation plan (SIP) – A U.S. state plan required by the 1970 U.S. Clean Air Act for states with areas that do not meet Federal air quality standards. The plan is to indicate how such areas, called nonattainment areas, will be brought into compliance.

State of charge (SOC) – The percent of energy remaining in a battery.

Statfjord oil and gas field – The largest oil field in the North Sea discovered in 1974. It straddles the boundary between the Norwegian and British sectors of the North Sea.

Steam turbine – A spinning mechanical device powered by steam that turns a generator to produce electricity.

Stoichiometric condition – The proportion of the oxygen-to-fuel mixture that completely burns the fuel leaving no remaining fuel or oxygen.

Ston – Short ton.

Stone Age – Period of time from about 2 million BC to 2000 BC when humans used stone tools. Before the Bronze Age, it ended at different times in different regions.

Straddle spread – A spread is buying more than one derivative in a trading strategy. A long straddle spread is buying a put and a call at the same strike price and expiration date. With a short straddle spread, you would sell instead of buy.

Straight-fixed variable pricing – When peak users pay for capital or capacity costs and off-peak users only pay the variable costs.

Straight-line depreciation – Using an annual depreciation charge for tax purposes equal to the value of the asset divided by its allowed depreciable life.

Stranded cost – A cost for an electric generation plant that was put in under regulation that becomes priced out of the market if restructuring allows new cheaper competitors to enter the market.

Strangle Spread – A spread is buying more than one derivative in a trading strategy. A long strangle is buying a call with a strike price above the market price and the put strike price is below the market price. A short strangle would be sel.

Strategic petroleum reserve (SPR) – A U.S. government stockpile of petroleum stored in salt domes along the Gulf of Mexico to be used in times of oil disruption. A number of countries have such reserves including the United States and China.

Strict, joint, and several liability – A property of the U.S. 1980 Superfund Bill in which anyone who has contributed to a toxic waste site can be billed for the whole mess, if the other contributors cannot be found. (the bill is also called the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA]).

Strike price – The price at which a put or a call entitles you to buy the underlying asset.

Strip mining – Mining of minerals or coal that are close enough to the surface to only require removal of overburden rather than underground shafts to access the product.

Sub-additive cost – If it costs less to produce two goods together than to produce each separately, costs are sub-additive. If it costs the same to produce two goods together than to produce them separately, costs are additive.

Subbituminous coal – Coal with lower carbon content than bituminous coal with typical heat content ranges from 8,300 to 11,500 Btu/pound.

Submarine pipeline – A pipeline that is deep under water.

Subsidiary – A company legally owned and controlled by another corporation that has a majority of the subsidiaries share.

Subsidies – Government payments to encourage some economic activity.

Substation – Installations that change electricity voltage in utility power lines for long distance transport. Voltage is stepped up to send the power and stepped down for local distribution.

Suezmax – A class of ship from 120,000 – 160,000 DWT. It is the largest class size that can go through the Suez Canal.

Sulfur – A non-metallic chemical element with atomic number 16 found in some coal and oil and occasionally in natural gas. Burning fuels that contain sulfur typically creates sulfur dioxide, which can reduce visibility, damage health, and cause acid rain.

Sunk cost – A cost already incurred that cannot be recouped. Thus, it should be ignored in economic decision making.

Superheated steam – Water that is heated until steam is formed stays the same temperature (the boiling point) as the steam until all the water is vaporized. Once all the water is vaporized, the steam at a given pressure can rise above the boiling temperature for that pressure. Super heated steam is used in turbines to raise the temperature and increase their efficiency.

Supernova – A high energy stellar explosion caused by the surface layers of a large dying star igniting in a fusion reaction with large emissions of gamma rays. Such stars typically collapse into neutron stars.

Supervisory control and data acquisition (SCADA) – A computerized system that remotely monitors and controls some energy system such as a pipeline system or power plant.

Supply chain management (SCM) – The supply chain is the set of processes that take a product from raw material procurement through to sales and delivery of the end product. Supply chain management is the set of procedures developed to organize and coordinate this process, often with the help of computer programs that provide information across the chain.

Surface Mine – A coal-producing mine that is usually within a few hundred feet of the surface. Earth above or around the coal (overburden) is removed to expose the coalbed, which is then mined with surface excavation equipment such as draglines, power shovels, bulldozers, loaders, and augers.

Surface rights – The ownership of the surface area of land. It may not necessarily confer the rights to the minerals beneath the surface. Also a lessor's right to reasonable use the surface of the land to develop and operate an underlying mineral lease.

Survey – Questionnaire used to solicit information on planned activities for help in economic forecasting and planning.

Sustainable – An activity which can be maintained indefinitely without damage to the environment or diminution of produced services.

Sustained yield – The perpetual regular harvest of wood resources from forest land without reducing the yield.

Swap – An over-the-counter financial instrument that exchanges one set of cash flows for another. The most common type of swap is called a plain vanilla swap and is the exchange of a fixed for a floating rate.

Syngas – Gas produced by gasifying solid hydrocarbons, usually coal and sometimes biomass.

System dynamics model – A set of mathematical equations with feedback loops that simulates a complex economic system over time.

Taboo zones – Areas of the body that are not to be touched by certain segments of a culture. Often these areas have sexual or religious significance.

Tailings – Earth debris remaining after uranium oxides or other minerals are extracted from mined ore.

Tails – Depleted uranium from a nuclear reactor with about a 0.3% concentration of U-235.

Tangible development costs – Costs for the physical assets used for developing and later production of a mineral asset such as mine tracks, mine lighting and ventilation, oil wells and peripheral equipment.

Tar sands – Sands that contain extractable bitumen that yield liquid hydrocarbons for upgrading into crude oil. In such heavy oil deposits much of the lighter products have evaporated (also called oil sands).

Target revenue model – A model of a resource exporting country that has as its goal the amount of revenue needed for economic development. Such a model has a downward sloping supply function, since a higher price will require lower sales to meet the target revenue.

Tariff – A tax on imports. Also rates charged by a public utility.

Tax depletion allowances – A percent of revenues that can be deducted from the sales price of a mineral to reduce taxable income.

Tax equity – Whether a tax is distributed fairly across the taxable population. This depends on what is considered fair. It could be to tax entities in proportion to the government benefits they receive. Horizontal equity has people having similar incomes paying similar amounts and vertical equity has people having dissimilar incomes paying dissimilar amounts.

Tax free bonds – Bonds in which the interest payments are not taxable.

Taxes on products – A government assessed amount on a product to help support government spending. Categorized as indirect business taxes in national accounts because it taxes products instead of entities.

Technological determinism – The notion that technology has a determining influence on how economic and social systems evolve.

Terawatt – One trillion watts (10^{12} watts). A watt is a measure of electric power equal to one ampere under the pressure of one volt.

Tertiary recovery – Oil recovery techniques that reduce oil viscosity or increase reservoir permeability and increase recovery rates. Also called enhanced oil recovery.

TFC – Total final consumption of energy.

Theoretical Systematic culture – A culture that values the acquisition of knowledge.

Theory X – A management theory based on the premise that people dislike work and must be coerced to work to satisfy their basic needs for economic security.

Theory Y – A management theory based on the premise that people want to develop and improve themselves and will willingly work if motivated by an interesting and challenging job.

Therm – A non-metric energy measurement equal to 100,000 Btus (approximately 1000 big Calories or kJ). It is primarily applied to natural gas.

Thermal cracking – A refinery process using heat to break larger hydrocarbons into smaller ones.

Thermal efficiency – The percentage of useful work from a process equal to useful work out divided by gross energy into a process times 100.

Thermal electricity – Electricity generated by using heat to spin a turbine that in turn spins magnets in a generator. Heat sources include fossil fuels, nuclear fuels, geothermal energy, combustible waste and concentrated solar energy.

Thermal energy – Heat energy.

Thermal reactor – A fission reactor with the fission chain reaction being sustained by slow neutrons.

Thin film – A thin layer of semiconductor material on a photovoltaic (no more than a few microns thick). Thin film PVs, also called amorphous, are cheaper than crystalline PVs but less efficient.

Third-party access – Allowing non-owners use of a facility on a nondiscriminatory basis (also called open access). Open access facilities are called common carriers.

Three Gorges Dam – Dam on the Yangtze River, China. It is part of the world's largest power station in terms of installed capacity (22,500 MW).

TIC – Transparency international corruption perception index.
(<http://www.transparency.org/research/cpi/overview>).

Tie line – A transmission line connecting two country's electricity grids.

Tipple – Place where the mine cars are tipped and emptied of their coal or more broadly the area and structures for loading and unloading coal.

toe – Metric tonne of oil equivalent.

Tonne – metric tonne = 1,000 kilograms = 2,204 pounds.

Topping and back pressure turbines – Turbines with high pressure exhaust. They are often used in cogeneration systems with their exhaust heat also providing useful energy.

Total quality management (TQM) – A business philosophy that focuses on continuous improvement by paying attention to customers, quantitatively measuring quality, and having all employees, not just management, contribute to quality and process improvement.

Town gas – Gas manufactured from coal.

Toxic substances – An unusable byproduct of consumption or production that causes death or disease.

TPA –Third-party access.

TPES – Total primary energy supply.

Tracking array – PV array that tracks the sun to increase the useful solar radiation absorbed. With one axis, the array tracks the sun from east to west adding up to 25% more power a day. With two axes, the array can align itself directly with the sun all the time for an additional 5% of power. Actual power generated depends on the latitude, season, and weather conditions.

Trading strategies – Buying more than one asset at a time.

Transaction cost economics – Maintains that the market governance that will prevail (spot market, bilateral contracts, vertical integration) is that which minimizes transaction costs.

Transfer price – The prices different parts of a company charge each other for goods and services. Such purchases are not arms-length purchases.

Transit – An energy flow across a country, where the country is neither the source or sink for the flow.

TransMed pipeline – A submarine natural gas pipeline from Tunisia to Sicily that passes under the Mediterranean Sea.

Transmission – The process of long-distance transport of energy. For electricity the power is usually stepped up to high voltages and stepped down when arriving at substation for further distribution.

Transmission congestion – When flows in a system are higher than its capacity causing flows to be impaired or less than desired by market participants.

Transmission congestion contract (TCC) – A financial instrument that provides a hedge against congestion caused price differences in systems with location pricing.

Transmission losses – The difference between the energy fed into a transmission system and the energy delivered to distributors. Thus, it includes any own use for the operation of the system.

Transmission owner – An entity owning or having contractual rights to use energy transmission facilities.

Transmission pipelines – Large pipelines that transport oil or gas over long distances.

Transmission system – The network of high voltage power lines that transports bulk power from generators to local distribution systems.

Transmission system operator (TSO) - A company that is responsible for operating, maintaining and developing the transmission system for a control area and its interconnections.

Transuranic element – A very heavy radioactive element with atomic number greater than that of uranium (92). They are formed artificially by neutron capture and subsequent beta decay and include neptunium, plutonium and americium.

Treaty of Rome – The treaty that created the European Economic Community.

Trickle charge – Slow charging of a battery to replace self-discharge and maintain a full charge.

Troll gas field – Norway’s largest oil and gas field.

TSO – Transmission system operator.

TSP – Total suspended particulates.

Turbine – A machine in which gas or liquid push blades to turn a shaft. If the shaft is connected to an electricity generator, electricity is produced.

Turnkey plant – Plant that is totally built by a contractor with limited owner involvement. When it is turned over the owner, it is ready to operate.

TW – terawatt.

Two period dynamic model – A model of a fixed resource in which the objective function is the net present value of profits. This model allocates production over two time periods.

U.S. Code of Federal Regulations – Federal regulations published at the U.S. Federal Register. (<https://www.federalregister.gov/>).

U.S. Price Anderson Bill – A U.S. bill that limits utility liability for nuclear power accidents.

U-235 – Uranium isotope 235.

U₃O₈ – Triuranium oxide (also called uranium oxide). It is the main component of yellow cake.

UF₆ – Uranium hexafluoride.

UHVAC – Ultra High Voltage Alternating Current.

UHVDC – Ultra High Voltage Direct Current.

UK CEGB – UK Central Electric Generating Board.

UK Director General of Electricity Supply (DGES) - An appointed regulator of the UK electricity industry.

UK FFL – Fossil fuel levy.

UK NFFO – UK non-fossil fuel obligation.

UK OFFER – UK Office of Electricity Regulation.

UK REC – UK Regional Electricity Companies.

ULCC – Ultra Large Crude Carrier. Tanker with a capacity of 320,000 dwt or larger.

Ultimate Analysis – Measured chemical properties of coal including the percentage by weight of carbon, hydrogen, sulfur, oxygen, moisture, and ash.

UN FCCC – UN Framework Convention on Climate Change. (<http://unfccc.int/2860.php>).

UN HDI – UN Human Development Index. (<http://hdr.undp.org/en/data>).

Unbundled Rates – Separate charges for services along a supply chain such as generation, transmission, distribution, and spinning reserve.

Unbundling – Breaking separate processes in the supply chain into separate line-item charges. For example, U.S. natural gas pipelines used to provide all the services of getting gas supplies to distributors. Now the steps in this process such as transportation, storage, and title transfer are required to be unbundled, so they can be purchased separately from different suppliers.

Uncertainty – Not knowing the exact outcome.

Uncertainty avoidance – A cultural trait of a group in which uncertainty and change make members uncomfortable and are avoided.

Unconventional resource play – Generally referred to in the oil and gas industry as any play or activity where petroleum is produced using any method other than the conventional oil well method. Examples include tight light oil such as in the Eagle Ford or the Barnett shale, or oil sands as found in Alberta, Canada.

UNCTAD – United Nations Conference on Trade and Development. (<http://unctad.org/en/Pages/Home.aspx>).

Underground Mine – A mine where coal is so deep that access must be made by tunneling into the earth to the coalbed. Equipment for underground mining or recovery of the coal include cutting machines as well as continuous, longwall and shortwall mining machines. Underground mines are classified according to the angle of the opening used to reach the coal: drift (level tunnel), slope (inclined tunnel), or shaft (vertical tunnel).

Under-the-boiler use – Burning hydrocarbons or other combustibles to create hot water or steam.

Undeveloped property – A mineral property yet lacking facilities to produce commercial quantities of the mineral.

Unfinished oils – Oils requiring further processing beyond mechanical blending.

Unified governance – When transactions are governed by vertical integration.

Uniform Building Code (UBC) – A building code published by the International Conference of Building Officials that relates to the safety, quality and integrity of buildings.

Uniform Mechanical Code (UMC) – A code related to installing and maintaining equipment for heating, cooling, ventilation, and refrigeration.

Unit capital costs – The costs obtained by dividing capital costs over all units of production (also called leveled capital costs).

Unit operating costs – Total operating costs divided by production (also called average operating cost).

Unit tax – A tax on each unit sold. The tax is the same no matter what the price as opposed to an ad valorem tax in which the tax is a percent of the price.

Unit Train – A train for which all cars have the same origin and destination. Often it is also devoted to one product as in a unit train for coal.

Unitized production – When a pool of oil is optimized and produced as one unit even if there are many owners of the pool. This procedure avoids the overproduction encouraged by the law of capture.

Univariate time series – A statistical forecasting technique in which a variable is forecast by using historical values of itself.

Universalist culture – A culture that believes there are norms, values, and behavior patterns that are valid everywhere at all times.

Unplanned outages – Unexpected interruptions of electricity generation, transmission, or distribution reducing deliveries to end-use customers.

UO₂ – uranium dioxide.

Upside risk – In finance, risk is the variability of investment returns. Upside risk is the probability and size of positive returns on an investment.

Uranium – A metallic, radioactive element with 92 protons. The isotope U-238 is the most common. It is not fissionable with slow thermal neutrons but when it absorbs a fast neutron it can convert to Plutonium (Pu-239) which is fissionable by both slow and fast neutrons. U-235, the less common isotope, is fissionable when bombarded by slow neutrons and is the most common fuel for nuclear power plants.

Uranium conversion – Chemical process to release uranium from uranium oxide.

Uranium deposit – An economically recoverable concentration of uranium ore.

Uranium dioxide (UO₂) – The enriched uranium fuel placed in rods to fuel nuclear reactors.

Uranium hexafluoride (UF₆) – White solid substance produced from chemical processing of U₃O₈ allowing enrichment of uranium.

Uranium ore – Economically viable uranium bearing rock with 0.05 to 0.20 percent U₃O₈.

Urengoi gas field – Russian gas, which is the largest in the world.

U.S. BLM – The Bureau of Land Management is a federal agency that manages federal lands. (<http://www.blm.gov/wo/st/en.html>).

U.S. Commodity Futures Trading Commission (CFTC) – A U.S. regulatory agency created in 1974 to regulate futures and options markets. (<http://www.cftc.gov/>).

U.S. DOE – U.S. Department of Energy.

U.S. EIA – United States Energy Information Administration, which is part of the U.S. Department of Energy. (<http://www.eia.gov>).

U.S. Energy Information Administration (U.S. EIA) - Principal U.S. government agency that collects, analyzes, and disseminates energy information. It is located within the U.S. Department of Energy. (<http://www.eia.gov>).

U.S. EPA – U.S. Environmental Protection Agency. (<http://www.epa.gov>).

U.S. Federal Energy Regulatory Commission (U.S. FERC) – An independent U.S. federal regulatory agency created in 1977 that regulates energy transmission involved in interstate commerce. (<http://www.ferc.gov>).

U.S. Federal Power Commission (FPC) – FERC’s predecessor, created in 1920. The FPC regulated electricity and gas transmission involved in interstate commerce. Its functions were broken up and delegated to U.S. DOE and FERC in 1977.

U.S. FTC – U.S. Federal Trade Commission (<http://www.ftc.gov/>). The U.S. Federal agency responsible for preventing anticompetitive, deceptive, and unfair business behavior towards consumers.

U.S. Natural Gas Act of 1938 (U.S. NGA) – The first U.S. Federal regulation relating to natural gas, which regulated pipeline tariffs on interstate pipelines.

U.S. NEMS – U.S. National Energy Modeling System. (<http://www.eia.gov/oiaf/aeo/overview/>).

U.S. NGA – U.S. Natural Gas Act of 1938.

U.S. NGPA – U.S. Natural Gas Policy Act of 1978.

U.S. NMA – National Mining Association. (<http://www.nma.org/>).

U.S. Public Utilities Regulatory Policy Act of 1978 (PURPA) – U.S. Federal law that began the electricity market restructuring process by requiring utilities to buy power from qualified independent power producers if their price was lower than the utility's avoided costs.

U.S. PURPA – U.S. Public Utilities Regulatory Policy Act of 1978.

User cost – The difference between price and marginal cost. A measure of Hotelling rent in a dynamically optimized market.

USFS – United States Department of Agriculture Forest Service.

USFWS – United States Fish and Wildlife Service.

USGS – U.S. Geological Survey. (<http://www.usgs.gov>).

USSR – Union of Soviet Socialist Republics also called the Soviet Union.

Utility theory – A branch of microeconomics in which consumers are assumed to have utility functions that represent their preferences. Rational behavior assumes that they will undertake economic activity to maximize these functions subject to constraints. Although it is not strictly true that consumers typically have utility functions, under some fairly reasonable assumptions consumer preferences can be represented by such functions. Thus, they provide a convenient and powerful tool for analyzing consumer behavior.

V – volt.

Valdez Principle – Set of 10 environmental principles that corporations can voluntarily endorse and commit their company to. Endorsing companies fill out annual environmental reports and are

committed to reducing emissions, reducing waste, and more sustainable operations (also called the Ceres Principle). (<http://www.ceres.org/>).

Value added tax – A tax in which a producer does not pay a tax on goods bought from other firms but only on the value added from labor, profits, and primary material produced by the firm.

Value chains – A series of sequential processes that create profits for a company.

Variance – The square of the standard deviation of a variable.

Vertical equity – A criteria of fairness for taxation. Vertical equity has people with dissimilar incomes paying dissimilar amounts of taxes.

Vertical integration – A market structure in which a firm handles more than one process in the supply chain. Thus, if an oil producer produces, transports, and refines oil it is a vertically integrated company.

Very large crude carriers (VLCC) – Ships sized from 200,000 to 320,000 DWT.

Vesting day – April 1, 1990 when former components of the CEGB in England and Wales became limited companies and the power pool began operation.

Vitrification – Solidifying high-level nuclear waste into a glass like substance to stabilize for permanent disposal.

VLCC – Very Large Crude Carrier. Tanker between 200,000 and 320,000 dwt.

VOC – Volatile organic compounds.

Volatile matter Weight percent of coal that gasifies when heated. High volatility is more than over 31%; medium volatility is 22% to 31%; low volatile is less than 22%.

Volatile organic compounds – (VOC) Organic compounds with low boiling points that easily evaporate at normal temperatures.

Volatiles – Easily vaporized materials.

VOLL – Value of lost load.

Volt (V) – A volt is the force needed to produce 1 Amp of current against 1 Ohm of resistance. It is a measure of electromotive force or how hard electrons are being pushed through a conducting medium. $V = \text{amps} \times \text{ohms}$ and $\text{watts} = \text{amps} \times \text{volts}$.

Wash trading – Buying and selling the same product so that it appears that exchanges have been made but in reality there has been no real transaction of the product. Such trades might be conducted to make it appear that there is more activity in a stock or to artificially change the price of the product. Wash trading is illegal under amendments to the U.S. Commodity Exchange Act of 1936.

Waste, high-level (HLW) – Highly radioactive material remaining after nuclear fission that requires careful handling and disposal. It can be reduced by reprocessing spent fuel and reusing or disposed of directly.

Waste, low-level waste (LLW) – Less radioactive material remaining from mostly medical or industrial applications of radioactivity. Disposal more typically is by incineration and burial.

Waste streams – Unusable solid or liquid by-products of an activity.

Wasting (non-regenerative) natural resources – Non-renewable natural resources that do not reproduce themselves in any reasonable human time frame.

Watt – The basic unit of power in the metric system. Power is the rate of doing work and one watt equals one joule per second or 3.413 Btu/hr or volts times amps.

WDI – World development indicators. (<http://data.worldbank.org/data-catalog/world-development-indicators>).

WEC – World Energy Council. (<http://www.worldenergy.org/>).

Well-defined property right – Exclusive right to clearly specified aspects of an economic good. A common area that everyone has access to does not have well-defined property rights.

Wellhead price – The arm's length value of oil and gas when bought to the surface or top of the well. This is usually the sales prices provided the transaction is conducted by independent parties.

West Texas Intermediate (WTI) – A light sweet crude produced in West Texas with API gravity of around 40. It is one of the crude oils specified in NYMEX crude futures and options contracts, and its price is an index used in numerous oil contracts.

Wet natural gas – Natural gas without the gas liquids removed.

Wheeling – Wholesale sales of electricity between different electrical systems.

White cargoes – Ship cargos consisting of white or clean oil products. Such products from the top of the distillation tower are more valuable than crude oil as opposed to black products at the bottom of the distillation tower that are less valuable than crude oil. White cargoes require more care to avoid contamination.

Wholesale sales – Sales for resale. For example, electric energy sales made through the transmission grid to parties who are not end-users.

Wildcatter – Someone drilling for oil or gas on a previously unexplored area.

Wind energy – Energy that comes from the wind pushing blades to create mechanical energy. The mechanical energy may in turn be converted into electrical energy.

Windfall profits – Larger than normal profits as the result of unforeseen events, such a product shortfall or disruption. Governments sometimes implement windfall profits taxes.

Winner's curse – The winner of a bid for an oil concession may be the one who is most optimistic about the property. If they are overly optimistic, the curse is that they may win the concession but lose money in the process.

Work bidding – A concession system for oil leases in which the bid is not in money but is a work program. Work bidding is often designed to hasten the development of concession. The winning bid typically is the one that bids the most or soonest work.

Working Interest – An interest in a mineral property that entitles the owner of that interest to all or a share of mineral production from the property, usually subject to a royalty. A working interest permits the owner to explore, develop, and operate the property. The working interest owner bears the costs of exploration, development, and operation of the property, and in return is entitled to a share of the mineral production from the property, or to a share of the proceeds

therefrom. It may be assigned to another party in whole or in part, or it may be divided into other special property interests. o **Gross Working Interest.** The reporting company's working interest plus the proportionate share of any basic royalty interest or overriding royalty interest related to the working interest. o **Net Working Interest.** The reporting company's working interest not including any basic royalty or overriding royalty interests.

Working interest – Ownership rights in a mineral property giving a share of production and the right to explore, develop, and operate the property.

World Development Indicators (WDI) database – World Bank collection of international time series data collected from official sources that can contribute to our understanding of the development status of numerous countries and regions. It is available free at <http://data.worldbank.org/data-catalog/world-development-indicators>.

World Energy Council (WEC) – An international organization composed of a network of energy interested participants. It strives to be a neutral provider of information and advice to energy policy makers and other energy pro

fessionals and organization to provide a sustainable energy future for all.
(<http://www.worldenergy.org/>)

Worldscale (WS) – International freight index for crude oil. It is revised annually and represents costs in USD per tonne between numerous ports worldwide for a standard ship of 75,000 DWT. The base rate is called Worldscale 100 or flat rate and other rates are quoted as a percent of Worldscale (e.g. Worldscale 30 would be a rate 30 % of the Worldscale 100 rate). (<https://www.worldscale.co.uk/>).

WTI – West Texas Intermediate (crude oil).

X-Inefficiency – Higher costs for government-owned facilities from lack of competitive discipline or having not only economic but other political and social objectives.

Yamburg gas field – Second largest gas field in Western Siberia.

Yellowcake (U₃O₈) – Triuranium oxide (also called uranium concentrate) is the most common oxide from milled uranium and the most abundant oxide in yellow cake. It is the stable uranium oxide sent for enrichment and conversion to UO₂.

Yin/Yang – Chinese Taoist philosophical concept seeking to describe how seemingly opposite or contrary forces are interconnected, interdependent, complementary and give rise to each other forming natural dynamic systems. Physical examples of such dual forces include light and dark, hot and cold, fire and water, male and female. These principles have applications in many aspects of Chinese culture including science, medicine, and marshall arts. The male/female dichotomy is the most well known form of Yin and Yang in Western culture with the female (Yin) and male (Yang) being opposing forces but each is thought to have some of the other force within it.

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