A GLOSSARY OF POWER, ENERGY & MINERAL RESOURCES

Published by

Hydrocarbon Unit

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In conjunction with

Energy & Mineral Resources Division
Government of the People's Republic of Bangladesh

1st Edition, December 2018

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Users are invited to suggest additions or improvements which would enhance the value of the Glossary.

Preface

A GLOSSARY OF POWER, ENERGY & MINERAL RESOURCES is being prepared and published by Hydrocarbon Unit for the first time in late 2018. Terminologies commonly used by State-owned Enterprise (SoE), International Oil Companies (IOC) and Joint Venture Undertakings in Bangladesh have been reflected. Petroleum industry acronyms and measurement units have been included in the glossary as well. Moreover, several wordings have been illustrated with graphical presentation wherever presumed necessary.

This glossary has been prepared based on the data available from the internationally familiar vocabulary collections and frequently used handbooks in the energy sector of the world. Some relevant power (electrical) related terms also have been incorporated in order to fulfill the necessity of comprehensive search of terms by a professional like geologists, engineers, miners etc. It is expected that the glossary will be helpful as reference book and elements of interest for the concerned. It will be of use to a broad audience – CEOs, traders, regulators, tax consultants and many more – bringing together geological, technological, engineering, commercial, accounting and other terms from both inside and outside the sector.

We publish it in conjunction with Energy & Mineral Resources Division, Government of the People's Republic of Bangladesh as a practical contribution to promoting transparency, understanding and knowledge in the national energy sector. The glossary will also be available at HCU's website: www.hcu.org.bd

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Acknowledgement

We are privileged to express our token of gratitude to several persons who helped directly or indirectly to accomplish this painstaking work.

We deliver our heart-full indebtness and owe a deep sense of thankfulness to the Hon'ble State Minister of MoPEMR and the Secretary of EMRD for managing time to have a glance and guide us to make it an effective publication for the professionals related to this industry.

Sincere guidance and appreciation from Petrobangla, BPC, BPI, GSB, BMD have made this endeavor to reach at this stage.

We cannot thank enough with this little gratitude note to all those people who time to time had substantial intervention for making this publication a significant one. Please accept our apology in this regard.

We also thank Hydrocarbon Unit office staffs who have more or less contributed to the preparation of this meticulous task, especially, Mr. Mahadehe Hassan, Deputy Director (Planning & PSC) and Mr. Shihab Mahmud, Assistant Director (Reservoir & Production).

We look forward to having the opportunity to enrich this booklet shortly with all of your valuable comments and feedback over this edition.

We thank and acknowledge all of our readers in advance; hopefully you will have the help what you are looking for.

Nasrul Hamid MP
State Minister
Ministry of Power, Energy & Mineral Resources
Government of the People's Republic of Bangladesh

Message

I congratulate the initiative of publishing "A GLOSSARY OF POWER, ENERGY & MINERAL RESOURCES" by Hydrocarbon Unit.

In the energy sector so many words and abbreviations are used which are completely technical and not easily understandable. Energy related activities are greatly facilitated through a proper knowledge of the terminologies. In this context, this publication will have a significant contribution for proper understanding of those expressions. I hope, time will see more upgrade and improvement of this Glossary through active participation and sharing the hard-earned knowledge and views of the esteemed people working in the energy sector of Bangladesh.

I wish every success of the initiatives.

Joy Bangla, Joy Bangabandhu.
Long live Bangladesh.

Nasrul Hamid, MP

Abu Hena Md. Rahmatul Muneem

Secretary
Energy & Mineral Resources Division

A WELCOME MESSAGE FROM THE SECRETARY

I take the opportunity in appreciating Hydrocarbon Unit for the publication of "A GLOSSARY OF POWER, ENERGY & MINERAL RESOURCES". This publication has been created with the hope of understanding the terminologies used in the energy sector.

Knowledge of appropriate terminologies for energy related decision making and performing the day to day works are very necessary. This book will help every organization and person who work in the energy sector to understand the meaning of the technical words.

I appreciate Hydrocarbon Unit for preparing this type of publication and also advise to conduct day to day upgradation and improvement of this Glossary.

(Abu Hena Md. Rahmatul Muneem)

Md. Harun-or-Rashid Khan

Director General (Joint Secretary)
Hydrocarbon Unit

MESSAGE FROM THE DIRECTOR GENERAL

Hydrocarbon Unit is publishing "A GLOSSARY OF POWER, ENERGY & MINERAL RESOURCES" which makes it possible for us to be directly involved in ongoing knowledge construction.

I hope users will take part in the creative process that Hydrocarbon Unit is undertaking here. We have strived to make it a high-quality publication. We have also tried to make it relevant, challenging, thought-provoking and inclusive of a diverse range of voices and perspectives.

Contributions from any corner and critical commentaries will be duly noted and incorporated for the betterment of this publication. Hydrocarbon Unit will look forward to continuing and updating this glossary regularly.

(Md. Harun-or-Rashid Khan)

Volume Abbreviations:

Natural Gas

Bcf: one billion cubic feet of natural gas

Mcf: one thousand cubic feet of natural gas

Mmcf/d: millions of cubic feet of gas per day

Mmcf: one million cubic feet of natural gas

Tcf: one trillion cubic feet of natural gas

Energy equivalents

Bcfe: one billion cubic feet of natural gas equivalent

Boe: barrel of oil (one barrel of oil equals 6,000 cubic feet of natural gas)

Kgoe: one Kilogram of oil equivalent

Mboe: one thousand barrels of oil equivalent

Mmboe: one million barrels of oil equivalent

Mmcfe: one million cubic feet of natural gas equivalent

Mtoe: one million ton of oil equivalent

Tcfe: one trillion cubic feet of natural gas equivalent

Toe: one metric ton of oil equivalent

Unit abbreviations

bcm	billion cubic metres	**MBtu**	million British thermal units
Gcal	gigacalorie	**Mt**	million tonnes
GCV	gross calorific value	**Mtoe**	million tonnes of oil equivalent
GW	gigawatt	**MWh**	megawatt hour
GWh	gigawatt hour	**PPP**	purchasing power parity
kbl/cd	thousand barrels per calendar day	**t**	metric ton = tonne = 1 000 kg
kcal	kilocalorie	**TJ**	terajoule
kg	kilogramme	**toe**	tonne of oil equivalent = 10^7 kcal
kJ	kilojoule	**TWh**	terawatt hour
kWh	kilowatt hour	**USD**	United States dollar

General conversion factors for energy

To: / From:	TJ	Gcal	Mtoe	MBtu	GWh
	multiply by:				
TJ	1	2.388×10^{2}	2.388×10^{-5}	9.478×10^{2}	2.778×10^{-1}
Gcal	4.187×10^{-3}	1	1.000×10^{-7}	3.968	1.163×10^{-3}
Mtoe	4.187×10^{4}	1.000×10^{7}	1	3.968×10^{7}	1.163×10^{4}
MBtu	1.055×10^{-3}	2.520×10^{-1}	2.520×10^{-8}	1	2.931×10^{-4}
GWh	3.600	8.598×10^{2}	8.598×10^{-5}	3.412×10^{3}	1

Conversion factors for mass

To: / From:	kg	t	lt	st	lb
	multiply by:				
kilogramme (kg)	1	1.000×10^{3}	9.842×10^{-4}	1.102×10^{-3}	2.205
tonne (t)	1.000×10^{3}	1	9.842×10^{-1}	1.102	2.205×10^{3}
long ton (lt)	1.016×10^{3}	1.016	1	1.120	2.240×10^{3}
short ton (st)	9.072×10^{2}	9.072×10^{-1}	8.929×10^{-1}	1	2.000×10^{3}
pound (lb)	4.536×10^{-1}	4.536×10^{-4}	4.464×10^{-4}	5.000×10^{-4}	1

Conversion factors for volume

To: / From:	gal U.S.	gal U.K.	bbl	ft^3	l	m^3
	multiply by:					
U.S. gallon (gal)	1	8.327×10^{-1}	2.381×10^{-2}	1.337×10^{-1}	3.785	3.785×10^{-3}
U.K. gallon (gal)	1.201	1	2.859×10^{-2}	1.605×10^{-1}	4.546	4.546×10^{-3}
barrel (bbl)	4.200×10^{1}	3.497×10^{1}	1	5.615	1.590×10^{2}	1.590×10^{-1}
cubic foot (ft^3)	7.481	6.229	1.781×10^{-1}	1	2.832×10^{1}	2.832×10^{-2}
litre (l)	2.642×10^{-1}	2.200×10^{-1}	6.290×10^{-3}	3.531×10^{-2}	1	1.000×10^{-3}
cubic metre (m^3)	2.642×10^{2}	2.200×10^{2}	6.290	3.531×10^{1}	1.000×10^{3}	1

COMMONLY USED ACRONYMS IN BANGLADESH IN THE OIL & GAS INDUSTRY

ACC - Auxiliary Control Center
ADB - Asian Development Bank
AIIB - Asian Infrastructure Investment Bank
AMD - Acid Mine Drainage
ARC - Armored Rear Conveyor
ARD - Airborne Respirable dust
BAPEX- Bangladesh Petroleum Exploration and Production Company Limited
BB - Bangladesh Bank
BCF - Billion Cubic Feet
BCMCL - Barapukuria Coal Mining Company Limited
BMD - Bureau of Mineral Development, Bangladesh
BMD - Bureau of Mineral Development
BPC - Bangladesh Petroleum Corporation
BPDP - Bangladesh Power Development Board
BPI - Bangladesh Petroleum Institute
CBM - Coal Bed Methane
CITES- Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMC - Chinese National Machinery Import & Export Corporation
CPEF - Coal Price Equalization Fund
CRIRSCO - Committee for Mineral Reserves International Reporting Standards
DOE - Department of Environment
EA - Executing Agency
ECA - Environment Conservation Act
ECC - Environmental Clearance Certificate
ECR - Environment Conservation Rules
EIA - Environmental Impact Assessment
EMP - Environmental Management Plan
EMRD - Energy and Mineral Resources Division
ERL - Eastern Refinery Limited
ESA - Environmental and Safety Assessment
ESMS - Environment and Safety Management System
FSRU - Floating Storage and Re-gasification Unit
G to G- Government to Government
GDP - Gross Domestic Product
GNI - Gross National Income
GoB - Government of Bangladesh
GRC - Grievance Redress Committee
GSB - Geological Survey of Bangladesh
GTCL - Gas Transmission Company Limited
GTDP- Gas Transmission and Development Project
HCU - Hydrocarbon Unit, Bangladesh
IBFPL- Indo-Bangla Friendship pipeline
ICT - Information and Communications Technology
IEE - Initial Environmental Examination
IGF - Intergovernmental Forum
ILO - International Labour Organization
IMCL - International Mining Consultants Limited
IMF - International Monetary Fund
IOC - International Oil Company
IRR - Internal Rate of Return
ISO-OHSAS - International Organization for Standardization - Occupational Health and Safety Advisory Services
JGI - Japan Geoscience Institute
JORC - Joint Ore Reserves Committee
JV - Joint Venture
LC - Letter of Credit
LCC - Locational Clearance Certificate
LDT - Lower Dupi Tila
LNG - Liquefied Natural Gas
LPG - Liquefied Petroleum Gas
LTCC - Longwall Top Coal Caving

M&P Contract - Management Production and Maintenance Service Contract
MCC - Master Control Center
MGMCL - Maddhapara Granite Mining Company Ltd
MMCFD- Million Cubic Feet per Day
MMDP - Mines and Minerals Development Project
MMMSD- Mining, Minerals, Metals and Sustainable Development
MMR - Mines and Minerals Rules
MMSCF - Million Standard Cubic Feet
MMtpa - Million Tons per Annum
MOECO - Mitsui Oil Exploration Co. Ltd.
MOEF - Ministry of Environment and Forests
MoU - Memorandum of Understanding
MPEMR- Ministry of Power, Energy and Mineral Resources
Mt - Million Tonne
Mtoe - Million Tons Oil Equivalent
NOC - National Oil Companies
NOC - No Objection Certificate
NOC - Note of Completion of Work
NPV - Net Present Value
NRL - Numaligarh Refinery Limited
ODA - Overseas Development Administration
OH&S- Operations Health and Safety
Petrobangla (BOGMC) - Bangladesh Oil, Gas and Minerals Corporation
PIU - Project Implementation Unit
PME - Periodical Medical Examination
POL - Petroleum, Oil & Lubricants
PPE - Personal Protective Equipment
PSC - Production Sharing Contracts
PSU - Public Sector Unit
PwC - PricewaterhouseCoopers Pvt. Ltd., India
R&D - Research and Development
R&R - Rehabilitation and Resettlement
REC - Revised Cost Estimate
RoW - Right-of-Way
RTU - Remote Terminal Unit
S&P - Standard & Poor
SDF - Sustainable Development Framework
SDG - Sustainable Development Goal
SGFL - Sylhet Gas Fields Limited
SOP - Standard Operating Procedure
SPS - Safeguard Policy Statement
SSR - Systematic Support Rule
TCF - Trillion Cubic Feet
TEFS - Techno-Economic Feasibility Study
UCG - Underground Coal Gasification
UDT - Upper Dupi Tila
UNFC- United Nations Framework Classification

a

Abandoned well: a well (oil, natural gas, or water injection) not in use because it was a dry hole originally, or because it has ceased to produce economical quantities of oil and/or natural gas, or has become unusable. Regulations require the plugging of abandoned wells to prevent the seepage of oil, gas, or water from one stratum of underlying rock to another.

Able-bodied seaman (AB): a member of an LNG crew, with three years of sea service, certified by examination to perform all the duties of an experienced seaman. A typical LNG ship carries five ABs in her crew complement. *See,* ***Crew***

Absolute humidity: The ratio of the mass of water vapor to the volume occupied by a mixture of water vapor and dry air.

Absorbent: A material that extracts one or more substances from a fluid (gas or liquid) medium on contact, and which changes physically and/or chemically in the process. The less volatile of the two working fluids in an absorption cooling device.

Absorber: The component of a solar thermal collector that absorbs solar radiation and converts it to heat, or, as in a solar photovoltaic device, the material that readily absorbs photons to generate charge carriers (free electrons or holes).

Absorption Chiller: A type of air cooling device that uses absorption cooling to cool interior spaces.

Absorption Coefficient: In reference to a solar energy conversion device, the degree to which a substance will absorb solar energy. In a solar photovoltaic device, the factor by which photons are absorbed as they travel a unit distance through a material.

Absorption cooling: A process in which cooling of an interior space is accomplished by the evaporation of a volatile fluid, which is then absorbed in a strong solution, then desorbed under pressure by a heat source, and then recondensed at a temperature high enough that the heat of condensation can be rejected to an exterior space.

Absorption refrigeration: A system in which a secondary fluid absorbs the refrigerant, releasing heat, then releases the refrigerant and reabsorbs the heat. Ammonia or water is used as the vapor in commercial absorption cycle systems, and water or lithium bromide is the absorber.

Absorption: The passing of a substance or force into the body of another substance.

Absorptivity: In a solar thermal system, the ratio of solar energy striking the absorber that is absorbed by the absorber to that of solar energy striking a black body (perfect absorber) at the same temperature. The absorptivity of a material is numerically equal to its emissivity.

AC: *See,* alternating current.

Accent Lighting: Draws attention to special features or enhances the aesthetic qualities of an indoor or outdoor environment.

Acceptor: A dopant material, such as boron, which has fewer outer shell electrons than required in an otherwise balanced crystal structure, providing a hole, which can accept a free electron.

Accumulator: A component of a heat pump that stores liquid and keeps it from flooding the compressor. The accumulator takes the strain off the compressor and improves the reliability of the system.

Acid gas: a gas that contains compounds, such as CO_2, H_2S, or mercaptans that can form an acid in solution with water.

Acid Rain: A term used to describe precipitation that has become acidic (low pH) due to the emission of sulfur oxides from fossil fuel burning power plants.

Acquiring shipper: in the context of capacity release, a shipper who acquires firm capacity rights from a releasing shipper. Also known as replacement shipper. *See, Capacity (gas)*

Acreage: Land leased for oil and gas exploration and/or land for which ConocoPhillips owns the mineral rights.

Activated Shelf Life: The period of time, at a specified temperature, that a charged battery can be stored before its capacity falls to an unusable level.

Activation Voltage(s): The voltage(s) at which a charge controller will take action to protect the batteries.

Active Cooling: The use of mechanical heat pipes or pumps to transport heat by circulating heat transfer fluids.

Active Power: The power (in Watts) used by a device to produce useful

work. Also called input power.

Active Solar Heater: A solar water or space-heating system that use pumps or fans to circulate the fluid (water or heat-transfer fluid like diluted antifreeze) from the solar collectors to a storage tank subsystem.

Adiabatic: a term describing a thermodynamic process in which no heat is added to or removed from the system. Without loss or gain of heat to a system. An adiabatic change is a change in volume and pressure of a parcel of gas without an exchange of heat between the parcel and its surroundings. In reference to a steam turbine, the adiabatic efficiency is the ratio of the work done per pound of steam, to the heat energy released and theoretically capable of transformation into mechanical work during the adiabatic expansion of a unit weight of steam.

Adjustable Set Point: A feature allowing the user to adjust the voltage levels at which a charge controller will become active.

Adjustable Speed Drive: An electronic device that controls the rotational speed of motor-driven equipment such as fans, pumps, and compressors. Speed control is achieved by adjusting the frequency of the voltage applied to the motor.

Admeasurement: the confirmed or official dimensions of an LNG ship.

Adobe: A building material made from clay, straw, and water, formed into blocks, and dried; used traditionally in the southwestern U.S.

Advanced turbine systems (ATS): industrial gas turbines, approximately 5 and 15 megawatts (MW) in capacity, for distributed generation, industrial and cogeneration markets; and gas turbines, combined-cycle systems, 400 MW, for large, baseload, central-station power-generation markets. ATS expectations are to meet or exceed 60% system efficiencies in the utility market, and to increase efficiencies of industrial turbines by 15%. The new turbines emit far less nitrogen oxides, carbon dioxide, and unburned hydrocarbons than current gas turbine systems. *See, Combined-cycle gas turbine (CCGT)*

Aerobic Bacteria: Microorganisms that require free oxygen, or air, to live, and that which contribute to the decomposition of organic material in soil or composting systems.

Agency service: an arrangement that allows a gas buyer to give an agent authority to act on the buyer's behalf to arrange or administer pipeline transportation and/or sales services.

Aggregate receipt points: 1) a hub where different supply sources intersect on a gas pipeline; 2) multiple producer meters entering a pipeline. *See, Hub* or *Market centre*

Aggregator: 1) acts on behalf of groups of producers to collect producer supplies and sell the gas in commingled blocks to end-users. Prior to deregulation, a limited number of aggregators operated. Aggregators do not take title to the gas but simply find markets and negotiate prices for pools of producers. Also called core transport agent; 2) also a firm that bargains on behalf of a large group of consumers to achieve the lowest possible price for utilities such as electricity and gas. The firm "aggregates" or combines many smaller customers into one large customer for purposes of negotiation and then purchases the utility commodity on behalf of the group.

AIC: *see,* amperage interrupt capability.

Air Change: A measure of the rate at which the air in an interior space is replace by outside (or conditioned) air by ventilation and infiltration; usually measured in cubic feet per time interval (hour), divided by the volume of air in the room.

Air Conditioning: The control of the quality, quantity, and temperature-humidity of the air in an interior space.

Air Diffuser: An air distribution outlet, typically located in the ceiling, which mixes conditioned air with room air.

Air Infiltration Measurement: A building energy auditing technique used to determine and/or locate air leaks in a building shell or envelope.

Air Mass (*sometimes called* **Air Mass Ratio**): Equal to the cosine of the zenith angle-that angle from directly overhead to a line intersecting the sun. The air mass is an indication of the length of the path solar radiation travels through the atmosphere. An air mass of 1.0 means the sun is directly overhead and the radiation travels through one atmosphere (thickness).

Air Pollution Control: The use of devices to limit or prevent the release of pollution into the atmosphere.

Air Pollution: The presence of contaminants in the air in concentrations that prevent the normal dispersive ability of the air, and that interfere with biological processes and human economics.

Air Quality Standards: The prescribed level of pollutants allowed in outside or indoor air as established by legislation.

Air Register: The component of a combustion device that regulates the amount of air entering the combustion chamber.

Air Retarder/Barrier: A material or structural element that inhibits air flow into and out of a building's envelope or shell. This is a continuous sheet composed of polyethylene, polypropylene, or extruded polystyrene. The sheet is wrapped around the outside of a house during construction to reduce air in-and exfiltration, yet allow water to easily diffuse through it.

Air Space: The area between the layers of glazing (panes) of a window.

Air: The mixture of gases that surrounds the earth and forms its atmosphere, composed of, by volume, 21 percent oxygen, 78 percent nitrogen.

Airlock Entry: A building architectural element (vestibule) with two airtight doors that reduces the amount of air infiltration and exfiltration when the exterior most door is opened.

Air-Source Heat Pump: A type of heat pump that transfers heat from outdoor air to indoor air during the heating season, and works in reverse during the cooling season.

Airtight Drywall Approach (ADA): A building construction technique used to create a continuous air retarder that uses the drywall, gaskets, and caulking. Gaskets are used rather than caulking to seal the drywall at the top and bottom. Although it is an effective energy-saving technique, it was designed to keep airborne moisture from damaging insulation and building materials within the wall cavity.

Air-to-Air Heat Pump: *see,* Air-Source Heat Pump.

Air-to-Water Heat Pump: A type of heat pump that transfers heat in outdoor air to water for space or water heating.

Albedo: The ratio of light reflected by a surface to the light falling on it.

Alcohol: A group of organic compounds composed of carbon, hydrogen, and oxygen; a series of molecules composed of a hydrocarbon plus a hydroxyl group; includes methanol, ethanol, isopropyl alcohol and others.

Algae: Primitive plants, usually aquatic, capable of synthesizing their own food by photosynthesis.

Alternating Current (AC): A type of electrical current, the direction of which is reversed at regular intervals or cycles. In the United States, the standard is 120 reversals or 60 cycles per second. Electricity transmission networks use AC because voltage can be controlled with relative ease.

Alternative fuel capability: the on-site availability of a power plant to burn more than one fuel.

Alternative Fuels: A popular term for "non-conventional" transportation fuels derived from natural gas (propane, compressed natural gas, methanol, etc.) or biomass materials (ethanol, methanol).

Alternator: A generator producing alternating current by the rotation of its rotor, and which is powered by a primary mover.

Ambient Air: The air external to a building or device.

Ambient Lighting: Provides general illumination indoors for daily activities, and outdoors for safety and security.

Ambient Temperature: The temperature of a medium, such as gas or liquid, which comes into contact with or surrounds an apparatus or building element. *OR,* environmental temperature unaffected by other heat sources, such as radiation from artificial objects. ***OR,*** The temperature of the surrounding area

American National Standards Institute (ANSI): the coordinating organization for US federated national standards system.

American Petroleum Institute (API): The American Petroleum Institute is the oil and gas industry's trade organization. API's research and engineering work provides a basis for establishing operating and safety standard issues and specifications for the manufacturing of oil field equipment and furnishes statistical and other information to related agencies. Visit API at www.api.org.

Ammonia: A colorless, pungent, gas (NH_3) that is extremely soluble in water, may be used as a refrigerant; a fixed nitrogen form suitable as fertilizer.

Amorphous Semiconductor: A non-crystalline semiconductor material that has no long-range order.

Amorphous Silicon: A thin-film, silicon photovoltaic cell having no crystalline structure. Manufactured by depositing layers of doped silicon on a substrate. *See also,* **single-crystal**

silicon and **polycrystalline silicon**.

Amperage Interrupt Capability (AIC): direct current fuses should be rated with a sufficient AIC to interrupt the highest possible current.

Ampere (amp): A unit of electrical current or rate of flow of electrons. One volt across one ohm of resistance causes a current flow of one ampere. ***OR,*** A unit of measure for an electrical current; the amount of current that flows in a circuit at an electromotive force of one Volt and at a resistance of one Ohm. Abbreviated as amp.

Ampere Hour Meter: An instrument that monitors current with time. The indication is the product of current (in amperes) and time (in hours).

Amp-Hours *OR,* **Ampere-Hour (Ah/AH):** A measure of the flow of current (in amperes) over one hour; used to measure battery capacity.

Anaerobic Bacteria: Microorganisms that live in oxygen deprived environments.

Anaerobic Digester: A device for optimizing the anaerobic digestion of biomass and/or animal manure, and possibly to recover biogas for energy production. Digester types include batch, complete mix, continuous flow (horizontal or plug-flow, multiple-tank, and vertical tank), and covered lagoon.

Anaerobic Digestion: The complex process by which organic matter is decomposed by anaerobic bacteria. The decomposition process produces a gaseous byproduct often called "biogas" primarily composed of methane, carbon dioxide, and hydrogen sulfide.

Anaerobic Lagoon: A holding pond for livestock manure that is designed to anaerobically stabilize manure, and may be designed to capture biogas, with the use of an impermeable, floating cover.

Ancillary Services: Services that assist the grid operator in maintaining system balance. These include regulation and the contingency reserves: spinning, non-spinning, and in some regions, supplemental operating reserve.

Anemometer: An instrument for measuring the force or velocity of wind; a wind gauge.

Angle Of Incidence: In reference to solar energy systems, the angle at which direct sunlight strikes a surface; the angle between the direction of the sun and the perpendicular to the surface. Sunlight with an incident angle of 90 degrees tends to be absorbed, while lower angles tend to be reflected. ***OR,*** The angle that a ray of sun makes with a line perpendicular to the surface. For example, a surface that directly faces the sun has a solar angle of incidence of zero, but if the surface is parallel to the sun (for example, sunrise striking a horizontal rooftop), the angle of incidence is 90°.

Angle Of Inclination: In reference to solar energy systems, the angle that a solar collector is positioned above horizontal.

Angstrom Unit: A unit of length named for A.J. Ångström, a Swedish spectroscopist, used in measuring electromagnetic radiation equal to 0.000,000,01 centimeters.

Anhydrous Ethanol: One hundred percent alcohol; neat ethanol.

Annual Contract Quantity: the annual delivery quantity contracted for during each contract year as specified in a gas sales or LNG contract.

Annual Delivery Programme (ADP): a key document for both the buyer and seller in determining how they will work together over the life of an LNG project to achieve the efficient delivery and receipt of LNG cargoes; normally agreed between the parties before the beginning of each contract year. For an ex-ship sale, the ADP deals with the dates on which the sellers' LNG ships will deliver LNG to the buyers' terminals. For a Free on board (FOB) sale, the ADP covers the dates of arrival of the buyers' ships at the LNG plant. Whether the sale is ex-ship or FOB, the ADP provides a basis for decisions on how buyers and sellers will operate their facilities during the contract year covered. Usually, the procedures to be adopted to develop the ADP are agreed upon in the Sales and Purchase Agreement (SPA). *See, Sales and Purchase Agreement (SPA), CIF contract, Ex-ship contract,* and *FOB contract*

Annual Fuel Utilization Efficiency (AFUE): The measure of seasonal or annual efficiency of a residential heating furnace or boiler. It takes into account the cyclic on/off operation and associated energy losses of the heating unit as it responds to changes in the load, which in turn is affected by changes in weather and occupant controls.

Annual Load Fraction: That fraction of annual energy demand supplied by a solar system.

Annual Solar Savings: The annual solar savings of a solar building is the energy savings attributable to a solar feature relative to the energy

requirements of a non-solar building.

Anode: The positive electrode in an electrochemical cell (battery) vacuum tube, etc. Also, the earth or ground in a cathodic protection system. Also, the positive terminal of a diode. (see also, sacrificial anode).

Anthracite (Coal): A hard, dense type of coal, that is hard to break, clean to handle, difficult to ignite, and that burns with an intense flame and with the virtual absence of smoke because it contains a high percentage of fixed carbon and a low percentage of volatile matter.

Anthropogenic: Referring to alterations in the environment due to the presence or activities of humans.

Anticline: A convex-upward formation of rock layers, which may form a trap for hydrocarbons.

Antifreeze Solution: A fluid, such as methanol or ethylene glycol, added to vehicle engine coolant, or used in solar heating system heat transfer fluids, to protect the systems from freezing.

Antireflection Coating: A thin coating of a material applied to a solar cell (photovoltaic) surface that reduces the light reflection and increases light transmission.

Aperture: An opening; in solar collectors, the area through which solar radiation is admitted and directed to the absorber.

Apparent Day: A solar day; an interval between successive transits of the sun's center across an observer's meridian; the time thus measured is not equal to clock time.

Apparent Power (KVA): This is the voltage-ampere requirement of a device designed to convert electric energy to a non-electrical form.

Appliance Energy Efficiency Ratings: The ratings under which specified appliances convert energy sources into useful energy, as determined by procedures established by the U.S. Department of Energy.

Appliance Standards: Standards established by the U.S. Congress for energy consuming appliances in the National Appliance Energy Conservation Act (NAECA) of 1987, and as amended in the National Appliance Energy Conservation Amendments of 1988, and the Energy Policy Act of 1992 (EPAct). NAECA established minimum standards of energy efficiency for refrigerators, refrigerator-freezers, freezers, room air conditioners, fluorescent lamp ballasts, incandescent reflector lamps, clothes dryers, clothes washers, dishwashers, kitchen ranges and ovens, pool heaters, television sets (withdrawn in 1995), and water heaters. The EPAct added standards for some fluorescent and incandescent reflector lamps, plumbing products, electric motors, and commercial water heaters and Heating, Ventilation, and Air Conditioning (HVAC) systems. It also allowed for the future development of standards for many other products. The U.S. Department of Energy (DOE) is responsible establishing the standards and the procedures that manufacturers must use to test their models. These procedures are published in the Code of Federal Regulations (10 CFR, Ch. II, Part 430), January 1, 1994 (Federal Register).

Appliance: A device for converting one form of energy or fuel into useful energy or work.

Aquifer Storage Field: A sub-surface facility for storing natural gas consisting of water-bearing sands topped by an impermeable cap rock.

Aquifer Storage Field: A sub-surface facility for storing natural gas consisting of water-bearing sands topped by an impermeable cap rock.

Aquifer: An underground layer of water-bearing permeable rock or unconsolidated materials (gravel, sand, silt or clay) from which groundwater can be extracted using a water well.

Arbitrage: the simultaneous purchase and sale of an asset in order to profit from a difference in the price, usually on different exchanges or marketplaces. Where appropriate infrastructure exists, LNG offers the opportunity for price arbitrage between different gas markets.

Argon: A colorless, odorless inert gas sometimes used in the spaces between the panes in energy efficient windows. This gas is used because it will transfer less heat than air. Therefore, it provides additional protection against conduction and convection of heat over conventional double -pane windows.

Array (Solar): Any number of solar photovoltaic modules or solar thermal collectors or reflectors connected together to provide electrical or thermal energy. *See,* photovoltaic (PV) array.

Array Current: The electrical current produced by a photovoltaic array when it is exposed to sunlight.

Array Operating Voltage: The voltage produced by a photovoltaic array when exposed to sunlight and connected to a load.

Articles of agreement: the document containing all particulars relating to the terms of agreement between the Master of the LNG vessel and the crew. Sometimes called ship's articles or shipping articles.

Ash: The non-combustible residue of a combusted substance composed primarily of alkali and metal oxides.

ASHRAE: Abbreviation for the American Society of Heating, Refrigeration, and Air-Conditioning Engineers.

Asian Development Bank (ADB): a major multilateral financing institution engaged in LNG project finance. *See, Export-credit agencies (ECAs)* and *Multilateral institutions*

Ask: the average price asked by those persons recently willing to sell a commodity at a point in time. The asking price is considered by commodity purchasers in a market-making or price-discovery context.

Associated gas: natural gas found mixed with oil in underground reservoirs that comes out of solution as a by-product of oil production. In these fields, natural gas production fluctuates with oil production. See *Non-associated gas*

Associated-free natural gas: in immediate contact, but not in solution, with oil in the reservoir. One usually distinguishes between associated (free) gas, dissolved gas and non-associated gas.

Astern: a backward direction in the line of a vessel's fore and aft line. If a vessel moves backwards it is said to move astern, opposite to ahead.

ASTM: Abbreviation for the American Society for Testing and Materials, which is responsible for the issue of many standard methods used in the energy industry.

Asynchronous Generator: A type of electric generator that produces alternating current that matches an existing power source.

Atlantic basin market: See *LNG markets*

Atmospheric Pressure: The pressure due to the weight of the atmosphere (air and water vapor) on the earth's surface. The pressure of the air at sea level; one standard atmosphere at zero degrees centigrade is equal to 14.695 pounds per square inch (1.033 kilograms per square centimeter).

At-risk condition: a certificate condition that places the responsibility for under-recovery of costs regarding pipeline expansion or new construction on the pipeline sponsor, rather than on the pipeline's other customers.

Atrium: An interior court to which rooms open.

Attic Fan: A fan mounted on an attic wall used to exhaust warm attic air to the outside.

Attic Vent: A passive or mechanical device used to ventilate an attic space, primarily to reduce heat buildup and moisture condensation.

Attic: The usually unfinished space above a ceiling and below a roof.

Audit (Energy): The process of determining energy consumption, by various techniques, of a building or facility.

Auto ignition temperature: The lowest temperature at which a gas will ignite after an extended time of exposure.

Automatic Damper: A device that cuts off the flow of hot or cold air to or from a room as controlled by a thermostat.

Automatic (or Remote) Meter Reading System: A system that records the consumption of electricity, gas, water, etc. and sends the data to a central data accumulation device.

Autonomous System: *See* stand-alone system.

Auxiliary Energy or System: Energy required to operate mechanical components of an energy system, or a source of energy or energy supply system to back-up another.

Availability: The quality or condition of a photovoltaic system being available to provide power to a load. Usually measured in hours per year. One minus availability equals downtime. ***OR,*** Describes the reliability of power plants. It refers to the number of hours that a power plant is available to produce power divided by the total hours in a set time period, usually a year.

Available Heat: The amount of heat energy that may be converted into useful energy from a fuel.

Average Cost: The total cost of production divided by the total quantity produced.

Average daily quantity (ADQ): the monthly contracted quantity of gas divided by the number of customers' operating days in that month.

Average day: the temperature condition corresponding to a typical day in an average temperature year. The gas sales or requirements for an average day are annual totals divided by 365 days.

Average Demand: The demand on, or the power output of, an electrical system or any of its parts over an interval of time, as determined by the total number of kilowatt-hours divided by the units of time in the interval. ***OR,*** measure of the total of energy loads placed by customers on a system divided by the time period over which the demands are incurred.

Average temperature year: long-term average recorded temperature.

Average Wind Speed (or Velocity): The mean wind speed over a specified period of time.

Avoided Cost: The incremental cost to an electric power producer to generate or purchase a unit of electricity or capacity or both.

AWG: The abbreviation for American Wire Gauge; the standard for gauging the size of wires (electrical conductors).

Awning: An architectural element for shading windows and wall surfaces placed on the exterior of a building; can be fixed or movable.

Axial Fans: Fans in which the direction of the flow of the air from inlet to outlet remains unchanged; includes propeller, tubaxial, and vaneaxial type fans.

Axial Flow Compressor: A type of air compressor in which air is compressed in a series of stages as it flows axially through a decreasing tubular area.

Axial Flow Turbine: A turbine in which the flow of a steam or gas is essentially parallel to the rotor axis.

Azimuth (Solar) Angle: The angle between true south and the point on the horizon directly below the sun.

b

Backdrafting: The flow of air down a flue/chimney and into a house caused by low indoor air pressure that can occur when using several fans or fireplaces and/or if the house is very tight.

Backhaul: a natural gas transportation service that requires movement of gas from a point of receipt to a point of delivery such that the contractual direction of movement on the pipeline is in a direction opposite to the flow of the gas.

Back-stopping: arranging for alternate supplies of gas in the event the primary source fails to be delivered.

Backup Energy System: A reserve appliance; for example, a stand-by generator for a home or commercial building.

Backwardation: a market where the price for nearby delivery is higher than for further forward months. The opposite of backwardation is contango – a market situation where prices are higher for forward delivery dates than for nearer delivery dates.

Bacteria: Single-celled organisms, free-living or parasitic, that break down the wastes and bodies of dead organisms, making their components available for reuse by other organisms.

Baffle: A device, such as a steel plate, used to check, retard, or divert a flow of a material.

Bagasse: The fibrous material remaining after the extraction of juice from sugarcane; often burned by sugar mills as a source of energy.

Baghouse: An air pollution control device used to filter particulates from waste combustion gases; a chamber containing a bag filter.

Balance Point: An outdoor temperature, usually 20 to 45 degrees Fahrenheit, at which a heat pump's output equals the heating demand. Below the balance point, supplementary heat is needed.

Balance: the amount of natural gas put into the pipeline and the amount of gas taken out of the pipeline are equal on a fixed-time basis.

Balance-of-system: In a renewable energy system, refers to all components other than the mechanism used to harvest the resource (such as photovoltaic panels or a wind turbine). Balance-of-system costs can include design, land, site preparation, system installation, support structures, power conditioning, operation and maintenance costs, indirect storage, and related costs. ***OR,*** Represents all components and costs other than the photovoltaic modules/array.

Balancing Area: A metered segment of the power system, maintained by a balancing area authority that ensures the total of all electrical generation equals the total of all system loads.

Balancing Item: Represents differences between the sum of the components of natural gas supply and the sum of the components of natural gas disposition. These differences may be due to quantities lost or to the effects of data reporting problems. Reporting problems include differences due to the net result of conversions of flow data

metered at varying temperature and pressure bases and converted to a standard temperature and pressure base; the effect of variations in company accounting and billing practices; differences between billing cycle and calendar period time frames; and imbalances resulting from the merger of data-reporting systems that vary in scope, format, definitions, and type of respondents.

Balancing service: gas-balancing service accommodates imbalances between actual customer usage and gas delivered for that customer's use.

Balancing: 1) the requirement imposed by both electricity grids and natural gas pipelines that supply and demand be equal over a certain time period; 2) the practice by shippers of offsetting (balancing) their gas deliveries from the pipeline with injections of gas supplies into the pipeline on a regular basis.

Baling: A means of reducing the volume of a material by compaction into a bale.

Ballast Efficacy Factor: The measure of the efficiency of fluorescent lamp ballasts. It is the relative light output divided by the power input.

Ballast Factor: The ratio of light output of a fluorescent lamp operated on a ballast to the light output of a lamp operated on a standard or reference ballast.

Ballast tank: compartments at the bottom of a ship or on the sides that are filled with liquids for stability and to make the ship seaworthy. Any shipboard tank or compartment on a tanker normally used for carrying salt water ballast. When these compartments or tanks are not connected with the cargo system, they are called segregated ballast tanks or systems.

Ballast: A device used to control the voltage in a fluorescent lamp. ***OR,*** Heavy substances loaded by a vessel to improve stability, trimming, sea-keeping and to increase the immersion at the propeller. Seawater ballast is commonly loaded in most vessels in ballast tanks, positioned in compartments right at the bottom and in some cases on the sides, called wing tanks. On a tanker, ballast is seawater that is taken into the cargo tanks to submerge the vessel to a proper trim.

Band Gap Energy (Eg): The amount of energy (in electron volts) required to free an outer shell electron from its orbit about the nucleus to a free state, and thus promote it from the valence to the conduction level.

Band Gap: In a semiconductor, the energy difference between the highest valence band and the lowest conduction band.

Bare-boat charter: a charter in which the bare ship is chartered without crew; the charterer, for a stipulated sum takes over the vessel for a stated period of time with a minimum of restrictions; the charterer appoints the master and the crew and pays all running expenses.

Barrel (petroleum) (b/bl/bbl): a volumetric unit of measure for crude oil and petroleum products equivalent to 42 US gallons or 158.978 litres ***OR,*** 306 pounds of oil, or 5.78 million Btu. See *Barrel of oil equivalent (boe)*

Barrel of oil equivalent (BOE): A measure used to aggregate oil and gas resources or production, with one BOE being approximately equal to 6,000 cubic feet of natural gas. ***OR,*** The oil equivalence of natural gas is normally based on the amount of heat released when the gas is burned as compared with burning a barrel of oil. For a typical natural gas, burning 6,000 standard cubic feet liberates about the same amount of heat as burning one barrel of an average crude.

Barrels a day (b/d, bpd, or bbl/d): a unit of measurement used in the industry for the production rates of oilfields, pipelines and transportation.

Barrels per calendar day (b/cd): total throughput divided by number of calendar days. The total divided by actual number of days in operation (i.e., stream days) gives the stream-day-rate, which equals or exceeds the calendar-day-rate. Calendar day is a term describing the throughput of a facility that occurs on a daily basis averaged over a long period of time. A calendar day rate times 365 gives the average annual rate.

Barrier Energy: The energy given up by an electron in penetrating the cell barrier; a measure of the electrostatic potential of the barrier.

Basal Metabolism: The amount of heat given off by a person at rest in a comfortable environment; approximately 50 Btu per hour (Btu/h).

Base gas: gas required in a storage pool to maintain sufficient pressure to keep the working gas recoverable.

Base Load Generating Plants: Typically coal or nuclear generating units that are committed and dispatched at constant or near-constant

levels with minimum cycling. They are often the sources of lowest-cost of energy when run at very high capacity factors.

Base Load: The average amount of electric power that a utility must supply in any period.

Base period: in the US under FERC regulations, a recent 12-month period that serves as the "sample" period for demonstrating pipeline operational costs on which the pipeline's future rates will be based.

Base Power: Power generated by a power generator that operates at a very high capacity factor.

Base pressure: standard unit of pressure used in determining gas volume. Volumes are measured at operating pressures and then corrected to base-pressure volume. Base pressure is normally defined in any gas measurement contract. The standard value for natural gas in the US is 14.73 psia, established in 1969 by the American National Standards Institute as standard Z-132.1. Also called base conditions. The standard pressure specified in US state regulations on base pressure varies slightly from state to state.

Base temperature: an arbitrary temperature to which measurements of a volume of gas are referred. The standard value in the US is 60°F (520°R) for natural gas as established by the American National Standards Institute as standard Z-132.1.

Baseboard Radiator: A type of radiant heating system where the radiator is located along an exterior wall where the wall meets the floor.

Baseload capacity: the generating equipment normally operated to serve loads on an around-the-clock basis. ***OR,*** The power output of a power plant that can be continuously produced.

Baseload Demand: The minimum demand experienced by a power plant.

Baseload Power Plant: A power plant that is normally operated to generate a base load, and that usually operates at a constant load; examples include coal fired and nuclear fueled power plants.

Basement: The conditioned or unconditioned space below the main living area or primary floor of a building.

Basin: A large, natural depression on the Earth's surface in which sediments, generally brought by water, accumulate.

Batch Heater: This simple passive solar hot water system consists of one or more storage tanks placed in an insulated box that has a glazed side facing the sun. A batch heater is mounted on the ground or on the roof (make sure your roof structure is strong enough to support it). Some batch heaters use "selective" surfaces on the tank(s). These surfaces absorb sun well but inhibit radiative loss. Also known as bread box systems or integral collector storage systems.

Batch Process: A process for carrying out a reaction in which the reactants are fed in discrete and successive charges.

Batt/Blanket: A flexible roll or strip of insulating material in widths suited to standard spacings of building structural members (studs and joists). They are made from glass or rock wool fibers. Blankets are continuous rolls. Batts are pre-cut to four or eight foot lengths.

Battery Available Capacity *OR,* Battery Capacity: The total maximum electrical charge, expressed in ampere-hours, that can be withdrawn from a cell or battery under a specific set of operating conditions including discharge rate, temperature, initial state of charge, age, and cut-off voltage.

Battery Cell: The simplest operating unit in a storage battery. It consists of one or more positive electrodes or plates, an electrolyte that permits ionic conduction, one or more negative electrodes or plates, separators between plates of opposite polarity, and a container for all the above.

Battery Cycle Life: The number of cycles, to a specified depth of discharge, that a cell or battery can undergo before failing to meet its specified capacity or efficiency performance criteria.

Battery Energy Capacity: The total energy available, expressed in watt-hours (kilowatt-hours), which can be withdrawn from a fully charged cell or battery. The energy capacity of a given cell varies with temperature, rate, age, and cut-off voltage. This term is more common to system designers than it is to the battery industry where capacity usually refers to ampere-hours.

Battery Energy Storage: Energy storage using electrochemical batteries. The three main applications for battery energy storage systems include spinning reserve at generating stations, load leveling at substations, and peak shaving on the customer side of the meter.

Battery Life: The period during which a cell or battery is capable of operating above a specified capacity or efficiency performance level.

Life may be measured in cycles and/or years, depending on the type of service for which the cell or battery is intended.

Battery: An energy storage device composed of one or more electrolyte cells. OR, Two or more electrochemical cells enclosed in a container and electrically interconnected in an appropriate series/parallel arrangement to provide the required operating voltage and current levels. Under common usage, the term battery also applies to a single cell if it constitutes the entire electrochemical storage system.

BBL: One stock tank barrel, of 42 U.S. gallons liquid volume, used in reference to crude oil, bitumen, condensate or natural gas liquids.

BCF/bcf: acronym for billion cubic feet. Used to measure the volume of large quantities of natural gas.

Beach gas: natural gas transported through offshore pipelines to a number of gas gathering and processing terminals at or near a coastal region.

Beach price: price applying to natural gas at landfall.

Beadwall: A form of movable insulation that uses tiny polystyrene beads blown into the space between two window panes.

Beam Radiation: Solar radiation that is not scattered by dust or water droplets.

Beam: the width of a ship; also called breadth.

Bearing Wall: A wall that carries ceiling rafters or roof trusses.

Benefits Charge: The addition of per unit tax on sales of electricity, with the revenue generated used for or to encourage investments in energy efficiency measures and/or renewable energy projects.

Best bid: in the context of bids for firm transportation capacity to be released, the highest bid that qualifies under the specified criteria.

Bid: the purchase price suggested by those in a market to purchase a commodity from suppliers.

Bid-Ask Spread: The market-making differential between buyers and sellers of a commodity. Narrow spreads are a sign of market liquidity.

Bill of lading (B/L): a document by which the Master of a ship acknowledges having received in good order and condition (or the reverse) certain specified goods consigned to him by some particular shipper, and binds himself to deliver them in similar condition, unless the perils of the sea, fire or enemies prevent him, to the consignees of the shippers at the point of destination on their paying him the stipulated freight. A bill of lading specifies the name of the master, the port and destination of the ship, the goods, the consignee, and the rate of freight; documentation legally demonstrating a cargo has been loaded. The bill of lading is signed by the Master of the ship and the contract supplier.

Bimetal: Two metals of different coefficients of expansion welded together so that the piece will bend in one direction when heated, and in the other when cooled, and can be used to open or close electrical circuits, as in thermostats.

Bin Method: A method of predicting heating and/or cooling loads using instantaneous load calculation at different outdoor dry-bulb temperatures, and multiplying the result by the number of hours of occurrence of each temperature.

Binary Cycle Geothermal Plants: Binary cycle systems can be used with liquids at temperatures less than 350° F (177 ° C). In these systems, the hot geothermal liquid vaporizes a secondary working fluid, which then drives a turbine.

Binary Cycle: Combination of two power plant turbine cycles utilizing two different working fluids for power production. The waste heat from the first turbine cycle provides the heat energy for the operation of the second turbine, thus providing higher overall system efficiencies.

Biochemical Oxygen Demand: The weight of oxygen taken up mainly as a result of the oxidation of the constituents of a sample of water by biological action; expressed as the number of parts per million of oxygen taken up by the sample from water originally saturated with air, usually over a period of five days at 20 degrees centigrade. A standard means of estimating the degree of contamination of water.

Bioconversion: The conversion of one form of energy into another by the action of plants or microorganisms. The conversion of biomass to ethanol, methanol, or methane.

Bioenergy: The conversion of the complex carbohydrates in organic material into energy.

Biogas: A combustible gas created by anaerobic decomposition of organic material, composed primarily of methane, carbon dioxide, and hydrogen sulfide.

Biogasification or Biomethanization: The process of decomposing biomass with anaerobic bacteria to produce biogas.

Biomass Energy: Energy produced by the conversion of biomass directly to heat or to a liquid or gas that can be converted to energy.

Biomass Fuel: Biomass converted directly to energy or converted to liquid or gaseous fuels such as ethanol, methanol, methane, and hydrogen.

Biomass Gas: A medium Btu gas containing methane and carbon dioxide, resulting from the action of microorganisms on organic materials such as a landfill.

Biomass Gasification: The conversion of biomass into a gas, by bio-gasification (see above) or thermal gasification, in which hydrogen is produced from high-temperature gasifying and low-temperature pyrolysis of biomass.

Biomass: As defined by the Energy Security Act (PL 96-294) of 1980, "any organic matter which is available on a renewable basis, including agricultural crops and agricultural wastes and residues, wood and wood wastes and residues, animal wastes, municipal wastes, and aquatic plants."

Biophotolysis: The action of light on a biological system that results in the dissociation of a substrate, usually water, to produce hydrogen.

BIPV: See building integrated photovoltaics.

Bitumen: A highly viscous form of crude oil (greater than 10,000 centipoise) resembling cold molasses (at room temperature). Bitumen must be heated or combined with lighter hydrocarbons for it to be produced. Contains sulfur, metals and other nonhydrocarbons in its natural form.

Black start: the initial operation of a facility that begins with no utilities in service.

Blackbody: An ideal substance that absorbs all radiation falling on it, and reflecting nothing.

Block: the subdivision of a nation's exploration and production acreage. Blocks are generally defined in terms of latitude and longitude, at one-degree intervals.

Blocking Diode: A semiconductor connected in series with a solar cell or cells and a storage battery to keep the battery from discharging through the cell when there is no output, or low output, from the solar cell. It can be thought of as a one-way valve that allows electrons to flow forwards, but not backwards.

Blowdown: the depressuring of a reservoir through production of gas. This can occur with either gas or oil reservoirs at any stage in their lifecycle.

Blower Door: A device used by energy auditors to pressurize a building to locate places of air leakage and energy loss.

Blower: The device in an air conditioner that distributes the filtered air from the return duct over the cooling coil/heat exchanger. This circulated air is cooled/heated and then sent through the supply duct, past dampers, and through supply diffusers to the living/working space.

Blown in Insulation (*see also,* **Loose Fill):** An insulation product composed of loose fibers or fiber pellets that are blown into building cavities or attics using special pneumatic equipment.

Blowout: an uncontrolled flow of natural gas, oil, or water from a well caused by the release of pressure from a reservoir; may be the result of the failure of the containment system.

Boatswain (Bosun): on an LNG vessel, tantamount to a foreman; directly supervises maintenance operations. *See, Crew*

BOED: Barrels of oil equivalent per day.

Boiler Feedwater: The water that is forced into a boiler to take the place of that which is evaporated in the generation of steam.

Boiler Horsepower: A unit of rate of water evaporation equal to the evaporation per hour of 34.5 pounds of water at a temperature of 212 degrees Fahrenheit into steam at 212 degrees F.

Boiler Pressure: The pressure of the steam or water in a boiler as measured; usually expressed in pounds per square inch gauge (psig).

Boiler Rating: The heating capacity of a steam boiler; expressed in Btu per hour (Btu/h), or horsepower, or pounds of steam per hour.

Boiler: a closed vessel in which a liquid is heated, or heated and evaporated. Boilers are often classified as steam or hot water, low pressure or high pressure, capable of burning one fuel or a number of fuels. ***OR,*** A vessel or tank where heat produced from the combustion of fuels such as natural gas, fuel oil, or coal is used to generate hot water or steam for applications ranging from building space heating to electric

power production or industrial process heat.

Boil-Off Vapour: usually refers to the gases generated during the storage of volatile liquefied gases, such as LNG. LNG boils at slightly above –163°C at atmospheric pressure and is loaded, transported and discharged at this temperature, which requires special materials, insulation and handling equipment to deal with the low-temperature and the boil-off vapour (heat leakage keeps the cargo surface constantly boiling).

Bone (Oven) Dry: In reference to solid biomass fuels, such as wood, having zero moisture content.

Bone Dry Unit: A quantity of (solid) biomass fuel equal to 2,400 pounds bone dry.

Booster Pump: A pump for circulating the heat transfer fluid in a hydronic heating system.

Booster station: an installation built in an onshore or offshore pipeline to increase the pressure of the fluid in the pipeline. Also applies to oil and NGL pipelines. *See, Compressor station*

BOOT (Build-Own-Operate-Transfer): or, **Build–operate–transfer** (BOT) is a form of project financing, wherein a private entity receives a concession from the private or public sector to finance, design, construct, and operate a facility stated in the concession contract.

BOOT: In heating and cooling system distribution ductwork, the transformation pieces connecting horizontal round leaders to vertical rectangular stacks.

Borehole: A hole in the earth made by a drilling rig.

Boron (B): The chemical element commonly used as the dopant in photovoltaic device or cell material.

Bottled Gas: A generic term for liquefied and pressurized gas, ordinarily butane, propane, or a mixture of the two, contained in a cylinder for domestic use. ***OR,*** liquefied petroleum gas (LPG) stored in a liquid state in steel containers at moderate pressure and ambient temperatures.

Bottoming-Cycle: A means to increase the thermal efficiency of a steam electric generating system by converting some waste heat from the condenser into electricity. The heat engine in a bottoming cycle would be a condensing turbine similar in principle to a steam turbine but operating with a different working fluid at a much lower temperature and pressure.

Boule: A sausage-shaped, synthetic single-crystal mass grown in a special furnace, pulled and turned at a rate necessary to maintain the single-crystal structure during growth.

Bow Thrusters: propeller at the lower sea-covered part of the bow of the ship that turns at right angles to the fore-and-aft line and provides transverse thrust as a maneuvering aid.

Brayton Cycle: A thermodynamic cycle using constant pressure, heat addition and rejection, representing the idealized behavior of the working fluid in a gas turbine type heat engine.

Bread Box System: This simple passive solar hot water system consists of one or more storage tanks placed in an insulated box that has a glazed side facing the sun. A bread box system is mounted on the ground or on the roof (make sure your roof structure is strong enough to support it). Some systems use "selective" surfaces on the tank(s). These surfaces absorb sun well but inhibit radiative loss. Also known as batch heaters or integral collector storage systems.

Break bulk: to commence discharge of cargo.

Bridge: loosely used to refer to the navigating section of the vessel where the wheelhouse and chart room are located; erected either amidship, aft or very rarely fore over the main deck of a ship.

Brine: Water saturated or strongly impregnated with salt.

British thermal unit (BTU): an energy unit; the quantity of heat necessary to raise the temperature of one pound-mass of water by one degree Fahrenheit (equal to 252 calories) from 58.5°F to 59.5°F under a standard pressure of 30 inches of mercury at 32°F. The following conversions would apply to gas that contains exactly 1,000 Btu/cf – approximately true for most gas delivered in the US:

1 cubic foot (cf) = 1,000 Btu
1 therm = 100 cf = 100,000 Btu
1 mcf = 1 mmBtu
1 bcf = 1 trillion Btu
1 tcf = 1 quad = 1 quadrillion Btu

In general, the quantity of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit at the temperature at which

water has its greatest density (approximately 39 degrees Fahrenheit). One BTU is equivalent to 252 calories, 0.293 watt-hours or 1,055 joules.

Broker: gas merchant who charges a fee for matching sellers to buyers and who may help arrange gas transportation, but does not take title to the gas.

BTU Per Cubic Foot: The total heating value, expressed in Btu, produced by the combustion, at constant pressure, of the amount of the gas that would occupy a volume of 1 cubic foot at a temperature of 60 degrees F if saturated with water vapor and under a pressure equivalent to that of 30 inches of mercury at 32 degrees F and under standard gravitational force (980.665 cm. per sec. squared) with air of the same temperature and pressure as the gas, when the products of combustion are cooled to the initial temperature of gas and air when the water formed by combustion is condensed to the liquid state. (Sometimes called gross heating value or total heating value.)

Bubble point: the temperature and pressure at which a liquid first begins to vaporize to gas.

Building Energy Ratio: The space-conditioning load of a building.

Building Envelope: The structural elements (walls, roof, floor, foundation) of a building that encloses conditioned space; the building shell.

Building Heat-Loss Factor: A measure of the heating requirements of a building expressed in Btu per degree-day.

Building Integrated Photovoltaics: A term for the design and integration of photovoltaic (PV) technology into the building envelope, typically replacing conventional building materials. This integration may be in vertical facades, replacing view glass, spandrel glass, or other facade material; into semitransparent skylight systems; into roofing systems, replacing traditional roofing materials; into shading "eyebrows" over windows; or other building envelope systems.

Building Orientation: The relationship of a building to true south, as specified by the direction of its longest axis.

Building Overall Energy Loss Coefficient-Area Product: The factor, when multiplied by the monthly degree-days, which yields the monthly space heating load.

Building Overall Heat Loss Rate: The overall rate of heat loss from a building by means of transmission plus infiltration, expressed in Btu per hour, per degree temperature difference between the inside and outside.

Bulb Turbine: A type of hydro turbine in which the entire generator is mounted inside the water passageway as an integral unit with the turbine. These installations can offer significant reductions in the size of the powerhouse.

Bulb: The transparent or opaque sphere in an electric light that the electric light transmits through.

Bulk Cargo: any liquid or solid cargo loaded on to a vessel without packaging (for example, oil or LNG).

Bulk Density: The weight of a material per unit of volume compared to the weight of the same volume of water.

Bulkhead: name given to any vertical partition that separates different compartments or spaces from one another on a ship.

Buoy: a floating object employed as an aid to mariners to mark the navigable limits of channels, their fairways, sunken dangers, isolated rocks, telegraph cables, and so forth; reference points for navigation.

Burner Capacity: The maximum heat output (in Btu per hour) released by a burner with a stable flame and satisfactory combustion.

Burner Tip: the point at which natural gas is used as a fuel.

Burning Point: The temperature at which a material ignites.

Bus (Electrical): An electrical conductor that serves as a common connection for two or more electrical circuits; may be in the form of rigid bars or stranded conductors or cables.

Busbar: The power conduit of an electric power plant; the starting point of the electric transmission system.

Busbar Cost: The cost of producing electricity up to the point of the power plant busbar.

Buy/Sell Arrangement: whereby a party sells gas at the wellhead to a party with priority space in the pipeline queue and then repurchases the gas downstream, paying transmission costs and any prearranged differentials.

Bypass Diode: A diode connected across one or more solar cells in a photovoltaic module such that the diode will conduct if the cell(s) become reverse biased. It protects these solar cells from thermal

destruction in case of total or partial shading of individual solar cells while other cells are exposed to full light.

Bypass: An alternative path. In a heating duct or pipe, an alternative path for the flow of the heat transfer fluid from one point to another, as determined by the opening or closing of control valves both in the primary line and the bypass line.

C

Cadmium (Cd): A chemical element used in making certain types of solar cells and batteries.

Cadmium Telluride (CdTe): A polycrystalline thin-film photovoltaic material.

Cage: The component of an electric motor composed of solid bars (of usually copper or aluminum) arranged in a circle and connected to continuous rings at each end. This cage fits inside the stator in an induction motor in channels between laminations, thin flat discs of steel in a ring configuration.

Calendar Month: the period beginning on the first gas day of the calendar month and ending on the first gas day of the next calendar month.

Calorie: The amount of heat required to raise the temperature of a unit of water, at or near the temperature of maximum density, one degree Celsius (or Centigrade [C]); expressed as a "small calorie" (the amount of heat required to raise the temperature of 1 gram of water one degree C), or as a "large calorie" or "kilogram calorie" (the amount of heat required to raise one kilogram [1,000 grams] of water one degree C); capitalization of the word calorie indicates a kilogram-calorie.

Calorific value: The heat liberated by the combustion of a unit quantity of a fuel under specific conditions; measured in calories. ***OR,*** The quantity of heat produced by the complete combustion of a fuel. This can be measured dry or saturated with water vapour, net or gross. The general convention is dry and gross. See, *Heating value*

Candela: The luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.

Candle Power: The illuminating power of a standard candle employed as a unit for determining the illuminating quality of an illuminant.

Capability Margin: The difference between net electrical system capability and system maximum load requirements (peak load); the margin of capability available to provide for scheduled maintenance, emergency outages, system operating requirements and unforeseen loads.

Capability: The maximum load that a generating unit, power plant, or other electrical apparatus can carry under specified conditions for a given period of time, without exceeding its approved limits of temperature and stress.

Capacitance: A measure of the electrical charge of a capacitor consisting of two plates separated by an insulating material.

Capacitor: An electrical device that adjusts the leading current of an applied alternating current to balance the lag of the circuit to provide a high power factor.

Capacity (C): See battery capacity.

Capacity: unit of volume of infrastructure and shipping, usually quoted in billions of cubic meters (cm) or millions of tonnes (t). ***OR,*** The load that a power generation unit or other electrical apparatus or heating unit is rated by the manufacture to be able to meet or supply.

Capacity (Condensing Unit): The refrigerating effect in Btu/h produced by the difference in total enthalpy between a refrigerant liquid leaving the unit and the total enthalpy of the refrigerant vapor entering it. Generally measured in tons or Btu/h.

Capacity (Effective, of a Motor): The maximum load that a motor is capable of supplying.

Capacity (Heating, of a Material): The amount of heat energy needed to raise the temperature of a given mass of a substance by one degree Celsius. The heat required to raise the temperature of 1 kg of water by 1 degree Celsius is 4186 Joules.

Capacity allocations: allotment of space in a pipeline or regasification infrastructure.

Capacity assignment: the process by which an entity that holds the rights and obligations to pipeline capacity transfers those rights and obligations to another entity.

Capacity brokering: the assignment of rights to receive firm gas transportation service.

Capacity constraint: a restriction or limitation at any point along a pipeline system that affects acceptance, movement or subsequent redelivery of natural gas. A pipeline company determines the sufficiency of its capacity to deliver gas to customers.

Capacity emergency: a condition that exists when a system's or pool's load exceeds its operating capacity and cycling reserve margin, plus firm purchases from other systems and available imports from adjacent systems.

Capacity factor: The ratio of the average load on (or power output of) an electricity generating unit or system to the capacity rating of the unit or system over a specified period of time.

Capacity release: enables a shipper (releasing shipper) who has reserved firm transportation capacity to release – sell – excess capacity to a replacement shipper. The revenue received from the replacement shipper can be used to offset some of the costs associated with reserving firm transportation. Although capacity-release deals can be negotiated between shippers, the preferred method of releasing capacity is with the use of a pipeline's electronic bulletin board through a closed bidding process. Capacity release has created a secondary market and has increased efficiency in the gas transportation market. Capacity release can also occur in regasification terminals.

CAPEX: Capital expenditure.

Capital Costs: The amount of money needed to purchase equipment, buildings, tools, and other manufactured goods that can be used in production.

Capital investment: money spent for an asset expected to produce income over its useful life.

Capital lease (finance lease): a lease that transfers substantially all the risks and rewards incidental to ownership of an asset. Legal title of the asset may or may not eventually be transferred.

Captive Customer: buyer that can receive natural gas from only one service provider, with no access to alternate fuel sources; usually describing a residential or small commercial user, but may apply to a large industrial and electricity utility user that is attached to a single pipeline.

Captive Electrolyte Battery: A battery having an immobilized electrolyte (gelled or absorbed in a material).

Carbon capture and storage (CCS): Process by which carbon dioxide emissions are captured and removed from the atmosphere and then stored, normally via injection into a secure underground geological formation.

Carbon dioxide equivalents (CO_2e): The quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO_2 that would have the same global warming potential (GWP) when measured over a specified timescale (generally 100 years).

Carbon Dioxide: A colorless, odorless noncombustible gas with the formula CO_2 that is present in the atmosphere. It is formed by the combustion of carbon and carbon compounds (such as fossil fuels and biomass), by respiration, which is a slow combustion in animals and plants, and by the gradual oxidation of organic matter in the soil.

Carbon intensity: The quantity of greenhouse gas emissions associated with producing an intermediate or final product. For the oil and gas industry, carbon intensity is commonly expressed in units of Tonnes CO_2e per product volume (e.g. Tonnes CO_2e/bbl or Tonnes CO_2e/MCF).

Carbon Monoxide: A colorless, odorless but poisonous combustible gas with the formula CO. Carbon monoxide is produced in the incomplete combustion of carbon and carbon compounds such as fossil fuels (i.e. coal, petroleum) and their products (e.g. liquefied petroleum gas, gasoline), and biomass.

Carbon sequestration: The fixation of atmospheric carbon dioxide in a carbon sink through biological or physical processes.

Carbon sink: A reservoir that absorbs or takes up released carbon from another part of the carbon cycle. The four sinks, which are regions of the Earth within which carbon behaves in a systematic manner, are the atmosphere, terrestrial biosphere (usually including freshwater systems), oceans and sediments (including fossil fuels).

Carbon Zinc Cell Battery: A cell produces electric energy by the galvanic oxidation of carbon; commonly used in household appliances.

Carbon: the base of all hydrocarbons; capable of combining with hydrogen in almost numberless hydrocarbon compounds. The carbon content of a hydrocarbon determines, to a degree, the hydrocarbon's burning

characteristics and qualities.

Cargo Handling: the act of loading and discharging a cargo ship.

Cargo Plan: a plan giving the quantities and description of the various grades carried in the ship's cargo tanks, after the loading is completed.

Carnot Cycle: An ideal heat engine (conceived by Sadi Carnot) in which the sequence of operations forming the working cycle consists of isothermal expansion, adiabatic expansion, isothermal compression, and adiabatic compression back to its initial state.

Cash-Out: a procedure in which shippers are allowed to resolve imbalances by cash payments, in contrast to making up imbalances with gas volumes in-kind. See *Imbalance trading*

Casing: Thick walled steel pipe placed in wells to isolate formation fluids (such as fresh water) and to prevent borehole collapse.

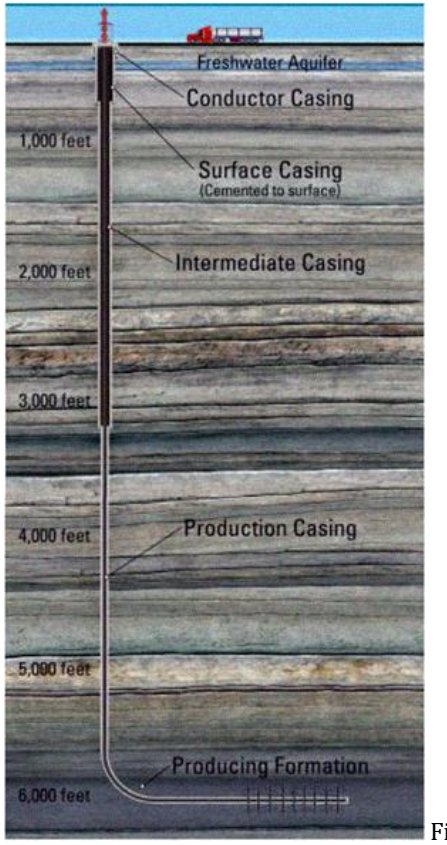

Figure: Casing

Casinghead Gas: unprocessed natural gas produced from a reservoir containing oil.

Catalyst: a substance whose presence changes the rate of chemical reaction without itself undergoing permanent change in its composition. Catalysts may be accelerators or retarders.

Catalytic Converter: An air pollution control device that removes organic contaminants by oxidizing them into carbon dioxide and water through a chemical reaction using a catalysis, which is a substance that

increases (or decreases) the rate of a chemical reaction without being changed itself; required in all automobiles sold in the United State, and used in some types of heating appliances.

Cathedral Ceiling/Roof: A type of ceiling and roof assembly that has no attic.

Cathode Disconnect Ballast: An electromagnetic ballast that disconnects a lamp's electrode heating circuit once is has started; often called "low frequency electronic" ballasts.

Cathode: The negative pole or electrode of an electrolytic cell, vacuum tube, etc., where electrons enter (current leaves) the system; the opposite of an anode.

Cathodic Protection: a method employed to minimize the rate of electrochemical corrosion of pipelines or structures. ***OR,*** A method of preventing oxidation of the exposed metal in structures by imposing between the structure and the ground a small electrical voltage.

Caulking: A material used to seal areas of potential air leakage into or out of a building envelope.

CCF - One Hundred Cubic Feet One CCF is one hundred cubic feet of natural gas at standard distribution pressure of 14.73 pounds per square inch and 60° Fahrenheit.

Cd: See cadmium.

CdTe: See cadmium telluride.

Ceiling Fan: A mechanical device used for air circulation and to provide cooling.

Ceiling: The downward facing structural element that is directly opposite the floor.

Cell barrier: A very thin region of static electric charge along the interface of the positive and negative layers in a photovoltaic cell. The barrier inhibits the movement of electrons from one layer to the other, so that higher-energy electrons from one side diffuse preferentially through it in one direction, creating a current and thus a voltage across the cell. Also called depletion zone or space charge.

Cell junction: The area of immediate contact between two layers (positive and negative) of a photovoltaic cell. The junction lies at the center of the cell barrier or depletion zone.

Cell (battery): A single unit of an electrochemical device capable of producing direct voltage by converting chemical energy into electrical energy. A battery usually consists of several cells electrically connected together to produce higher voltages. (Sometimes the terms cell and battery are used interchangeably). See also photovoltaic (PV) cell.

Cell: A component of an electrochemical battery. A 'primary' cell consists of two dissimilar elements, known as 'electrodes,' immersed in a liquid or paste known as the 'electrolyte.' A direct current of 1-1.5 volts will be produced by this cell. A 'secondary' cell or accumulator is a similar design but is made useful by passing a direct current of correct strength through it in a certain direction. Each of these cells will produce 2 volts; a 12 volt car battery contains six cells.

Cellulase: An enzyme complex, produced by fungi and bacteria, capable of decomposing cellulose into small fragments, primarily glucose.

Cellulose Insulation: A type of insulation composed of waste newspaper, cardboard, or other forms of waste paper.

Cellulose: The fundamental constituent of all vegetative tissue; the most abundant material in the world.

Celsius (C): temperature scale based on the freezing (0°) and boiling (100°) points of water at atmospheric pressure; formerly known as Centigrade. To convert Celsius to Fahrenheit, multiply the number by 1.8 and add 32.

Central Heating System: A system where heat is supplied to areas of a building from a single appliance through a network of ducts or pipes.

Central Power Plant: A large power plant that generates power for distribution to multiple customers.

Central Receiver Solar Power Plants: Also known as "power towers," these use fields of two-axis tracking mirrors known as heliostats. Each heliostat is individually positioned by a computer control system to reflect the sun's rays to a tower-mounted thermal receiver. The effect of many heliostats reflecting to a common point creates the combined energy of thousands of suns, which produces high-temperature thermal energy. In the receiver, molten nitrate salts absorb the heat energy. The hot salt is then used to boil water to steam, which is sent to a conventional steam turbine-generator to produce electricity.

Certificate of discharge: an essential document for officers and seamen;

official certification confirming completion of the employment for which engaged.

Certificate of registry: a document specifying the nation registry of the vessel.

Cetane Number: A measure of a fuel's (liquid) ease of self-ignition.

Char: A byproduct of low-temperature carbonization of a solid fuel.

Charcoal: A material formed from the incomplete combustion or destructive distillation (carbonization) of organic material in a kiln or retort, and having a high energy density, being nearly pure carbon. (If produced from coal, it is coke.) Used for cooking, the manufacture of gunpowder and steel (notably in Brazil), as an absorbent and decolorizing agent, and in sugar refining and solvent recovery.

Charge: The process of adding electrical energy to a battery.

Charge carrier: A free and mobile conduction electron or hole in a semiconductor.

Charge controller: A component of a photovoltaic system that controls the flow of current to and from the battery to protect it from over-charge and over-discharge. The charge controller may also indicate the system operational status. ***OR,*** An electronic device that regulates the electrical charge stored in batteries so that unsafe, overcharge conditions for the batteries are avoided.

Charge factor: A number representing the time in hours during which a battery can be charged at a constant current without damage to the battery. Usually expressed in relation to the total battery capacity, i.e., C/5 indicates a charge factor of 5 hours. Related to charge rate.

Charge rate: The current applied to a cell or battery to restore its available capacity. This rate is commonly normalized by a charge control device with respect to the rated capacity of the cell or battery.

Charter party: contractual agreement between a ship-owner and a cargo owner, usually arranged by a broker, whereby a ship is chartered (hired) either for one voyage or a period of time.

Charter rates: tariff applied for chartering tonnage in a particular trade.

Charterer: the entity to whom is given the use of the whole of the carrying capacity of a ship for the transportation of cargo to a stated port for a specified time. See *Time charter party*

Chemical Energy: The energy liberated in a chemical reaction, as in the combustion of fuels.

Chemical vapor deposition (**CVD**): A method of depositing thin semiconductor films used to make certain types of photovoltaic devices. With this method, a substrate is exposed to one or more vaporized compounds, one or more of which contain desirable constituents. A chemical reaction is initiated, at or near the substrate surface, to produce the desired material that will condense on the substrate.

Cherry-picking: pursuing desirable customers and ignoring less desirable customers. The term is commonly used to describe a company's tactic of trying to secure the business of the largest energy or service users.

Chiller: A device for removing heat from a gas or liquid stream for air conditioning/cooling.

Chimney Effect: The tendency of heated air or gas to rise in a duct or other vertical passage, such as in a chimney, small enclosure, or building, due to its lower density compared to the surrounding air or gas.

Chimney: A masonry or metal stack that creates a draft to bring air to a fire and to carry the gaseous byproducts of combustion safely away.

Chlorofluorocarbon (**CFC**) A family of chemicals composed primarily of carbon, hydrogen, chlorine, and fluorine whose principal applications are as refrigerants and industrial cleansers and whose principal drawback is the tendency to destroy the Earth's protective ozone layer. ***OR,*** Family of manufactured chemicals; also called chlorinated fluorocarbons.

Christmas tree: The arrangement of pipes and valves at the wellhead to control the flow of oil or natural gas and to prevent blowouts. (See Wellhead)

Circuit Breaker: A device used to interrupt or break an electrical circuit when an overload condition exists; usually installed in the positive circuit; used to protect electrical equipment.

Circuit Lag: As time increases from zero at the terminals of an inductor, the voltage comes to a particular value on the sine function curve ahead of the current. The voltage reaches its negative peak exactly 90 degrees before the current reaches its negative peak thus the current lags behind by 90 degrees.

Circuit: A device, or system of devices, that allows electrical current to flow through it and allows voltage to occur across positive and negative terminals.

Circulating Fluidized Bed: A type of furnace or reactor in which the emission of sulfur compounds is lowered by the addition of crushed limestone in the fluidized bed thus obviating the need for much of the expensive stack gas clean-up equipment. The particles are collected and recirculated, after passing through a conventional bed, and cooled by boiler internals.

City gas: treated and conditioned gas for consumer use. Also known as Sales gas.

City-gate rate: the rate charged a distribution utility by its suppliers; refers to the cost of the natural gas at the point at which the distribution utility historically takes title to the natural gas. Also called gate rate.

City-gate station (city gate): the point or measuring station at which a gas-distribution utility physically receives gas from a pipeline or transmission company; the point at which the backbone transmission system connects to the distribution system. There is not necessarily a change of ownership at a city-gate station.

Citygate: A point or measuring station at which a distributing gas utility receives gas from a natural gas pipeline company or transmission system.

Class of service: a group of customers with similar characteristics (for example, residential, commercial, industrial) that are identified for the purpose of setting a rate for service.

Classification society: private organizations that arrange inspections and advise on the hull and machinery of a ship. Supervise vessels during their construction and afterwards, in respect to their seaworthiness, and places vessels in grades or classes according to the society's rules for each particular type. It is not compulsory by law that a ship-owner have his vessel built according to the rules of any classification society. In practice, the difficulty in securing satisfactory insurance rates for an unclassed vessel makes it a commercial obligation. The major classification societies – American Bureau of Shipping, Lloyds Register of Shipping, Det Norske Veritas, Bureau Veritas and Germanischer Lloyd – have included the International Maritime Organization (IMO) LNG Gas Codes in their rules. See International Maritime Organization (IMO)

Clean Power Generator: A company or other organizational unit that produces electricity from sources that are thought to be environmentally cleaner than traditional sources. Clean, or green, power is usually defined as power from renewable energy that comes from wind, solar, biomass energy, etc. There are various definitions of clean resources. Some definitions include power produced from waste-to-energy and wood-fired plants that may still produce significant air emissions. Some states have defined certain local resources as clean that other states would not consider clean. For example, the state of Texas has defined power from efficient natural gas-fired power plants as clean. Some northwest states include power from large hydropower projects as clean although these projects damage fish populations. Various states have disclosure and labeling requirement for generation source and air emissions that assist customers in comparing electricity characteristics other than price. This allows customers to decide for themselves what they consider to be "clean." The federal government is also exploring this issue.

Cleavage of lateral epitaxial films for transfer (CLEFT): A process for making inexpensive gallium arsenide (GaAs) photovoltaic cells in which a thin film of GaAs is grown atop a thick, single-crystal GaAs (or other suitable material) substrate and then is cleaved from the substrate and incorporated into a cell, allowing the substrate to be reused to grow more thin-film GaAs.

Clerestory: A window located high in a wall near the eaves that allows daylight into a building interior, and may be used for ventilation and solar heat gain.

Climate Change: A term used to describe short and long-term effects on the Earth's climate as a result of human activities such as fossil fuel combustion and vegetation clearing and burning.

Climate: The prevailing or average weather conditions of a geographic region.

Close Coupled: An energy system in which the fuel production equipment is in close proximity, or connected to, the fuel using equipment.

Closed Cycle: A system in which a working fluid is used over and over

without introduction of new fluid, as in a hydronic heating system or mechanical refrigeration system.

Closed-Loop Biomass: As defined by the Comprehensive National Energy Act of 1992 (or the Energy Policy Act; EPAct): any organic matter from a plant which is planted for the exclusive purpose of being used to produce energy." This does not include wood or agricultural wastes or standing timber.

Closed-Loop Geothermal Heat Pump Systems: Closed-loop (also known as "indirect") systems circulate a solution of water and antifreeze through a series of sealed loops of piping. Once the heat has been transferred into or out of the solution, the solution is recirculated. The loops can be installed in the ground horizontally or vertically, or they can be placed in a body of water, such as a pond. See **horizontal ground loop**, **vertical ground loop**, **slinky ground loop**, and **surface water loop** for more information on the different types of closed-loop geothermal heat pump systems.

Cloud enhancement: The increase in solar intensity caused by reflected irradiance from nearby clouds.

CNG: Compressed Natural Gas

Coal bed methane (CBM): Natural gas extracted from coal beds.

Coalbed Methane Well Gas: Methane is generated during coal formation and is contained in the coal microstructure. Typical recovery entails pumping water out of the coal to allow the gas to escape. Methane is the principal component of natural gas. Coal bed methane can be added to natural gas pipelines without any special treatment.

Codes: Legal documents that regulate construction to protect the health, safety, and welfare of people. Codes establish minimum standards but do not guarantee efficiency or quality.

Coefficient Of Heat Transmission (U-Value): A value that describes the ability of a material to conduct heat. The number of Btu that flow through 1 square foot of material, in one hour. It is the reciprocal of the R-Value (U-Value = 1/R-Value).

Coefficient Of Performance (COP): A ratio of the work or useful energy output of a system versus the amount of work or energy inputted into the system as determined by using the same energy equivalents for energy in and out. Is used as a measure of the steady state performance or energy efficiency of heating, cooling, and refrigeration appliances. The COP is equal to the Energy Efficiency Ratio (EER) divided by 3.412. The higher the COP, the more efficient the device.

Coefficient Of Utilization (CU): A term used for lighting appliances; the ratio of lumens received on a flat surface to the light output, in lumens, from a lamp; used to evaluate the effectiveness of luminaries in delivering light.

Co-firing: the process of burning natural gas simultaneously with another fuel. Co-firing can reduce sulphur dioxide (SO2) and nitrogen oxides (NOx) emissions. ***OR,*** The use of two or more different fuels (e.g. wood and coal) simultaneously in the same combustion chamber of a power plant.

Cogeneration (Cogen): the simultaneous production of electrical energy from the combustion of a single fuel source through two means: gas turbines and steam turbines. See *Combined-cycle gas turbine* ***OR,*** The generation of electricity or shaft power by an energy conversion system and the concurrent use of rejected thermal energy from the conversion system as an auxiliary energy source.

Cogenerator: A class of energy producer that produces both heat and electricity from a single fuel.

Coil: As a component of a heating or cooling appliance, rows of tubing or pipe with fins attached through which a heat transfer fluid is circulated and to deliver heat or cooling energy to a building.

Coincidence Factor: The ratio of the coincident, maximum demand or two or more loads to the sum of their non-coincident maximum demand for a given period; the reciprocal of the diversity factor, and is always less than or equal to one.

Coincident Demand: The demand of a consumer of electricity at the time of a power supplier's peak system demand.

Coke Oven Gas: The mixture of permanent gases produced by the carbonization of coal in a coke oven at temperatures in excess of 1,000 degrees Celsius.

Cold Night Sky: The low effective temperature of the sky on a clear night.

Collector Efficiency: The ratio of solar radiation captured and transferred to the collector (heat transfer) fluid.

Collector Fluid: The fluid, liquid (water or water/antifreeze solution) or

air, used to absorb solar energy and transfer it for direct use, indirect heating of interior air or domestic water, and/or to a heat storage medium.

Collector Tilt: The angle that a solar collector is positioned from horizontal.

Collector: The component of a solar energy heating system that collects solar radiation, and that contains components to absorb solar radiation and transfer the heat to a heat transfer fluid (air or liquid).

Color Rendition (Rendering) Index (**CRI**): A measure of light quality. The maximum CRI value of 100 is given to natural daylight and incandescent lighting. The closer a lamp's CRI rating is to 100, the better its ability to show true colors to the human eye.

Color Rendition: How colors appear when illuminated by a light source. Color rendition is generally considered to be a more important lighting quality than color temperature. Most objects are not a single color, but a combination of many colors. Light sources that are deficient in certain colors may change the apparent color of an object. The Color Rendition Index (CRI) is a 1–100 scale that measures a light source's ability to render colors the same way sunlight does. The top value of the CRI scale (100) is based on illumination by a 100-watt incandescent light bulb. A light source with a CRI of 80 or higher is considered acceptable for most indoor residential applications.

Color Temperature: The color of the light source. By convention, yellow-red colors (like the flames of a fire) are considered warm, and blue-green colors (like light from an overcast sky) are considered cool. Color temperature is measured in Kelvin (K) temperature. Confusingly, higher Kelvin temperatures (3600–5500 K) are what we consider cool and lower color temperatures (2700–3000 K) are considered warm. Cool light is preferred for visual tasks because it produces higher contrast than warm light. Warm light is preferred for living spaces because it is more flattering to skin tones and clothing. A color temperature of 2700–3600 K is generally recommended for most indoor general and task lighting applications.

Combined Collector: A photovoltaic device or module that provides useful heat energy in addition to electricity.

Combined heat and power (CHP): the simultaneous generation of two forms of energy from a single fuel source. Electrical energy is produced through gas turbines and heat energy (steam) is produced through a heat-recovery steam generator. See *Combined-cycle gas turbine*

Combined-cycle gas turbine (**CCGT**): this is the combination of simple gas turbines with a *Heat-Recovery Steam Generator* (HRSG) and a steam turbine in a power generation plant. Gas is combined with air and burned, with the expanded gas turning the blades of the gas turbines to power an electricity generator (the Brayton thermodynamic cycle). The hot exhaust gases are passed to the HRSG, in which water is converted to steam that is used in a single steam turbine to power another generator (the Rankine thermodynamic cycle). Also called combined cycle generation.

Combined-Cycle Power Plant: A power plant that uses two thermodynamic cycles to achieve higher overall system efficiency; e.g.: the heat from a gas-fired combustion turbine is used to generate steam for heating or to operate a steam turbine to generate additional electricity.

Combustion Air: Air that provides the necessary oxygen for complete, clean combustion and maximum heating value.

Combustion Chamber: Any wholly or partially enclosed space in which combustion takes place.

Combustion Gases: The gaseous byproducts of the combustion of a fuel.

Combustion Power Plant: A power plant that generates power by combusting a fuel.

Combustion Turbine: A turbine that generates power from the combustion of a fuel.

Combustion: The process of burning; the oxidation of a material by applying heat, which unites oxygen with a material or fuel.

Comfort Zone: A frequently used room or area that is maintained at a more comfortable level than the rest of the house; also known as a "warm room."

Commercial Building: A building with more than 50 percent of its floor space used for commercial activities, which include stores, offices, schools, churches, libraries, museums, health care facilities, warehouses, and government buildings except those on military bases.

Commercial Consumption: Gas used by nonmanufacturing establishments

or agencies primarily engaged in the sale of goods or services. Included are such establishments as hotels, restaurants, wholesale and retail stores and other service enterprises; gas used by local, State, and Federal agencies engaged in nonmanufacturing activities.

Commercial field: a hydrocarbons field that, under existing economic and operating conditions, is judged to be capable of generating enough revenues to exceed the costs of development.

Commercial Sector: Consists of businesses that are not engaged in transportation or manufacturing or other types of industrial activities. Standard Industrial Classification (SIC) codes for commercial establishments are 50 through 87, 89, and 91 through 97.

Commissioning: The process by which a power plant, apparatus, or building is approved for operation based on observed or measured operation that meets design specifications.

Committed gas contract: a source-specific natural gas sales contract that commits the seller to deliver natural gas, from specific described reserves or sources.

Commodity charge: throughput or usage charge, a fee paid to the pipeline operator, based on the number of decatherms moved by the pipeline for the shipper. At the local market it is referred to as the gas portion of the end-user's bill – charged at the burner tip; the component of rates charged to customers that reflects the volume of gas actually transported by a utility or the cost of gas actually purchased by the utility.

Common carrier: a facility obligated by law to provide service to all potential users without discrimination, with services to be prorated among users in the event capacity is not sufficient to meet all requests. In the US, interstate oil pipelines are common carriers, but interstate natural gas pipelines are not (they are open-access contract carriers).

Compact Fluorescent: A smaller version of standard fluorescent lamps which can directly replace standard incandescent lights. These lights consist of a gas filled tube, and a magnetic or electronic ballast.

Company-used gas: natural gas consumed by a gas-distribution or gas-transmission company, or the gas department of a combination utility, for example, fuel for compressor stations.

Complement: the number of officers and crew employed upon a vessel for its safe navigation and operation.

Complete Mix Digester: A type of anaerobic digester that has a mechanical mixing system and where temperature and volume are controlled to maximize the anaerobic digestion process for biological waste treatment, methane production, and odor control.

Completion: The process of making a well ready to produce natural gas or oil. Completion involves installing permanent equipment, such as a wellhead, and often includes hydraulic fracturing.

Composting Toilet: A self-contained toilet that use the process of aerobic decomposition (composting) to break down feces into humus and odorless gases.

Composting: The process of degrading organic material (biomass) by microorganisms in aerobic conditions.

Compound annual growth rate (CAGR): The average year-over-year growth rate of a metric over a specific period of time.

Compound Paraboloid Collector: A form of solar concentrating collector that does not track the sun.

Compressed Air Storage: The storage of compressed air in a container for use to operate a prime mover for electricity generation.

Compressed natural gas (CNG): natural gas that has been compressed under high pressures (typically between 3000 and 6000 psi) and held in a container; expands when released for use as a fuel. ***OR***, Natural gas which is comprised primarily of methane, compressed to a pressure at or above 2,400 pounds per square inch and stored in special high-pressure containers. It is used as a fuel for natural gas powered vehicles.

Compressibility factor: the ratio of the actual volume of a gas divided by the volume that would be predicted by the ideal gas law, usually referred to as the Z factor.

Compression Chiller: A cooling device that uses mechanical energy to produce chilled water.

Compression ratio: the relationship of absolute outlet pressure at a compressor to absolute inlet pressure.

Compression: the act or process of contracting a volume of gas into a smaller space.

Compressor station: a booster station associated with a natural gas pipeline that uses compressors to increase the gas pressure. When gas turbines are used to provide compressor power, stations can use some of the gas moving through the line as fuel.

Compressor: A device used to compress air for mechanical or electrical power production, and in air conditioners, heat pumps, and refrigerators to pressurize the refrigerant and enabling it to flow through the system. ***OR,*** a mechanical device used to raise the pressure of a gas. Compressors can be of three types: axial, centrifugal, or reciprocating. The usual means of providing the required power are electrical motors, steam turbines, or gas turbines.

Concentrating (Solar) Collector: A solar collector that uses reflective surfaces to concentrate sunlight onto a small area, where it is absorbed and converted to heat or, in the case of solar photovoltaic (PV) devices, into electricity. Concentrators can increase the power flux of sunlight hundreds of times. The principal types of concentrating collectors include: compound parabolic, parabolic trough, fixed reflector moving receiver, fixed receiver moving reflector, Fresnel lense, and central receiver. A PV concentrating module uses optical elements (Fresnel lense) to increase the amount of sunlight incident onto a PV cell. Concentrating PV modules/arrays must track the sun and use only the direct sunlight because the diffuse portion cannot be focused onto the PV cells. Concentrating collectors for home or small business solar water heating applications are usually parabolic troughs that concentrate the sun's energy on an absorber tube (called a receiver), which contains a heat-transfer fluid.

Concentrating photovoltaics (CPV): A solar technology that uses lenses or mirrors to concentrate sunlight onto high-efficiency solar cells.

Concentrating solar power (**CSP**): A solar technology that use mirrors to reflect and concentrate sunlight onto receivers that convert solar energy to heat. This thermal energy is then used to produce electricity with a steam turbine or heat engine driving a generator.

Concentrator: A photovoltaic module, which includes optical components such as lenses (Fresnel lens) to direct and concentrate sunlight onto a solar cell of smaller area. Most concentrator arrays must directly face or track the sun. They can increase the power flux of sunlight hundreds of times.

Condensate: Mixture of hydrocarbons which are in a gaseous state under reservoir conditions and, when produced, become a liquid as the temperature and pressure is reduced. ***OR***, a hydrocarbon liquid that forms by precipitation from a gas. When the liquid precipitates in the reservoir during pressure depletion, the liquid is referred to as retrograde condensate. Surface production of hydrocarbon liquids through primary separation facilities is referred to as condensate when it comes from a gas reservoir. Natural gas condensates consist primarily of pentanes (C_5H_{12}) and heavier components; there will be some propane and butane dissolved within the mixture. ***OR,*** The liquid resulting when water vapor contacts a cool surface; also the liquid resulting when a vaporized working fluid (such as a refrigerant) is cooled or depressurized.

Condensation: The process by which water in air changes from a vapor to a liquid due to a change in temperature or pressure; occurs when water vapor reaches its dew point (condensation point); also used to express the existence of liquid water on a surface.

Condenser Coil: The device in an air conditioner or heat pump through which the refrigerant is circulated and releases heat to the surroundings when a fan blows outside air over the coils. This will return the hot vapor that entered the coil into a hot liquid upon exiting the coil.

Condenser: The device in an air conditioner or heat pump in which the refrigerant condenses from a gas to a liquid when it is depressurized or cooled.

Condensing Furnace: A type of heating appliance that extracts so much of the available heat content from a combusted fuel that the moisture in the combustion gases condenses before it leaves the furnace. Also this furnace circulates a liquid to cool the furnace's heat exchanger. The heated liquid may either circulate through a liquid-to-air heat exchanger to warm room air, or it may circulate through a coil inside a separate indirect-fired water heater.

Condensing Unit: The component of a central air conditioner that is designed to remove heat absorbed by the refrigerant and transfer it outside the conditioned space.

Conditioned Space: The interior space of a building that is heated or cooled.

Conduction band (or conduction level): An energy band in a semiconductor in which electrons can move freely in a solid, producing a net transport of charge.

Conduction: The transfer of heat through a material by the transfer of kinetic energy from particle to particle; the flow of heat between two materials of different temperatures that are in direct physical contact.

Conductivity (Thermal): This is a positive constant, k, which is a property of a substance and is used in the calculation of heat transfer rates for materials. It is the amount of heat that flows through a specified area and thickness of a material over a specified period of time when there is a temperature difference of one degree between the surfaces of the material.

Conductor: The material through which electricity is transmitted, such as an electrical wire, or transmission or distribution line.

Conduit: A tubular material used to encase and protect one or more electrical conductors.

Confirmed nomination: verification by a pipeline company that a change in a customer's level of transportation service will be matched by a change in supplier quantities.

Congressional (Energy) Committees: House Subcommittee on Energy and Environment: This committee has legislative jurisdiction and general and special oversight and investigative authority on all matters relating to energy and environmental research and development and demonstration.

Connected Load: The sum of the ratings of the electricity consuming apparatus connected to a generating system.

Connection Charge: An amount paid by a customer for being connected to an electricity supplier's transmission and distribution system.

Conservation Cost Adjustment: A means of billing electric power consumers to pay for the costs of demand side management/energy conservation measures and programs. (See also Benefits Charge.)

Conservation: To reduce or avoid the consumption of a resource or commodity.

Consignee: the entity to whom cargo is consigned as stated on the bills of lading.

Consignor: the entity named in the bill of lading as the one from whom the goods have been received for shipment.

Constant Dollars: The value or purchasing power of a dollar in a specified year carried forward or backward.

Constant-Speed Wind Turbines: Wind turbines that operate at a constant rotor revolutions per minute (RPM) and are optimized for energy capture at a given rotor diameter at a particular speed in the wind power curve.

Consumer: the ultimate end-user of natural gas at their burner tip as contrasted with a customer who may purchase natural gas for resale.

Consumption Charge: The part of a power provider's charge based on actual energy consumed by the customer; the product of the kilowatt-hour rate and the total kilowatt-hours consumed.

Consumption: Natural gas used as lease fuel, plant fuel, for use by pipeline and distribution systems, and by end-users (including residential, commercial, industrial, electric power, and vehicle fuel).

Contact resistance: The resistance between metallic contacts and the semiconductor.

Contingency reserves: Reserve services that are sufficient to cover the unplanned trip (disconnect) of a large generator or transmission line and maintain system balance. Contingency reserves are generally split between spinning and non-spinning reserves, and are often based on the largest single hazard (generator or transmission capacity).

Contingent asset/liability: a possible asset/liability that arises from past events and whose existence will be confirmed only by the occurrence, or non-occurrence, of one or more uncertain future events not wholly within the control of the entity.

Continuous Fermentation: A steady-state fermentation process.

Contract price (CP): price agreed between sellers and buyers.

Contract term: the term of effectiveness of a contract.

Contracted reserves: natural gas reserves dedicated to fulfil gas contracts.

Contrast: The difference between the brightness of an object compared to that of its immediate background.

Convection: The transfer of heat by means of air currents.

Conventional Fuel: The fossil fuels: coal, oil, and natural gas.

Conventional gas: 1) natural gas occurring in nature, as opposed to synthetic gas; 2) gas produced under present-day technology at a cost not greater than the current market value.

Conventional Heat Pump: This type of heat pump is known as an air-to air system.

Conventional Power: Power generation from sources such as petroleum, natural gas, or coal. In some cases, large-scale hydropower and nuclear power generation are considered conventional sources.

Conventional resources: Discrete accumulations of hydrocarbons contained in rocks with relatively high matrix permeability, which normally have relatively high recovery factors. ***OR***, Any area where natural gas can be drilled and extracted vertically.

Conversion Efficiency: The amount of energy produced as a percentage of the amount of energy consumed. See photovoltaic (conversion) efficiency.

Converter: A unit that converts a direct current (dc) voltage to another dc voltage. ***OR,*** A device for transforming the quality and quantity of electrical energy; also an inverter.

Cooling Capacity: The quantity of heat that a cooling appliance is capable of removing from a room in one hour.

Cooling Degree Day: A value used to estimate interior air cooling requirements (load) calculated as the number of degrees per day (over a specified period) that the daily average temperature is above 65 degrees Fahrenheit (or some other, specified base temperature). The daily average temperature is the mean of the maximum and minimum temperatures recorded for a specific location for a 24 hour period.

Cooling Load: That amount of cooling energy to be supplied (or heat and humidity removed) based on the sensible and latent loads.

Cooling Pond: A body of water used to cool the water that is circulated in an electric power plant.

Cooling Tower: A structure used to cool power plant water; water is pumped to the top of the tubular tower and sprayed out into the center, and is cooled by evaporation as it falls, and then is either recycled within the plant or is discharged.

Copper indium diselenide (CuInSe2, or **CIS):** A polycrystalline thin-film photovoltaic material (sometimes incorporating gallium (CIGS) and/or sulfur).

Copper zinc tin sulfide/selenide (CZTS): A polycrystalline thin-film photovoltaic material.

Coproducts: The potentially useful byproducts of ethanol fermentation process.

Cord (of Wood): A stack of wood 4 feet by 4 feet by 8 feet.

Core customer: buyer that can purchase natural gas from only one supplier, with no access to alternate fuel sources; usually describing a residential or small commercial user, but may apply to a large industrial and electric utility user as well. Usually pays a higher rate for assured service.

Cost of capital: the weighted average cost of financing investment projects, primarily through debt and/or equity financing.

Cost of development/boe (COD): the unit cost ($/boe) required to develop a project. Calculated by taking the total unescalated net development investment including seismic, technical data, drilling and completion costs, and costs of incremental surface facilities divided by incremental net proved developed reserves.

Cost, insurance and freight (CIF): used in international trade statistics and sales contracts, transactions on CIF basis mean the purchase price includes all costs of moving the goods from the point of embarkation to their destination. With respect to LNG shipping, this means that the buyer purchases the gas at the point of vessel loading or during its transit to the receiving terminal, while the agreed price includes shipping charge and insurance for the load. See *ex-Ship contract and Free on Board contract*

Coulomb: A unit for the quantity of electricity transported in 1 second by a current of 1 ampere.

Counterflow Heat Exchanger: A heat exchanger in which two fluids flow in opposite directions for transfer heat energy from one to the other.

Covenants: Restrictions on the use of a property.

Crawlspace: The unoccupied, and usually unfinished and unconditioned space between the floor, foundation walls, and the slab or ground of a building.

Creosote: A liquid byproduct of wood combustion (or distillation) that

condenses on the internal surfaces of vents and chimneys, which if not removed regularly, can corrode the surfaces and fuel a chimney fire.

Crew: the company of officers and personnel on board ship. Although operations are similar to other types of ships, there is more emphasis on crew training for steam turbine plant and LNG cargo handling operations, as well as planned maintenance procedures.

Critical Compression Pressure: The highest possible pressure in a fuel-air mixture before spontaneous ignition occurs.

Critical pressure: 1) for a pure component, the pressure above which separate liquid and gas phases cannot exist; 2) the vapour pressure of a substance at its critical temperature; partial liquefaction can occur below the critical pressure even at the critical temperature.

Critical temperature: for a pure component, the temperature above which a liquid phase cannot exist.

Cryogenic: The science of producing very low temperatures such as those required for natural gas liquefaction.

Cryogenics: the production and application of low-temperature phenomena. The cryogenic temperature range is usually from –150°C (–238°F) to absolute zero (–273°C, or –460°F), the temperature at which molecular motion essentially ceases. A most important commercial application of cryogenic gas liquefaction techniques is the storage, transportation, and regasification of LNG.

Crystalline Silicon Photovoltaic Cell: A type of photovoltaic cell made from a single crystal or a polycrystalline slice of silicon. Crystalline silicon cells can be joined together to form a module (or panel).

Crystalline silicon: A type of photovoltaic cell made from a slice of single-crystal silicon or polycrystalline silicon.

Cube Law: In reference to wind energy, for any given instant, the power available in the wind is proportional to the cube of the wind velocity; when wind speed doubles, the power availability increases eight times.

Cubic capacity: the volumetric measurement of the ship's cargo compartments.

Cubic feet a day (cf/d): at standard conditions, the number of cubic feet of natural gas produced from a well over a 24-hour period, normally an average figure from a longer period of time. Generally expressed as mcf/d = thousand cubic feet a day; mmcf/d = million cubic feet a day; bcf/d = billion cubic feet a day; or tcf/d = trillion cubic feet a day.

Cubic foot (cf): The amount of natural gas required at room temperature at sea level to fill a volume of one cubic foot. ***OR***, the amount of gas required to fill a volume of 1 cubic foot under stated conditions of temperature, pressure and water vapour.

Cubic Foot (of Natural Gas): A unit of volume equal to 1 cubic foot at a pressure base of 14.73 pounds standard per square inch absolute and a temperature base of 60 degrees Fahrenheit. ***OR,*** A unit of measurement of gas volume. It is the amount of gas required to fill a volume of one cubic foot under stated conditions of temperature, pressure, and water vapor.

Cubic meter (cm): unit of measurement for gas volume. The amount of gas required to fill the volume of one cubic meter.

Current (Electrical): The flow of electrical energy (electricity) in a conductor, measured in amperes.

Current at maximum power (Imp): The current at which maximum power is available from a module.

Current Dollars: The value or purchasing power of a dollar that has not been reduced to a common basis of constant purchasing power, but instead reflects anticipated future inflation; when used in computations the assumed inflation rate must be stated.

Current-voltage (I-V) curve: See I-V curve

Curtailment: an action by which the customer receives less than the contract quantity of natural gas or services because of a system-wide shortage.

Cushion gas: the volume of gas that is required in an underground storage field to maintain minimum field pressure. This cushion gas (or base gas) is not available for withdrawal unless replaced with immiscible injectant to maintain field pressure.

Custody transfer measuring system (CTMS): LNG ships are fitted with high-accuracy liquid-level, temperature and vapour-pressure measuring equipment. The cargo tanks are calibrated by an independent measurer so that the volume of cargo can be determined accurately. The CTMS is accepted by the buyer and the seller of the cargo as the basis for the quantity purchased or sold.

Samples of the LNG cargo are taken ashore and analysed to determine the cargo's chemical composition from which the heating value can be calculated. The heating value is then multiplied by the volume loaded or discharged from the ship to obtain the British thermal unit (Btu) content of the delivered cargo, which is used as the basis for cargo invoices, import duties and fiscal accounting.

Customer Charge: An amount to be paid for energy periodically by a customer without regard to demand or energy consumption.

Customer Class: Categories of energy consumers, as defined by consumption or demand levels, patterns, and conditions, and generally included residential, commercial, industrial, agricultural.

Customer demand charge: the component of rates charged to customers that is expected to cover the fixed costs incurred by the pipeline. The other component of rates is the commodity charge. This charge is also referred to as a reservation charge.

Cut-In-Speed: The lowest wind speed at which a wind turbine begins producing usable power.

Cutoff voltage: The voltage levels (activation) at which the charge controller disconnects the photovoltaic array from the battery or the load from the battery.

Cut-Out-Speed: The highest wind speed at which a wind turbine stops producing power.

Cycle volume: volume of natural gas that can be withdrawn from underground storage during the winter season and then be replaced during the summer season.

Cycle: The discharge and subsequent charge of a battery. ***OR,*** In alternating current, the current goes from zero potential or voltage to a maximum in one direction, back to zero, and then to a maximum potential or voltage in the other direction. The number of complete cycles per second determines the current frequency; in the U.S. the standard for alternating current is 60 cycles.

Cycling Losses: The loss of heat as the water circulates through a water heater tank and inlet and outlet pipes.

Cyclone Burner: A furnace/combustion chamber in which finely ground fuel is blown in spirals in the combustion chamber to maximize combustion efficiency.

Czochralski Process: A method of growing large size, high quality semiconductor crystal by slowly lifting a seed crystal from a molten bath of the material under careful cooling conditions.

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Daily average send-out: total volume of natural gas delivered during a proscribed period of time, divided by the total number of days in the period.

Daily contracted quantity (DCQ): the average daily quantity of natural gas that is contracted to be supplied and taken.

Dam: A structure for impeding and controlling the flow of water in a water course, and which increases the water elevation to create the hydraulic head. The reservoir creates, in effect, stored energy.

Damper: A movable plate used to control air flow; in a wood stove or fireplace, used to control the amount and direction of air going to the fire.

Dangling Bonds: A chemical bond associated with an atom on the surface layer of a crystal. The bond does not join with another atom of the crystal, but extends in the direction of exterior of the surface.

Darrius (Wind) Machine: A type of vertical-axis wind machine that has long, thin blades in the shape of loops connected to the top and bottom of the axle; often called an "eggbeater windmill."

Daylighting: The use of direct, diffuse, or reflected sunlight to provide supplemental lighting for building interiors.

Day-one-gains: Under International Financial Reporting Standards, the best evidence of the fair value of a financial instrument at initial recognition is the transaction price, unless the fair value of that instrument is evidenced by comparison with other observable recent market transactions. The application of this standard may result in no gain or loss being recognised on the initial recognition of a financial asset or financial liability. The unobservable part of any fair value calculated at inception of a contract (also known as day-one-gains) should be deferred over the life of the contract.

Days of storage: The number of consecutive days the stand-alone system will meet a defined load without solar energy input. This term

is related to system availability.

DC: See direct current.

DC-to-DC converter: Electronic circuit to convert direct current voltages (e.g., photovoltaic module voltage) into other levels (e.g., load voltage). Can be part of a maximum power point tracker.

Deadfreight factor: percentage of a ship's carrying capacity that is not utilised.

Deadfreight: space booked by shipper or charterer on a vessel, but not used.

Deadweight tonnage (DWT): a measure of ship carrying capacity: 1) the number of metric tonnes (2,204.6 pounds) of cargo, stores and bunkers that a vessel can transport; 2) the difference in weight between a vessel when it is fully loaded and when it is empty (in general transportation terms, the net) measured by the water it displaces when submerged to the deep-load line. A vessel's cargo is less than its DWT.

Decentralized (Energy) System: Energy systems supply individual, or small-groups, of energy loads.

Declination: The angular position of the sun at solar noon with respect to the plane of the equator.

Declining Block Rate: An electricity supplier rate structure in which the per unit price of electricity decreases as the amount of energy increases. Normally only available to very large consumers.

Decommissioning: The process of removing a power plant, apparatus, equipment, building, or facility from operation.

Decomposition: The process of breaking down organic material; reduction of the net energy level and change in physical and chemical composition of organic material.

Dedicated design-day capacity (DDDC): the maximum volume of gas dedicated to a customer's use and based on the maximum number of therms recorded by meter on the most demanding day – typically the coldest day – of the year; expressed as a decimal number. Also known as premise demand factor.

De-energize(d): To disconnect a transmission and/or distribution line; a power line that is not carrying a current; to open a circuit.

Deep Discharge: Discharging a battery to 20% or less of its full charge capacity.

Deep-cycle battery: A battery with large plates that can withstand many discharges to a low state-of-charge.

Defect: See light-induced defects

Degree Day: A unit for measuring the extent that the outdoor daily average temperature (the mean of the maximum and minimum daily dry-bulb temperatures) falls below (in the case of heating, see Heating Degree Day), or falls above (in the case of cooling, see Cooling Degree Day) an assumed base temperature, normally taken as 65 degrees Fahrenheit, unless otherwise stated. One degree day is counted for each degree below (for heating) or above (in the case of cooling) the base, for each calendar day on which the temperature goes below or above the base.

Degree Hour: The product of 1 hour, and usually the number of degrees Fahrenheit the hourly mean temperature is above a base point (usually 65 degrees Fahrenheit); used in roughly estimating or measuring the cooling load in cases where processes heat, heat from building occupants, and humidity are relatively unimportant compared to the dry-bulb temperature.

Dehumidifier: A device that cools air by removing moisture from it.

Dehydration: the removal of water from a fluid.

Dehydrator: natural gas processing equipment that removes water vapour. Typically, glycol dehydration units are used to dry gas before it is sent to a gas transmission line. If the gas is to be sent to a cryogenic expander plant or LNG plant, then the gas is typically dehydrated using molecular sieves.

Deliverability: the volume of natural gas that a pipeline or distribution system can supply in a given period normally during a 24-hour period.

Deliverability (LNG ships): one major aspect of LNG project planning consists of estimating the transportation capacity required, taking into account the time necessary for each function in the chain of events within a typical round voyage of an LNG carrier. A typical delivery calculation for a 137,500-cm LNG carrier might be:

One-way distance (nautical miles)	6,000
Ship 'service' speed (knots)	19
Sea days (round trips)	26.31

Port days (round trips)	2
Total days in voyage	(28.31) 29
Operating days in year	350
Voyages per year	12.07
Ship capacity (net cm)	135,000
Less: heel (cm)	3,000

Discharge quantity (cm) = 132,000
Annual delivered quantity (cm) = 132,000 x 12.07 = 1,539,103 cm

Case specific: LNG specific gravity varies depending on gas composition, but is typically about 0.45, therefore, the annual deliverability of the vessel is 0.45 x 1,593,103 = 716,896 tonnes. If the maximum output of the liquefaction train is 3.3 million tonnes a year (mmt/y), this would equal a maximum daily production of 10,000 tonnes over the 330-day annual operating period. The deliverability of a 137,500 cm ship is 59,400 tonnes, which means it can cater for a daily production of 2,048 tonnes on this route, or five ships can carry 10,240 tonnes, slightly more than maximum production.

Delivered: The physical transfer of natural, synthetic, and/or supplemental gas from facilities operated by the responding company to facilities operated by others or to consumers.

Delivery point: designates the point where natural gas is transferred from one party to another.

Delivery-point operator: the operator responsible for balancing loads and allocating natural gas quantities received at delivery points to parties who have contracted to receive deliveries at the point.

Demand (Tankless) Water Heater: A type of water heater that has no storage tank thus eliminating storage tank stand-by losses. Cold water travels through a pipe into the unit, and either a gas burner or an electric element heats the water only when needed.

Demand Charge: A charge for the maximum rate at which energy is used during peak hours of a billing period. That part of a power provider service charged for on the basis of the possible demand as distinguished from the energy actually consumed. ***OR,*** A fixed fee, generally paid monthly, to reserve capacity space in a pipeline, storage, or distribution facility.

Demand forecast: estimate of the level of energy or capacity that is likely to be needed at some time in the future.

Demand Power: see Peak Power

Demand Response: The process of using voluntary load reductions during peak hours.

Demand(ed) Factor: The ratio of the maximum demand on an electricity generating and distribution system to the total connected load on the system; usually expressed as a percentage.

Demand: The rate at which electricity is delivered to or by a system, part of a system, or piece of equipment expressed in kilowatts, kilo-volt-amperes, or other suitable unit, at a given instant or averaged over a specified period of time.

Demand-Side Management (**DSM**): The process of managing the consumption of energy, generally to optimize available and planned generation resources.

Demurrage: a fee, per day or per hour, agreed to be paid by the charterer or receiver of the cargo, for the detention of a vessel, loading or unloading, beyond the laytime allowed in the charter party.

Dendrite: A slender threadlike spike of pure crystalline material, such as silicon.

Dendritic Web Technique: A method for making sheets of polycrystalline silicon in which silicon dendrites are slowly withdrawn from a melt of silicon whereupon a web of silicon forms between the dendrites and solidifies as it rises from the melt and cools.

Density: A property of a fluid equal to volume divided by weight.

Department Of Agriculture (**USDA**): A federal government agency involved in rural development, marketing and regulatory programs, food safety, research, education and economics, food, nutrition and consumer service, farm and foreign agricultural services, and natural resources and environment programs.

Department of Energy (**DOE**): A federal government agency created in 1977, that is entrusted to contribute to the welfare of the United States by providing technical information, and a scientific and educational

foundation for technology, policy and institutional leadership to achieve efficiency in energy use, diversity in energy sources, a more productive and competitive economy, improved environmental quality, and a secure national defense. ***OR,*** the US federal department that manages programs of research, development and commercialization for various energy technologies, and associated environmental, regulatory and defense programs. DOE announces energy policies and acts as a principal advisor to the President on energy matters.

Dependable Capacity: The load-carrying ability of an electric power plant during a specific time interval and period when related to the characteristics of the load to be/being supplied; determined by capability, operating power factor, and the portion of the load the station is to supply.

Depleted Storage Field: A sub-surface natural geological reservoir, usually a depleted oil or gas field, used for storing natural gas.

Depletion zone: Same as cell barrier. The term derives from the fact that this microscopically thin region is depleted of charge carriers (free electrons and hole).

Depth of Discharge (DOD): The ampere-hours removed from a fully charged cell or battery, expressed as a percentage of rated capacity. For example, the removal of 25 ampere-hours from a fully charged 100 ampere-hours rated cell results in a 25% depth of discharge. Under certain conditions, such as discharge rates lower than that used to rate the cell, depth of discharge can exceed 100%.

Derating: The production of energy by a system or appliance at a level less than its design or nominal capacity.

Deregulated gas: natural gas no longer subject to sales and/or price regulation.

Deregulation: The process of changing regulatory policies and laws to increase competition among suppliers of commodities and services. The process of deregulating the electric power industry was initiated by the Energy Policy Act of 1992. (See also Restructuring) ***OR,*** the process of removing restrictive regulations on previously regulated power and utility companies.

Derrick/Drilling Rig - A steel structure mounted over the borehole to support the drill pipe and other equipment that is lowered and raised during drilling operations.

Desiccant Cooling: To condition/cool air by desiccation.

Desiccant: A material used to desiccate (dry) or dehumidify air.

Desiccation: The process of removing moisture; involves evaporation.

Design Cooling Load: The amount of conditioned air to be supplied by a cooling system; usually the maximum amount to be delivered based on a specified number of cooling degree days or design temperature.

Design Heating Load: The amount of heated air, or heating capacity, to be supplied by a heating system; usually the maximum amount to be delivered based on a specified number of heating degree days or design outside temperature.

Design Life: Period of time a system or appliance (or component of) is expected to function at its nominal or design capacity without major repair.

Design month: The month having the combination of insolation and load that requires the maximum energy from the photovoltaic array.

Design Temperature: The temperature that a system is designed to maintain (inside) or operate against (outside) under the most extreme conditions.

Design Tip Speed Ratio: For a wind turbine, the ratio of the speed of the tip of a turbine blade for which the power coefficient is at maximum.

Design Voltage: The nominal voltage for which a conductor or electrical appliance is designed; the reference voltage for identification and not necessarily the precise voltage at which it operates.

Desulphurisation: processes by which sulphur and sulphur compounds are removed from gases or petroleum liquid mixtures.

Desuperheater: An energy saving device in a heat pump that, during the cooling cycle, recycles some of the waste heat from the house to heat domestic water.

Developed acreage: The number of acres that are allocated or assignable to productive wells or wells capable of production.

Developed reserves: Reserves that can be expected to be recovered through existing wells with existing equipment and operating methods or in which the cost of the required equipment is relatively

minor compared to the cost of a new well and, if extraction is by means other than a well, through installed equipment and infrastructure operational at the time of the reserves estimate.

Development agreement (**DA**): one of the range of agreements between governments and petroleum-resource developers is the DA or one of its variants – the Development and Fiscal Agreement (DFA) or the Development and Production Sharing Agreement (DPSA).

Development well: A well drilled within the proved area of an oil or gas reservoir to the depth of a stratigraphic horizon known to be productive.

Dewpoint: The temperature to which air must be cooled, at constant pressure and water vapor content, in order for saturation or condensation to occur; the temperature at which the saturation pressure is the same as the existing vapor pressure; also called saturation point. ***OR,*** the temperature, at a given pressure, at which a vapour will form a first drop of liquid on the subtraction of heat. Further cooling of liquid at its dew point results in condensation of part or all of the vapour as a liquid.

Difference Of Potential: The difference in electrical pressure (voltage) between any two points in an electrical system or between any point in an electrical system and the earth.

Differential Thermostat: A type of automatic thermostat (used on solar heating systems) that responds to temperature differences (between collectors and the storage components) so as to regulate the functioning of appliances (to switch transfer fluid pumps on and off).

Diffuse Insolation: Sunlight received indirectly as a result of scattering due to clouds, fog, haze, dust, or other obstructions in the atmosphere. Opposite of direct insolation.

Diffuse Radiation: Radiation received from the sun after reflection and scattering by the atmosphere and ground.

Diffuse Solar Radiation: Sunlight scattered by atmospheric particles and gases so that it arrives at the earth's surface from all directions and can not be focused.

Diffusion Furnace: Furnace used to make junctions in semiconductors by diffusing dopant atoms into the surface of the material.

Diffusion Length: The mean distance a free electron or hole moves before recombining with another hole or electron.

Diffusion: The movement of individual molecules through a material; permeation of water vapor through a material.

Digester (Anaerobic): A device in which organic material is biochemically decomposed (digested) by anaerobic bacteria to treat the material and/or to produce biogas.

Dimmer: A light control device that allows light levels to be manually adjusted. A dimmer can save energy by reducing the amount of power delivered to the light while consuming very little themselves.

Diode: An electronic device that allows current to flow in one direction only. See also blocking diode and bypass diode.

Dip Tube: A tube inside a domestic water heater that distributes the cold water from the cold water supply line into the lower area of the water heater where heating occurs.

Direct Access: The ability of an electric power consumer to purchase electricity from a supplier of their choice without being physically inhibited by the owner of the electric distribution and transmission system to which the consumer is connected to. (See also Open Access.)

Direct Beam Radiation: Solar radiation that arrives in a straight line from the sun. ***OR,*** Radiation received by direct solar rays. Measured by a pyrheliometer with a solar aperture of 5.7° to transcribe the solar disc.

Direct Current (DC): A type of electricity transmission and distribution by which electricity flows in one direction through the conductor, usually relatively low voltage and high current. To be used for typical 120 volt or 220 volt household appliances, DC must be converted to alternating current, its opposite.

Direct insolation: Sunlight falling directly upon a collector. Opposite of diffuse insolation.

Direct Solar Water Heater: These systems use water as the fluid that is circulated through the collector to the storage tank. Also known as "open-loop" systems.

Direct Vent Heater: A type of combustion heating system in which combustion air is drawn directly from outside and the products of combustion are vented directly outside. These features are beneficial in tight, energy-efficient homes because they will not depressurize a home and cause air infiltration, and backdrafting of other combustion

appliances.

Direct Water Heater: A type of water heater in which heated water is stored within the tank. Hot water is released from the top of the tank when a hot water faucet is turned. This water is replaced with cold water that flows into the tank and down to just above the bottom plate under which are the burners.

Direct-Gain: The process by which sunlight directly enters a building through the windows and is absorbed and stored in massive floors or walls.

Directional drilling: A technique that enables drilling at an angle to reach a particular underground formation. The application of special tools and techniques to drill a wellbore at a predetermined angle. Horizontal drilling is a form of directional drilling where the wellbore is ultimately drilled at +/- 90 degrees to the vertical direction.

Disabled ship: a vessel impaired so as to be incapable of proceeding on her voyage.

Discharge factor: A number equivalent to the time in hours during which a battery is discharged at constant current usually expressed as a percentage of the total battery capacity, i.e., C/5 indicates a discharge factor of 5 hours. Related to discharge rate.

Discharge rate: The rate, usually expressed in amperes or time, at which electrical current is taken from the battery.

Discharge: The withdrawal of electrical energy from a battery.

Disconnect: Switch gear used to connect or disconnect components in a photovoltaic system.

Discount Rate: The interest rate at which the Federal Reserve System stands ready to lend reserves to commercial banks. The rate is proposed by the 12 Federal Reserve banks and determined with the approval of the Board of Governors.

Discount: an amount agreed between buyer and seller to be subtracted from an existing benchmark.

Discounting: A method of financial and economic analysis used to determine present and future values of investments or expenses.

Dispatch: the monitoring and regulation of an electrical or natural gas system to provide coordinated operation; the sequence in which generating resources are called upon to generate power to serve fluctuating loads.

Dispatchability: The ability to dispatch power.

Dispatching (economic dispatch): A method by which system operators decide how much output should be scheduled from plants.

Dispatching: To schedule and control the generation and delivery of electric power.

Displacement gas: 1) in pipeline transportation, the substitution of a source of natural gas at one point for another source of natural gas at another point. Through displacement, natural gas can be transported by backhaul or exchange; 2) in natural gas marketing, the substitution of natural gas from one supplier of a customer with natural gas from another competing supplier.

Displacement Power: A source of power (electricity) that can displace power from another source so that source's power can be transmitted to more distant loads.

Dissolved gas: natural gas in solution in oil in the reservoir.

Distributed energy resources (DER): A variety of small, modular power-generating technologies that can be combined with energy management and storage systems and used to improve the operation of the electricity delivery system, whether or not those technologies are connected to an electricity grid.

Distributed Generation: A popular term used by the power industry to describe localized or on-site power generation.

Distributed power: Generic term for any power supply located near the point where the power is used. Opposite of central power. See also stand-alone systems.

Distributed systems: Systems that are installed at or near the location where the electricity is used, as opposed to central systems that supply electricity to grids. A residential photovoltaic system is a distributed system.

Distribution Company (gas): a gas utility that obtains the major portion of its natural gas operating revenues from the operation of a retail gas-distribution system, a gas distributor.

Distribution Feeder: (See Feeder)

Distribution Line: One or more circuits of a distribution system on the

same line or poles or supporting structures' usually operating at a lower voltage relative to the transmission line.

Distribution System: That portion of an electricity supply system used to deliver electricity from points on the transmission system to consumers.

Distribution: the delivery of a utility (natural gas, electricity, water) to a household or business. ***OR,*** **Distribution** (in terms of Electricity): The process of distributing electricity; usually defines that portion of a power provider's power lines between a power provider's power pole and transformer and a customer's point of connection/meter.

District Heating: A heating system in which steam or hot water for space heating or hot water is piped from a central boiler plant or electric power/heating plant to a cluster of buildings.

Diurnal storage: daily storage; refers to short-term or peak storage in pipelines or natural gas holders, as opposed to seasonal storage.

Diversion: the flexible routing of LNG cargoes where gas suppliers will seek to move cargoes to markets. Diversion rights for sellers and buyers in LNG supply contracts create opportunities for physical arbitrage, depending on the correlation of such demand and price variations between regional markets.

Diversity Factor: The ratio of the sum of the non-coincidental maximum demands of two or more loads to their coincidental maximum demands for the same period.

DOE: U.S. *Department of Energy* A cabinet-level federal agency created in 1977 to replace the Federal Energy Administration. The DOE manages national energy policy, nuclear power and nuclear weapons programs, and the national energy research labs. ***OR,*** The Department of Energy is the 12th Cabinet Position, and it consists of the Office of the Secretary of Energy and the Federal Energy Regulatory Commission. It was created on August 4, 1977 as a result of the Department of Energy Organization Act of 1977. There are many subdivisions within the DOE, but the Economic Regulatory Administration and Energy Information Administration are two groups which have significant bearing on gas utility operations.

DOE-2.1: A computer software program that simulates energy consumption of commercial buildings; used for design and auditing purposes.

Dome (Geodesic): An architectural design invented by Buckminster Fuller with a regular polygonal structure based on radial symmetry.

Domestic Hot Water: Water heated for residential washing, bathing, etc.

Donor level: The level that donates conduction electrons to the system.

Donor: In a solar photovoltaic device, an n-type dopant, such as phosphorus, that puts an additional electron into an energy level very near the conduction band; this electron is easily exited into the conduction band where it increases the electrical conductivity over than of an undoped semiconductor.

Dopant: A chemical element (impurity) added in small amounts to an otherwise pure semiconductor material to modify the electrical properties of the material. An n-dopant introduces more electrons. A p-dopant creates electron vacancies (holes).

Doping: The addition of dopants to a semiconductor.

Double Wall Heat Exchanger: A heat exchanger in a solar water heating system that has two distinct walls between the heat transfer fluid and the domestic water, to ensure that there is no mixing of the two.

Double-Pane or Glazed Window: A type of window having two layers (panes or glazing) of glass separated by an air space. Each layer of glass and surrounding air space reradiates and traps some of the heat that passes through thereby increasing the windows resistance to heat loss (R-value).

Downstream pipeline: pipeline receiving gas from another pipeline at an interconnection point. See *Upstream pipeline*

Downstream: commercial gas operations that are closer to the end-user or burner tip, as opposed to upstream, which is closer to production.

Downtime: Time when the photovoltaic system cannot provide power for the load. Usually expressed in hours per year or that percentage.

Downwind Wind Turbine: A horizontal axis wind turbine in which the rotor is downwind of the tower.

Draft Diverter: A door-like device located at the mouth of a fireplace chimney flue for controlling the direction and flow of the draft in the fireplace as well as the amount of oxygen that the fire receives.

Draft Hood: A device built into or installed above a combustion appliance to assure the escape of combustion byproducts, to prevent backdrafting of the appliance, or to neutralize the effects of the stack action of the

chimney or vent on the operation of the appliance.

Draft: the depth of a ship in the water; vertical distance between the waterline and the keel, expressed in feet in the US, elsewhere in meters; also *Draught*. ***OR,*** (in case of Gas) A column of burning combustion gases that are so hot and strong that the heat is lost up the chimney before it can be transferred to the house. A draft brings air to the fire to help keep it burning.

Drag: Resistance caused by friction in the direction opposite to that of movement (i.e., motion) of components such as wind turbine blades.

Drainback (Solar) Systems: A closed-loop solar heating system in which the heat transfer fluid in the collector loop drains into a tank or reservoir whenever the booster pump stops to protect the collector loop from freezing.

Draindown (Solar) Systems: An open-loop solar heating system in which the heat transfer fluid from the collector loop and the piping drain into a drain whenever freezing conditions occur.

Drill bit: Tool used in drilling to break up rock mechanically in order to penetrate the subsoil. The bit drills a circular hole.

Drilling permit: Authorization from a regulatory agency to drill a well.

Drilling rig: The machine used to d rill a wellbore.

Dry (or lean) gas: 1) gas that has been treated to remove liquids and inerts making it suitable for shipping in a pipeline; 2) natural gas from the well containing no water vapour that will liquefy at ambient temperature and pressure, i.e. the gas is water dry. Gas is usually priced on a dry basis. See *Pipeline quality gas;* 3) a gas whose water content has been reduced by dehydration or; 4) a gas containing little or no hydrocarbons that could be recovered as a liquid condensate.

Dry Bulb Temperature: The temperature of the air as measured by a standard thermometer.

Dry cell: A cell (battery) with a captive electrolyte. A primary battery that cannot be recharged.

Dry dock: an enclosed basin into which a ship is taken for underwater cleaning and repairing. It is fitted with water-tight entrance gates which, when closed, permit the dock to be pumped dry.

Dry gas: Dry gas is almost pure methane and occurs in the absence of liquid hydrocarbons or by processing natural gas to remove liquid hydrocarbons and impurities.

Dry gas field: reservoir(s) consisting primarily of light hydrocarbons and negligible quantities of condensate.

Dry hole: A well incapable of economically producing saleable hydrocarbons in sufficient quantities to justify commercial exploitation.

Dry Natural Gas Production: The process of producing consumer-grade natural gas. Natural gas withdrawn from reservoirs is reduced by volumes used at the production (lease) site and by processing losses. Volumes used at the production site include (1) the volume returned to reservoirs in cycling, repressuring of oil reservoirs, and conservation operations; and (2) gas vented and flared. Processing losses include (1) nonhydrocarbon gases (e.g., water vapor, carbon dioxide, helium, hydrogen sulfide, and nitrogen) removed from the gas stream; and (2) gas converted to liquid form, such as lease condensate and plant liquids. Volumes of dry gas withdrawn from gas storage reservoirs are not considered part of production. Dry natural gas production equals marketed production less natural gas plant liquids production.

Dry Natural Gas: Natural gas which remains after: 1) the liquefiable hydrocarbon portion has been removed from the gas stream (i.e., gas after lease, field, and/or plant separation); and 2) any volumes of nonhydrocarbon gases have been removed where they occur in sufficient quantity to render the gas unmarketable. (Note: Dry natural gas is also known as consumer-grade natural gas. The parameters for measurement are cubic feet at 60 degrees Fahrenheit and 14.73 pounds per square inch absolute.)

Dry Steam Geothermal Plants: Conventional turbine generators are used with the dry steam resources. The steam is used directly, eliminating the need for boilers and boiler fuel that characterizes other steam-power-generating technologies. This technology is limited because dry-steam hydrothermal resources are extremely rare. The Geysers, in California, is the nation's only dry steam field.

Dry-measurement basis: method of measuring total heating value, whereby one cubic foot of gas is measured absent of water vapour

under standard conditions of pressure and temperature.

Dual Duct System: An air conditioning system that has two ducts, one is heated and the other is cooled, so that air of the correct temperature is provided by mixing varying amounts of air from each duct.

Dual Fuel (or Flex Fuel) Vehicle: A vehicle with an engine capable of operating on two different types of fuels.

Duct Fan: An axial flow fan mounted in a section of duct to move conditioned air.

Duct(s): The round or rectangular tube(s), generally constructed of sheet metal, fiberglass board, or a flexible plastic-and-wire composite, located within a wall, floor, and ceiling that distributes heated or cooled air in buildings.

Duty cycle: The ratio of active time to total time. Used to describe the operating regime of appliances or loads in photovoltaic systems. ***OR,*** The duration and periodicity of the operation of a device.

Duty rating: The amount of time an inverter (power conditioning unit) can produce at full rated power.

Dynamic Head: The pressure equivalent of the velocity of a fluid.

Dynamo: A machine for converting mechanical energy into electrical energy by magneto-electric induction; may be used as a motor.

Dynamometer: An apparatus for measuring force or power, especially the power developed by a motor.

Dyne: The absolute centimeter-gram-second unit of force; that force that will impart to a free mass of one gram an acceleration of one centimeter per second per second.

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E&P: Exploration and Production.

Earth Berm: A mound of dirt next to exterior walls to provide wind protection and insulation.

Earth Cooling Tube: A long, underground metal or plastic pipe through which air is drawn. As air travels through the pipe it gives up some of its heat to the soil, and enters the house as cooler air.

Earth Sheltered Houses: Houses that have earth berms around exterior walls.

Earth-Coupled Ground Source (Geothermal) Heat Pump: A type of heat pump that uses sealed horizontal or vertical pipes, buried in the ground, as heat exchangers through which a fluid is circulated to transfer heat.

Earth-Ship: A registered trademark name for houses built with tires, aluminum cans, and earth.

Easement: An incorporated right, liberty, privilege, or use of another entity's property, distinct from ownership, without profit or compensation; a right-of-way.

Eccentric: A device for converting continuous circular motion into reciprocating rectilinear motion.

Economically producible: A resource that generates revenue that exceeds, or is reasonably expected to exceed, the costs of the operation.

Economizer: A heat exchanger for recovering heat from flue gases for heating water or air.

Edge-defined film-fed growth (EFG): A method for making sheets of polycrystalline silicon for photovoltaic devices in which molten silicon is drawn upward by capillary action through a mold.

EFET (European Federation of Energy Traders): a group of more than 80 energy-trading companies from 18 European countries focused on improving the conditions of energy trading in Europe and the promotion of a sustainable and liquid European wholesale energy market.

Effective Capacity: The maximum load that a device is capable of carrying.

Efficacy: The amount of energy service or useful energy delivered per unit of energy input. Often used in reference to lighting systems, where the visible light output of a luminary is relative to power input; expressed in lumens per Watt; the higher the efficacy value, the higher the energy efficiency.

Efficiency (Appliance) Ratings: A measure of the efficiency of an appliance's energy efficiency.

Efficiency: Under the First Law of Thermodynamics, efficiency is the ratio of work or energy output to work or energy input, and cannot exceed 100 percent. Efficiency under the Second Law of Thermodynamics is determined by the ratio of the theoretical minimum energy that is required to accomplish a task relative to the energy actually consumed

to accomplish the task. Generally, the measured efficiency of a device, as defined by the First Law, will be higher than that defined by the Second Law.

EIA (Energy Information Administration): An agency within the U.S. Department of Energy. EIA provides energy data, forecasts and analyses.

Elasticity Of Demand: The ratio of the percentage change in the quantity of a good or service demanded to the percentage change in the price.

Electric Circuit: The path followed by electrons from a generation source, through an electrical system, and returning to the source.

Electric current: The flow of electrical energy (electricity) in a conductor, measured in amperes.

Electric Energy: The amount of work accomplished by electrical power, usually measured in kilowatt-hours (kWh). One kWh is 1,000 Watts and is equal to 3,413 Btu.

Electric Furnace: An air heater in which air is blown over electric resistance heating coils.

Electric Power Consumption: Gas used as fuel in the electric power sector.

Electric Power Plant: A facility or piece of equipment that produces electricity.

Electric Power Sector: An energy-consuming sector that consists of electricity only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public – i.e., North American Industry Classification System 22 plants. ***OR,*** Those privately or publicly owned establishments that generate, transmit, distribute, or sell electricity.

Electric Power Transmission: The transmission of electricity through power lines.

Electric Rate Schedule: A statement of the electric rate(s), terms, and conditions for electricity sale or supply.

Electric Rate: The unit price and quantity to which it applies as specified in a rate schedule or contract.

Electric Resistance Heating: A type of heating system where heat, resulting when electric current flows through an "element" or conductor, such as Nichrome, which has a high resistance, is radiated to a room.

Electric System Loss(es): The total amount of electric energy loss in an electric system between the generation source and points of delivery.

Electric System: The physically connected generation, transmission, and distribution facilities and components operated as a unit.

Electric Utility: A corporation, person, agency, authority, or other legal entity or instrumentality aligned with distribution facilities for delivery of electric energy for use primarily by the public, also known as a power provider. Included are investor-owned electric utilities, municipal and State utilities, Federal electric utilities, and rural electric cooperatives. A few entities that are tariff based and corporately aligned with companies that own distribution facilities are also included. (Note: Due to the issuance of FERC Order 888 that required traditional electric utilities to functionally unbundled their generation, transmission, and distribution operations, "electric utility" currently has inconsistent interpretations from State to State.)

Electric Vehicles: A battery-powered electrically driven vehicle.

Electrical Charge: A condition that results from an imbalance between the number of protons and the number of electrons in a substance.

Electrical Energy: The energy of moving electrons.

Electrical grid: An integrated system of electricity distribution, usually covering a large area.

Electrical System Energy Losses: A measure of the amount of energy lost during the generation, transmission, and distribution of electricity.

Electrical System: All the conductors and electricity using devices that are connected to a source of electromotive force (or generator).

Electricity: Energy resulting from the flow of charge particles, such as electrons or ions.

Electricity Generation: The process of producing electricity by transforming other forms or sources of energy into electrical energy; measured in kilowatt-hours.

Electricity Grid: A common term referring to an electricity transmission and distribution system.

Electricity Industry Restructuring: The process of changing the structure of the electric power industry from one of guaranteed monopoly over service territories, as established by the Public Utility Holding Company Act of 1935, to one of open competition between power

suppliers for customers in any area.

Electrochemical cell: A device containing two conducting electrodes, one positive and the other negative, made of dissimilar materials (usually metals) that are immersed in a chemical solution (electrolyte) that transmits positive ions from the negative to the positive electrode and thus forms an electrical charge. One or more cells constitute a battery.

Electrode: A conductor that is brought in conducting contact with a ground.

Electrodeposition: Electrolytic process in which a metal is deposited at the cathode from a solution of its ions.

Electrolysis: A chemical change in a substance that results from the passage of an electric current through an electrolyte. The production of commercial hydrogen by separating the elements of water, hydrogen, and oxygen, by charging the water with an electrical current.

Electrolyte: A nonmetallic (liquid or solid) conductor that carries current by the movement of ions (instead of electrons) with the liberation of matter at the electrodes of an electrochemical cell.

Electromagnetic Energy: Energy generated from an electromagnetic field produced by an electric current flowing through a superconducting wire kept at a specific low temperature.

Electromagnetic Field (**EMF**): The electrical and magnetic fields created by the presence or flow of electricity in an electrical conductor or electricity consuming appliance or motor.

Electromotive Force: The amount of energy derived from an electrical source per unit quantity of electricity passing through the source.

Electron hole pair: The result of light of sufficient energy dislodging an electron from its bond in a crystal, which creates a hole. The free electron (negative charge) and the hole (positive charge) are a pair. These pairs are the constituents of electricity.

Electron volt (eV): The amount of kinetic energy gained by an electron when accelerated through an electric potential difference of 1 Volt; equivalent to 1.603 x 10^-19; a unit of energy or work.

Electron: An elementary particle of an atom with a negative electrical charge and a mass of 1/1837 of a proton; electrons surround the positively charged nucleus of an atom and determine the chemical properties of an atom. The movement of electrons in an electrical conductor constitutes an electric current.

Electronic Ballast: A device that uses electronic components to regulate the voltage of fluorescent lamps.

Electrostatic Precipitator: A device used to remove particulate matter from the waste gasses of a combustion power plant.

Ellipsoidal Reflector Lamp: A lamp where the light beam is focused 2 inches ahead of the lamp reducing the amount of light trapped in the fixture.

Embedded derivative: a derivative instrument contained within another contract – the host contract. The embedded derivative may change in value in different ways or to different magnitudes than its host contract (as it may be linked to a different price, asset or index). ***OR,*** IAS 39 requires all derivatives to be marked-to-market, placing explicit reporting requirements on embedded derivatives to achieve enhanced transparency in financial reporting.

Emergency-shutdown systems (ESD): a system, usually independent of the main control system that is designed to safely shut down an operating system. For example, at ship-shore interface, LNG cargo transfer between ship and shore is accomplished by a series of shore-based articulated loading arms, usually three or four liquid arms and a single vapour arm. The configuration is similar at both the loading and discharge terminals. These arms have flexibility in three directions to allow for relative motion between ship and shore. If this allowable motion is exceeded, alarms sound on the ship and shore. Cargo transfer is automatically stopped, either by the shore pumps shutting down during loading, or the ship's pumps shutting down during unloading.

Emission Factor: A measure of the average amount of a specified pollutant or material emitted for a specific type of fuel or process.

Emission(s): A substance(s) or pollutant emitted as a result of a process.

Emissions trading: Emissions trading is emerging as a key instrument in the drive to reduce greenhouse-gas (GHG) emissions. Emissions trading is particularly suited to the emissions of GHGs, which have the same effect wherever they are emitted. This allows central government to regulate the amount of emissions produced in aggregate by setting the overall cap for the scheme, but gives

companies the flexibility of determining how and where the emissions reductions will be achieved. By allowing participants the flexibility to trade allowances, the overall emissions reductions are achieved in the most cost-effective way possible. ***OR,*** The EU Emissions Trading Scheme (EU ETS) is a mechanism being introduced across Europe to reduce emissions of carbon dioxide and combat the serious threat of climate change. Phase I of the scheme began on 1 January 2005 and will run until 31 December 2007. Phase II will run from 2008-2012, to coincide with the first Kyoto Protocol commitment period.

Emissivity: The ratio of the radiant energy (heat) leaving (being emitted by) a surface to that of a black body at the same temperature and with the same area; expressed as a number between 0 and 1.

Enabling agreement: provides the general terms and conditions for the purchase, sale, or exchange of LNG, pipeline gas and electricity, but does not list specific contract details.

Enclosure: The housing around a motor that supports the active parts and protects them. They come in different varieties (open, protected) depending on the degree of protection required.

End Use: The purpose for which useful energy or work is consumed.

Endothermic: A heat absorbing reaction or a reaction that requires heat.

End-users: the ultimate consumers of natural gas, including residential, commercial, industrial, wholesale, cogeneration and utility electricity-generation customers.

Energize(d): To send electricity through a electricity transmission and distribution network; a conductor or power line that is carrying current.

Energy audit: A survey that shows how much energy used in a home, which helps find ways to use less energy.

Energy Charge: That part of an electricity bill that is based on the amount of electrical energy consumed or supplied.

Energy contribution potential: Recombination occurring in the emitter region of a photovoltaic cell.

Energy Crops: Crops grown specifically for their fuel value. These include food crops such as corn and sugarcane, and nonfood crops such as poplar trees and switchgrass. Currently, two energy crops are under development: short-rotation woody crops, which are fast-growing hardwood trees harvested in 5 to 8 years; and herbaceous energy crops, such as perennial grasses, which are harvested annually after taking 2 to 3 years to reach full productivity.

Energy density: The ratio of available energy per pound; usually used to compare storage batteries.

Energy Efficiency Ratio (**EER**): The measure of the instantaneous energy efficiency of room air conditioners; the cooling capacity in Btu/hr divided by the watts of power consumed at a specific outdoor temperature (usually 95 degrees Fahrenheit).

Energy Efficient Mortgages: A type of home mortgage that takes into account the energy savings of a home that has cost-effective energy saving improvements that will reduce energy costs thereby allowing the homeowner to more income to the mortgage payment. A borrower can qualify for a larger loan amount than otherwise would be possible.

Energy End-Use Sectors: Major energy consuming sectors of the economy. The Commercial Sector includes commercial buildings and private companies. The Industrial Sector includes manufacturers and processors. The Residential Sector includes private homes. The Transportation Sector includes automobiles, trucks, rail, ships, and aircraft.

Energy Factor (**EF**): The measure of overall efficiency for a variety of appliances. For water heaters, the energy factor is based on three factors: 1) the recovery efficiency, or how efficiently the heat from the energy source is transferred to the water; 2) stand-by losses, or the percentage of heat lost per hour from the stored water compared to the content of the water: and 3) cycling losses. For dishwashers, the energy factor is defined as the number of cycles per kWh of input power. For clothes washers, the energy factor is defined as the cubic foot capacity per kWh of input power per cycle. For clothes dryers, the energy factor is defined as the number of pounds of clothes dried per kWh of power consumed.

Energy Guide Labels: The labels placed on appliances to enable consumers to compare appliance energy efficiency and energy consumption under specified test conditions as required by the Federal Trade Commission.

Energy imbalance service: A market service that provides for the management of unscheduled deviations in individual generator output or load consumption.

Energy Information Administration (EIA): The statistical information collection and analysis branch of the Department of Energy.

Energy Intensity: The relative extent that energy is required for a process.

Energy levels: The energy represented by an electron in the band model of a substance.

Energy Policy Act of **1992 (EPACT**): A comprehensive legislative package that mandates and encourages energy efficiency standards, alternative fuel use, and the development of renewable energy technologies. Public Law 102-486, October 24th, 1992. Also authorized the Federal Energy Regulatory Commission (FERC) to order the owners of electric power transmission lines to transmit or "wheel" power for power generators including electric power providers, federal power marketing authorities, and exempt wholesale generators.

Energy Security Act of **1980**: Legislation authorizing a U.S. biomass and alcohol fuel program, and that authorized loan guarantees and price guarantees and purchase agreements for alcohol fuel production.

Energy Service Company (**ESCO**): A company that specializes in undertaking energy efficiency measures under a contractual arrangement whereby the ESCO shares the value of energy savings with their customer.

Energy Storage: The process of storing, or converting energy from one form to another, for later use; storage devices and systems include batteries, conventional and pumped storage hydroelectric, flywheels, compressed gas, and thermal mass.

Energy: The capability of doing work; different forms of energy can be converted to other forms, but the total amount of energy remains the same.

Engineering, procurement and construction (EPC) contract: 1) a legal agreement setting out the terms for all activities required to build a facility to the point that it is ready to undergo preparations for operations as designed. 2) the final contracting phase in the development of the export portion of the LNG chain that defines the terms under which the detailed design, procurement, construction and commissioning of the facilities will be conducted. Greenfield LNG project development entails a wide variety of design, engineering, fabrication and construction work far beyond the capabilities of a single contractor. Therefore, an LNG project developer divides the work into a number of segments, each one being the subject of an EPC contract. For example, separate EPC contracts are executed for construction of onshore LNG plant and related infrastructure, for the offshore production facilities and for the pipeline from the offshore location to the plant site. See *Front-end engineering and design (FEED) contract*

Enhanced oil recovery (EOR): One or more of a variety of processes that seek to improve recovery of hydrocarbon from a reservoir after the primary production phase.

Enriching: increasing the heat content of natural gas by mixing it with a gas of higher Btu content.

Ensign: flag carried by a ship to show her nationality.

Enthalpy: A thermodynamic property of a substance, defined as the sum of its internal energy plus the pressure of the substance times its volume, divided by the mechanical equivalent of heat. The total heat content of air; the sum of the enthalpies of dry air and water vapor, per unit weight of dry air; measured in Btu per pound (or calories per kilogram).

Entrained Bed Gasifier: A gasifier in which the feedstock (fuel) is suspended by the movement of gas to move it through the gasifier.

Entropy: A measure of the unavailable or unusable energy in a system; energy that cannot be converted to another form.

Environment: All the natural and living things around us. The earth, air, weather, plants, and animals all make up our environment.

Environmental assessment: A study that can be required to assess the potential direct, indirect and cumulative environmental impacts of a project.

Environmental Protection Agency (EPA): the US federal agency that administers federal environmental policies, enforces environmental laws and regulations, performs research and provides information on environmental subjects. The agency also acts as chief advisor to the President on US environmental policy and issues. ***OR***, A federal

agency created in 1970 to permit coordinated and effective governmental action, for protection of the environment by the systematic abatement and control of pollution, through integration of research monitoring, standard setting, and enforcement activities.

Environmental-impact assessment (EIA): an assessment of the impact of an industrial installation or activity on the surrounding environment, conducted before work on that activity has commenced. The original baseline study, a key part of this process, describes the original conditions.

Epitaxial Growth: In reference to solar photovoltaic devices, the growth of one crystal on the surface of another crystal. The growth of the deposited crystal is oriented by the lattice structure of the original crystal.

Equalization charge: The process of mixing the electrolyte in batteries by periodically overcharging the batteries for a short time.

Equalization: The process of restoring all cells in a battery to an equal state-of-charge. Some battery types may require a complete discharge as a part of the equalization process.

Equalizing charge: A continuation of normal battery charging, at a voltage level slightly higher than the normal end-of-charge voltage, in order to provide cell equalization within a battery.

Equation of state: a mathematical relationship between pressure, volume and the temperature of a fluid that permits the prediction of the real volumetric and thermodynamic behavior.

Equinox: The two times of the year when the sun crosses the equator and night and day are of equal length; usually occurs on March 21st (spring equinox) and September 23 (fall equinox).

Equity gas: the proportion of gas to which a producing company is entitled as a result of its financial contribution to the project.

ERG: A unit of work done by the force of one dyne acting through a distance of one centimeter.

Escalator clause: a clause in a gas purchase or sale contract that permits adjustment of the contract price under specified conditions.

Estimated ultimate recovery (EUR): The sum of reserves remaining as of a given date and cumulative production as of that date.

Ethanol: Ethyl Alcohol (C_2H_5OH): A colorless liquid that is the product of fermentation used in alcoholic beverages, industrial processes, and as a fuel additive. Also known as grain alcohol.

Ethyl Tertiary Butyl Ether (ETBE): A chemical compound produced in a reaction between ethanol and isobutylene (a petroleum-derived by-product of the refining process). ETBE has characteristics superior to other ethers: low volatility, low water solubility, high octane value, and a large reduction in carbon monoxide and hydrocarbon emissions.

European Commission: the executive body of the European Union. Its Directorate-General of Energy and Transport develops community transport and energy policies, including dealing with state aid, and is responsible for managing the financial support programs for the trans-European networks, technological development and innovation.

Eutectic Salts: Salt mixtures with potential applications as solar thermal energy storage materials.

Eutectic: A mixture of substances that has a melting point lower than that of any mixture of the same substances in other proportions.

Evacuated-Tube Collector: A collector is the mechanism in which fluid (water or diluted antifreeze, for example) is heated by the sun in a solar hot water system. Evacuated-tube collectors are made up of rows of parallel, transparent glass tubes. Each tube consists of a glass outer tube and an inner tube, or absorber. The absorber is covered with a selective coating that absorbs solar energy well but inhibits radiative heat loss. The air is withdrawn ("evacuated") from the space between the tubes to form a vacuum, which eliminates conductive and convective heat loss. Evacuated-tube collectors are used for active solar hot water systems.

Evaporation: The conversion of a liquid to a vapor (gas), usually by means of heat.

Evaporative Cooling: The physical process by which a liquid or solid is transformed into the gaseous state. For this process a mechanical device uses the outside air's heat to evaporate water that is held by pads inside the cooler. The heat is drawn out of the air through this process and the cooled air is blown into the home by the cooler's fan.

Evaporator Coil: The inner coil in a heat pump that, during the cooling mode, absorbs heat from the inside air and boils the liquid refrigerant

to a vapor, which cools the house.

Evergreen clause: a contract clause that extends the contract beyond the initial term, until one of the parties gives a required notice of termination.

Excess capacity: a pipeline that is operating at a point below capacity. If a pipeline has excess capacity, it can receive additional gas.

Excitation: The power required to energize the magnetic field of a generator.

Exciton: A quasi-particle created in a semiconductor that is composed of an electron hole pair in a bound state. An exciton can be generated by and converted back into a photon.

Exempt Wholesale Generator: An unregulated subsidiary of a power provider that is allowed to generate and sell wholesale power as an independent energy producer, and is exempt from the Public Utility Holding Company Act of 1935.

Exergy analysis: the evaluation of a thermodynamic process' irreversibility and inefficiency. Exergy analysis is a fundamental design mechanism to increase efficiency and reduce costs.

Exothermic: A reaction or process that produces heat; a combustion reaction.

Expanded Polystyrene: A type of insulation that is molded or expanded to produce coarse, closed cells containing air. The rigid cellular structure provides thermal and acoustical insulation, strength with low weight, and coverage with few heat loss paths. Often used to insulate the interior of masonry basement walls.

Expansion Tank: A tank used in a closed-loop solar heating system that provides space for the expansion of the heat transfer fluid in the pressurized collector loop.

Expansion Valve: The device that reduces the pressure of liquid refrigerant thereby cooling it before it enters the evaporator coil in a heat pump.

Exploratory well: A well drilled to find a new field or to find a new reservoir in a field previously found to be productive of oil or gas in another reservoir.

Explosion: The sudden release or creation of pressure and generation of high temperature as a result of a rapid change in chemical state (usually burning), or a mechanical failure.

Export-credit agencies (ECAs): government agencies whose mission is to facilitate the export sale of goods and services by providing credits that are more attractive than those available commercially and by providing security for credit and political risk that may not be available at an economic cost from private-sector finance sources. ECAs of the US, Europe and Japan have been consistent financing sources for LNG projects; includes Export-Import Banks of the US (USEXIM) and Japan Bank for International Cooperation (JBIC), the UK's Export Credit Guarantee Department (ECGD), Germany's Hermes, France's Coface and Italy's Sace. See *Multilateral institutions*

Exports: Natural gas deliveries out of the Continental United States (including Alaska) to foreign countries.

Ex-ship contract: in an LNG ex-ship contract, ownership of the LNG transfers to the buyer as the LNG is unloaded at the receiving terminal, payment is due at that time. See *Cost, insurance and freight contract and Free on board contract*

External Combustion Engine: An engine in which fuel is burned (or heat is applied) to the outside of a cylinder; a Stirling engine.

External quantum efficiency (external QE or EQE): Quantum efficiency that includes the effect of optical losses, such as transmission through the cell and reflection of light away from the cell.

Externality: The environmental, social, and economic impacts of producing a good or service that are not directly reflected in the market price of the good or service.

Extraction loss: the reduction in volume of wet natural gas caused by the removal of natural gas liquids, hydrogen sulphide, carbon dioxide, water vapour and other impurities from the natural gas stream. Also called shrinkage.

Extrinsic semiconductor: The product of doping a pure semiconductor.

Extruded Polystyrene: A type of insulation material with fine, closed cells, containing a mixture of air and refrigerant gas. This insulation has a high R-value, good moisture resistance, and high structural strength compared to other rigid insulation materials.

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Fahrenheit degrees (F): A temperature scale according to which water boils at 212 and freezes at 32 degrees. Convert to Centigrade degrees © by the following formula: (F -32)/1.8 = C.

Fan Coil: A heat exchanger coil in which a fluid such as water is circulated and a fan blows air over the coil to distribute heat or cool air to the different rooms.

Fan Velocity Pressure: The pressure corresponding to the outlet velocity of a fan; the kinetic energy per unit volume of flowing air.

Fan: A device that moves and/or circulates air and provides ventilation for a room or a building.

Farad: A unit of electrical capacitance; the capacitance of a capacitor between the plates of which there appears a difference of 1 Volt when it is charged by one coulomb of electricity.

Farm-in: The acquisition of part or all of an oil, natural gas or mineral interest from a third party.

Farm-out: The assignment of part or all of an oil, natural gas or mineral interest to a third party.

Feather: In a wind energy conversion system, to pitch the turbine blades so as to reduce their lift capacity as a method of shutting down the turbine during high wind speeds

Federal Energy Management Program (**FEMP**) **Office**: An office in the U.S. Department of Energy (DOE) that implements energy legislation and presidential directives. FEMP provides project financing, technical guidance and assistance, coordination and reporting, and new initiatives for the federal government. It also helps federal agencies identify the best technologies and technology demonstrations for their use.

Federal Energy Regulatory Commission (FERC): A U.S. government agency created by Congress in 1977. The act transferred to the FERC most of the former Federal Power Commission's interstate regulatory functions over the electric power and natural gas industries. In 1978, Congress passed the Natural Energy Act, broadening the FERC's jurisdiction and regulatory functions. The FERC now also regulates producer sales of natural gas in intrastate commerce. The FERC establishes uniform ceiling prices for each of several categories of natural gas, and these prices apply to all sales on a nationwide basis. ***OR,*** Responsible for regulating LNG facilities in the US. FERC is considered an independent regulatory agency responsible primarily to Congress, but is housed in the US Department of Energy. ***OR,*** DOE that has jurisdiction over interstate electricity sales, wholesale electric rates, natural gas pricing, oil pipeline rates, and gas pipeline certification. It also licenses and inspects private, municipal, and state hydroelectric projects and oversees related environmental matters.

Federal Power Marketing Administrations (**PMA**): These are separate and distinct organizational agencies within the U.S. DOE that market power at federal multipurpose water projects at lowest possible rates to consumers consistent with sound business principles. There are five PMA's: Alaska Power Administration, Bonneville Power Administration, Southeastern Power Administration, Southwestern Power Administration, Western Area Power Administration.

FEED: Front-end engineering and design – part of a project's life cycle.

Feeder: A power line for supplying electricity within a specified area.

Feedstock gas (feedgas): dry gas used as raw material for LNG, petrochemicals and gas-to-liquids (GTL) plants.

Feedstock: A raw material that can be converted to one or more products.

Fenestration: The arrangement, proportion, and design of windows in a building.

FERC blanket certificate: authorization from FERC to the interstate pipeline to offer a service to the public without individual certification or approval filings.

FERC Order 497 – a 1988 FERC Order: to do with the activities of marketing affiliates of interstate pipeline firms. Among other things, it establishes guidelines for sharing of certain insider information. It requires disclosure of certain information regarding shared personnel and affiliate transactions.

FERC Order 636: 1992 order that unbundled US pipeline services, requiring pipelines to cease their merchant function and instead become solely a transporter of gas.

FERC Order 637 – 2000 FERC Order: required changes in FERC regulation of interstate pipelines, changes designed to encourage greater comparability between primary pipeline capacity and the secondary

capacity (capacity release) market.

Fermentation: The decomposition of organic material to alcohol, methane, etc., by organisms, such as yeast or bacteria, usually in the absence of oxygen.

Fermi level: Energy level at which the probability of finding an electron is one-half. In a metal, the Fermi level is very near the top of the filled levels in the partially filled valence band. In a semiconductor, the Fermi level is in the band gap.

Fiberglass Insulation: A type of insulation, composed of small diameter pink, yellow, or white glass fibers, formed into blankets or batts, or used in loose-fill and blown-in applications.

Field natural gas: gas extracted from a production well prior to entering the first stage of processing, such as dehydration.

Field: an area consisting of a single or multiple hydrocarbon reservoirs all grouped on or related to the same individual geological structural feature and/ or stratigraphic condition. There may be two or more reservoirs in a field that are separated vertically by intervening impervious strata, or laterally by local geologic barriers, or by both.

Filament: A coil of tungsten wire suspended in a vacuum or inert gas-filled bulb. When heated by electricity the tungsten "filament" glows.

Fill Factor: The ratio of a photovoltaic cell's actual power to its power if both current and voltage were at their maxima. A key characteristic in evaluating cell performance.

Filter (Air): A device that removes contaminants, by mechanical filtration, from the fresh air stream before the air enters the living space. Filters can be installed as part of a heating/cooling system through which air flows for the purpose of removing particulates before or after the air enters the mechanical components.

Fin: A thin sheet of material (metal) of a heat exchanger that conducts heat to a fluid.

Financial-guarantee contract: a contract that requires the issuer to make specified payments to reimburse the holder for a loss it incurs because a specified debtor fails to make payment when due in accordance with the original or modified terms of a debt instrument.

Finish: Both a noun and a verb to describe the exterior surface of building elements (walls, floors, ceilings, etc.) and furniture, and the process of applying it.

FIP: Free in pipe. LPG is sometimes sold on this basis.

Fire Classification: Classifications of fires developed by the National Fire Protection Association.

Fireplace: A wood or gas burning appliance that is primarily used to provide ambiance to a room. Conventional, masonry fireplaces without energy saving features, often take more heat from a space than they put into it.

Fireplace Insert: A wood or gas burning heating appliance that fits into the opening or protrudes on to the hearth of a conventional fireplace.

Fire-Rating: The ability of a building construction assembly (partition, wall, floor, etc.) to resist the passage of fire. The rating is expressed in hours.

Firewall: A wall to prevent the spread of fire; usually made of non-combustible material.

Firing Rate: The amount of BTUs/hour or kWs produced by a heating system from the burning of a fuel.

Firm energy (contract): energy sales guaranteed to be delivered under terms defined by contract.

Firm transportation: a fixed obligation where the transporter is obligated to provide a specified capacity without interruption.

First Law of Thermodynamics: States that energy cannot be created or destroyed, but only changed from one form to another. First Law efficiency measures the fraction of energy supplied to a device or process that it delivers in its output. Also called the law of conservation of energy.

First mate: directly responsible for all deck operations – cargo handling and storage, deck maintenance and deck supplies; ship's medical officer. See *Crew*

Fiscal Year (**FY**): The U.S. Government's 12-month financial year, from October to September, of the following calender year; e.g.: FY 1998 extends from Oct. 1, 1997 to Sept. 30, 1988.

Fixed tilt array: A photovoltaic array set in at a fixed angle with respect to horizontal.

Fixed-price contract: contract in which a specific price is agreed for commodities.

Flame Spread Classification: A measure of the surface burning characteristics of a material.

Flame Spread Rating: A measure of the relative flame spread, and smoke development, from a material being tested. The flame spread rating is a single number comparing the flame spread of a material with red oak, arbitrarily given the number 100 and asbestos cement board with a flame spread of 0. Building codes require a maximum flame spread of 25 for insulation installed in exposed locations.

Flare: a flame used to burn off unwanted gas; a flare stack is the steel structure on a processing facility from which gas is flared.

Flared: Gas disposed of by burning in flares usually at the production sites or at gas processing plants.

Flaring: The controlled and safe burning of gas which cannot be used for commercial or technical reasons. ***OR***, The burning of natural gas for safety reasons or when there is no way to transport the gas to market or use the gas for other beneficial purposes (such as EOR or reservoir pressure maintenance). The practice of flaring is being steadily reduced as pipelines are completed and in response to environmental concerns.

Flash point: the temperature under very specific conditions at which a combustible liquid will give off sufficient vapour to form a flammable mixture with air in a standardised vessel. Related to the volatility of the liquid.

Flash vapours: gas vapours released from a stream of natural gas liquids as a result of an increase in temperature, or a decrease in pressure.

Flashing: Metal, usually galvanized sheet metal, used to provide protection against infiltration of precipitation into a roof or exterior wall; usually placed around roof penetrations such as chimneys.

Flashpoint: The minimum temperature at which sufficient vapor is released by a liquid or solid (fuel) to form a flammable vapor-air mixture at atmospheric pressure.

Flash-Steam Geothermal Plants: When the temperature of the hydrothermal liquids is over 350 F (177 C), flash-steam technology is generally employed. In these systems, most of the liquid is flashed to steam. The steam is separated from the remaining liquid and used to drive a turbine generator. While the water is returned to the geothermal reservoir, the economics of most hydrothermal flash plants are improved by using a dual-flash cycle, which separates the steam at two different pressures. The dual-flash cycle produces 20% to 30% more power than a single-flash system at the same fluid flow.

Flat Plate Solar Photovoltaic Module: An arrangement of photovoltaic cells or material mounted on a rigid flat surface with the cells exposed freely to incoming sunlight.

Flat Plate Solar Thermal/Heating Collectors: Large, flat boxes with glass covers and dark-colored metal plates inside that absorb and transfer solar energy to a heat transfer fluid. This is the most common type of collector used in solar hot water systems for homes or small businesses.

Flat Roof: A slightly sloped roof, usually with a tar and gravel cover. Most commercial buildings use this kind of roof.

Flat-Black Paint: Nonglossy paint with a relatively high absorptance.

Flat-plate array: A photovoltaic (PV) array that consists of non-concentrating PV modules.

Flat-plate module: An arrangement of photovoltaic cells or material mounted on a rigid flat surface with the cells exposed freely to incoming sunlight.

Flat-plate photovoltaics (PV): A PV array or module that consists of non-concentrating elements. Flat-plate arrays and modules use direct and diffuse sunlight, but if the array is fixed in position, some portion of the direct sunlight is lost because of oblique sun-angles in relation to the array.

Float charge: The voltage required to counteract the self-discharge of the battery at a certain temperature.

Float life: The number of years that a battery can keep its stated capacity when it is kept at float charge.

Float Service: A battery operation in which the battery is normally connected to an external current source; for instance, a battery charger which supplies the battery load< under normal conditions, while also providing enough energy input to the battery to make up for its internal quiescent losses, thus keeping the battery always up to full power and ready for service.

Floating production, storage and offloading (FPSO): Provides alternative

to pipeline to store oil production and load vessels for movement to markets.

Figure: Peng Bo FPSO in Bohai Bay, China

Float-zone process: In reference to solar photovoltaic cell manufacture, a method of growing a large-size, high-quality crystal whereby coils heat a polycrystalline ingot placed atop a single-crystal seed. As the coils are slowly raised the molten interface beneath the coils becomes single crystal.

Floor Space: The interior area of a building, calculated in square feet or meters.

Floor: The upward facing structure of a building.

Flow Condition: In reference to solar thermal collectors, the condition where the heat transfer fluid is flowing through the collector loop under normal operating conditions.

Flow Restrictor: A water and energy conserving device that limits the amount of water that a faucet or shower head can deliver.

Flue Gas: The gas resulting from the combustion of a fuel that is emitted to the flue.

Flue: The structure (in a residential heating appliance, industrial furnace, or power plant) into which combustion gases flow and are contained until they are emitted to the atmosphere.

Fluffing: The practice of installing blow-in, loose-fill insulation at a lower density than is recommended to meet a specified R-Value.

Fluidized Bed Combustion (FBC): A type of furnace or reactor in which fuel particles are combusted while suspended in a stream of hot gas.

Fluorescent Light: The conversion of electric power to visible light by using an electric charge to excite gaseous atoms in a glass tube. These atoms emit ultraviolet radiation that is absorbed by a phosphor coating on the walls of the lamp tube. The phosphor coating produces visible light.

Fly Ash: The fine particulate matter entrained in the flue gases of a combustion power plant.

Flywheel Effect: The damping of interior temperature fluctuations by massive construction.

Foam (Insulation): A high R-value insulation product usually made from urethane that can be injected into wall cavities, or sprayed onto roofs or floors, where it expands and sets quickly.

Foam Board: A plastic foam insulation product, pressed or extruded into board-like forms, used as sheathing and insulation for interior basement or crawl space walls or beneath a basement slab; can also be used for exterior applications inside or outside foundations, crawl spaces, and slab-on-grade foundation walls.

Foam Core Panels: A type of structural, insulated product with foam insulation contained between two facings of drywall, or structural wood composition boards such as plywood, wafer-board, and oriented strand board.

Foot Candle: A unit of illuminance; equal to one lumen per square foot.

Foot Pound: The amount of work done in raising one pound one foot.

Force Majeure*:* a term commonly used in contracts to describe an event or effect that cannot be reasonably controlled. This term essentially frees one or both parties from liability of obligation when an extraordinary event or circumstance prevents one or both parties from fulfilling their contractual obligations.

Force: The push or pull that alters the motion of a moving body or moves a stationary body; the unit of force is the dyne or poundal; force is equal to mass time velocity divided by time.

Forced Air System Or Furnace: A type of heating system in which heated air is blown by a fan through air channels or ducts to rooms.

Forced Ventilation: A type of building ventilation system that uses fans or blowers to provide fresh air to rooms when the forces of air pressure and gravity are not enough to circulate air through a building.

Formaldehyde: A chemical used as a preservative and in bonding agents. It

is found in household products such as plywood, furniture, carpets, and some types of foam insulation. It is also a by-product of combustion and is a strong-smelling, colorless gas that is an eye irritant and can cause sneezing, coughing, and other health problems.

Formation: A rock layer which has distinct characteristics (e.g. rock type, geologic age).

Forward contract: a commitment to buy (long) or sell (short) an underlying asset at a specified date at a price (known as the exercise or forward price) specified at the origination of the contract.

Forward haul: a gas-transportation service that requires movement of gas from a point of receipt to a point of delivery such that the contractual direction of movement on the pipeline is in the same direction as the flow of the gas.

Fossil Fuels: Fuels formed in the ground from the remains of dead plants and animals. It takes millions of years to form fossil fuels. Oil, natural gas, and coal are fossil fuels. ***OR,*** Any naturally occurring organic fuel formed in the earth's crust, such as petroleum, coal, or natural gas.

Foundation: The supportive structure of a building.

Fractional Horse Power Motor: An electric motor rated at less than one horse power (hp).

Fractionation: the process of separating a fluid mixture into its primary constituents, for example, separating a gas condensate into ethane, propane, butanes and heavier components.

Fracturing or fracing - The pumping of crude oil, diesel, water or chemicals into a reservoir with such force that the reservoir rock is cracked and results in greater flow of oil or gas from the reservoir.

Fracturing: refers to a method used by producers to extract more gas from a well by opening up rock formations using hydraulic or explosive force. Advanced fracturing techniques are enhancing producers' ability to find and recover natural gas, as well as extending the longevity of older wells.

Frame (Window): The outer casing of a window that sits in a designated opening of a structure and holds the window panes in place.

Framing: The structural materials and elements used to construct a wall.

Francis Turbine: A type of hydropower turbine that contains a runner that has water passages through it formed by curved vanes or blades. As the water passes through the runner and over the curved surfaces, it causes rotation of the runner. The rotational motion is transmitted by a shaft to a generator.

Free-on-board (FOB) contract: in an LNG FOB contract, the buyer lifts the LNG from the liquefaction plant and is responsible for transporting the LNG to the receiving terminal. The buyer is responsible for the shipping, either owning the LNG ships or chartering them from a ship-owner. In a FOB contract, the seller requires assurance that the shipping protocols provide a safe and reliable off-take for the LNG to prevent disruption to the sales and purchase agreement (SPA). See *Cost, insurance and freight (CIF) contract, Ex-ship contract* and *Sale and purchase agreement (SPA)*

Freight: charge made for the transportation of a cargo.

Freon: A registered trademark for a cholorfluorocarbon (CFC) gas that is highly stable and that has been historically used as a refrigerant.

Frequency: The number of repetitions per unit time of a complete waveform, expressed in Hertz (Hz). ***OR,*** The number of cycles through which an alternating current passes per second; in the U.S. the standard for electricity generation is 60 cycles per second (60 Hertz).

Frequency regulation: This indicates the variability in the output frequency. Some loads will switch off or not operate properly if frequency variations exceed 1%.

Fresnel lens: An optical device that focuses light like a magnifying glass; concentric rings are faced at slightly different angles so that light falling on any ring is focused to the same point.

Friction Head: The energy lost from the movement of a fluid in a conduit (pipe) due to the disturbances created by the contact of the moving fluid with the surfaces of the conduit, or the additional pressure that a pump must provide to overcome the resistance to fluid flow created by or in a conduit.

Front-end engineering and design (FEED) contract: 1) a legal agreement setting out the terms for all activities required to define the design of a facility to a level of definition necessary for the starting point of an engineering, procurement, and construction (EPC) contract; 2) generally, the second contracting phase for the development of the export facilities in the LNG chain which provides greater definition

than the prior Conceptual design phase. In an LNG project, the most important function of the FEED contract is to provide the maximum possible definition for the work to be performed by the EPC contractor. This enables potential EPC contractors to submit bids on a lump-sum basis, with the least possibility that the contract cost will change through undefined work or through claims for unanticipated changes in the work. Clear definition of contract costs is important not only for cost control purposes, but also for purposes of project financing – LNG project lenders will normally limit their lending commitment to a specific percentage of forecast project costs, and cost overruns will have to be covered by the borrower's equity investment. See *Engineering, procurement and construction (EPC) contract*

FSRU (Floating Storage and Re-gasification Unit): A Floating Storage Regasification Unit (FSRU) is the vital component required while transiting and transferring Liquefied Natural Gas (LNG) through the

oceanic channels.

Fuel Cell: An electrochemical device that converts chemical energy directly into electricity.

Fuel Efficiency: The ratio of heat produced by a fuel for doing work to the available heat in the fuel.

Fuel gas: a process stream internal to a facility that is used to provide energy for operating the facility.

Fuel Grade Alcohol: Usually refers to ethanol to 160 to 200 proof.

Fuel loss: a proportion of natural gas received by a pipeline or local distribution company that is retained to compensate for lost and unaccounted for natural gas.

Fuel Oil: Any liquid petroleum product burned for the generation of heat in a furnace or firebox, or for the generation of power in an engine. Domestic (residential) heating fuels are classed as Nos. 1, 2, 3; Industrial fuels as Nos. 4, 5, and 6.

Fuel Rate: The amount of fuel necessary to generate one kilowatt-hour of electricity.

Fuel: Any material that can be burned to make energy.

Fuel-switching capability: the ability of an end-user to readily change fuel.

Fugitive Emissions: Emissions of gases or vapors from pressurized equipment, including pipelines, due to leakage, unintended or irregular releases of gases.

Full Sun: The amount of power density in sunlight received at the earth's surface at noon on a clear day (about 1,000 Watts/square meter).

Full-cycle economics: economic analysis that includes all costs of field development including seismic, lease cost and construction, drilling, completion, development and, where relevant, decommissioning and environmental restitution.

Fungi: Plant-like organisms with cells with distinct nuclei surrounded by nuclear membranes, incapable of photosynthesis. Fungi are decomposers of waste organisms and exist as yeast, mold, or mildew.

Furling: The process of forcing, either manually or automatically, a wind turbine's blades out of the direction of the wind in order to stop the blades from turning.

Furnace (Residential): A combustion heating appliance in which heat is captured from the burning of a fuel for distribution, comprised mainly of a combustion chamber and heat exchanger.

Fuse: A safety device consisting of a short length of relatively fine wire, mounted in a holder or contained in a cartridge and connected as part of an electrical circuit. If the circuit source current exceeds a predetermined value, the fuse wire melts (i.e. the fuse 'blows') breaking the circuit and preventing damage to the circuit protected by the fuse.

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Ga: See gallium.

GaAs: See gallium arsenide.

Gallium (Ga): A chemical element, metallic in nature, used in making certain kinds of solar cells and semiconductor devices.

Gallium arsenide (GaAs): A crystalline, high-efficiency compound used to make certain types of solar cells and semiconductor material.

Gas cap: a free gas phase within a reservoir that overlies an oil zone.

Gas condensate reservoir: a reservoir initially containing natural gas that will precipitate hydrocarbon liquid (retrograde condensate) during pressure depletion. To increase the recovery of the condensate, gas may be re-cycled in early years and produced at a later date.

Gas Condensate Well: A gas well that produces from a gas reservoir containing considerable quantities of liquid hydrocarbons in the pentane and heavier range generally described as "condensate."

Gas cycling: process in which produced gas is re-injected into the reservoir after removal of condensate in order to maintain reservoir pressure and prevent condensate from condensing in the reservoir (retrograde condensation) and becoming difficult to recover.

Gas day: in the US, a period of 24 consecutive hours, beginning at 09:00 Central Time.

Gas grid: 1) the system of pipelines from the wellhead to the city gate; 2) the network of gas transmission and distribution pipelines in a region or country, through which gas is transported to industrial, commercial and domestic users.

Gas imbalance: a discrepancy between a transporter's receipt and deliveries of natural gas for a shipper.

Gas lift: one of several methods of artificial lift. A mechanical process using the continuous or intermittent injection of a gas into the production conduit (tubing or casing) to aerate or displace the produced fluids. This creates a reduction of the bottom-hole pressure of the well, increasing or sustaining the flow rate of the well.

Gas processing plant - A facility which extracts liquefiable hydrocarbons or sulfur from natural gas and/or fractionates a liquid stream.

Gas processing: the separation of oil and gas, and the removal of impurities and NGLs from natural gas.

Gas reserves: those quantities of gas that are likely to be commercially recovered from known accumulations from a given date forward.

Gas revenue: the product of gas volume times gas price; gross cash flow from sales of gas.

Gas send-out: the total natural gas produced or purchased (including exchange-gas receipts), or the net natural gas withdrawn from underground storage within a specified time interval, measured at the point of production, purchase or withdrawal, adjusted for changes in local storage quantity.

Gas to liquids (GTL): a processing technology that converts natural gas into high-value commodity liquid fuels and blending agents, petrochemicals feedstocks and chemicals by changing its chemical structure. GTL produces products that can be easily traded as commodities on world markets.

Gas treatment: removal of impurities, such as sulphur compounds, carbon dioxide and water vapour from natural gas.

Gas Turbine: A type of turbine in which combusted, pressurized gas is directed against a series of blades connected to a shaft, which forces the shaft to turn to produce mechanical energy.

Gas Well: A well completed for the production of natural gas from one or more gas zones or reservoirs. Such wells contain no completions for the production of crude oil.

Gas/condensate ratio: for a gas condensate reservoir, the ratio of gas to condensate is reported in cf per barrel. The inverse ratio (condensate-gas ratio, CGR) is also used, and is reported in barrels per mmcf.

Gas-distribution line: a gas pipeline, normally operating at pressures of 60 pounds per square inch (psi) or less, which transports gas from high-pressure transmission lines to end-users.

Gas field: a field or group of reservoirs of hydrocarbons containing natural gas, but insignificant quantities of oil.

Gas-gathering system: a system for collecting gas production from different sources for delivery by pipeline to a central point, such as a platform or processing facility. The gas sources could be individual

wells, smaller gathering systems, field facilities and platforms.

Gasification: The process in which a solid fuel is converted into a gas; also known as pyrolitic distillation or pyrolysis. Production of a clean fuel gas makes a wide variety of power options available.

Gasifier: A device for converting a solid fuel to a gaseous fuel.

Gasket/Seal: A seal used to prevent the leakage of fluids, and also maintain the pressure in an enclosure.

Gasohol: A registered trademark of an agency of the state of Nebraska, for an automotive fuel containing a blend of 10 percent ethanol and 90 percent gasoline.

Gasoline: A refined petroleum product suitable for use as a fuel in internal combustion engines.

Gassing current: The portion of charge current that goes into electrolytical production of hydrogen and oxygen from the electrolytic liquid. This current increases with increasing voltage and temperature.

Gassing: The evolution of gas from one or more of the electrodes in the cells of a battery. Gassing commonly results from local action self-discharge or from the electrolysis of water in the electrolyte during charging.

Gas-to-oil ratio (GOR): the number of standard cubic feet of gas produced per barrel of crude oil or other hydrocarbon liquid. In some parts of the world, the units are cubic meters of gas per cubic meter of liquid produced.

Gas-turbine power plant: a power plant in which the prime mover is a gas turbine. A gas turbine typically consists of an axial-flow compressor that feeds compressed air into one or more combustion chambers where liquid or gaseous fuel is burned. The resulting hot gases are expanded through the turbine, causing it to rotate. The rotating turbine shaft drives the compressors as well as the generator, producing electricity.

Gathering - The process of collecting natural gas flowing from numerous wells and bringing it together into pooling areas where it is received into transmission pipelines.

Gathering line: Pipelines that move natural gas or petroleum from wells to processing or transmission facilities. ***OR***, network-like pipeline that transports natural gas from individual wellheads to a compressor station, treating or processing plant, or main trunk transmission line. Gathering lines are generally relatively short in length and smaller in diameter than the gas sales line.

Gauss: The unit of magnetic field intensity equal to 1 dyne per unit pole.

Gel-type battery: Lead-acid battery in which the electrolyte is composed of a silica gel matrix.

Generator: A device for converting mechanical energy to electrical energy.

Geopressurized Brines: These brines are hot (300 F to 400 F) (149 C to 204 C) pressurized waters that contain dissolved methane and lie at depths of 10,000 ft (3048 m) to more than 20,000 ft (6096 m) below the earth's surface. The best known geopressured reservoirs lie along the Texas and Louisiana Gulf Coast. At least three types of energy could be obtained: thermal energy from high-temperature fluids; hydraulic energy from the high pressure; and chemical energy from burning the dissolved methane gas.

Geothermal Energy: Energy produced by the internal heat of the earth; geothermal heat sources include: hydrothermal convective systems; pressurized water reservoirs; hot dry rocks; manual gradients; and magma. Geothermal energy can be used directly for heating or to produce electric power.

Geothermal Heat Pump: A type of heat pump that uses the ground, ground water, or ponds as a heat source and heat sink, rather than outside air. Ground or water temperatures are more constant and are warmer in winter and cooler in summer than air temperatures. Geothermal heat pumps operate more efficiently than "conventional" or "air source" heat pumps.

Geothermal Power Station: An electricity generating facility that uses geothermal energy.

GGE - Gasoline Gallon Equivalent

Gigajoule (GJ): a joule is an international unit of energy defined as the energy produced from one watt flowing for one second. A very small unit of energy, there are 3.6m joules in a kilowatt-hour. For gas, one gigajoule = 960 cf under standard temperature and pressure conditions. Roughly, 1 gigajoule (Gj) = mcf; one terajoule (Tj) = 1 mmcf; one petajoule (Pj) = 1 bcf; one exajoule (Ej) = 1 tcf.

Gigawatt (GW): A unit of power equal to 1 billion Watts; 1 million

kilowatts, or 1,000 megawatts – enough power to supply the needs of a medium-sized city.

Gigawatt hour (GWh): 1bn watt-hours.

Gin Pole: A pole used to assist in raising a tower.

Glare: The excessive brightness from a direct light source that makes it difficult to see what one wishes to see. A bright object in front of a dark background usually will cause glare. Bright lights reflecting off a television or computer screen or even a printed page produces glare. Intense light sources—such as bright incandescent lamps—are likely to produce more direct glare than large fluorescent lamps. However, glare is primarily the result of relative placement of light sources and the objects being viewed.

Glauber's Salt: A salt, sodium sulfate decahydrate that melts at 90 degrees Fahrenheit; a component of eutectic salts that can be used for storing heat.

Glazing: A term used for the transparent or translucent material in a window. This material (i.e. glass, plastic films, coated glass) is used for admitting solar energy and light through windows. ***OR,*** Transparent or translucent material (glass or plastic) used to admit light and/or to reduce heat loss; used for building windows, skylights, or greenhouses, or for covering the aperture of a solar collector.

Global Insolation (or Solar Radiation): The total diffuse and direct insolation on a horizontal surface, averaged over a specified period of time.

Global Warming: A popular term used to describe the increase in average global temperatures due to the greenhouse effect.

Global-warming potential (GWP): The relative measure of how much heat a greenhouse gas traps in the atmosphere. It compares the amount of heat trapped by a certain mass of the gas in question to the amount of heat trapped by a similar mass of carbon dioxide. GWP is calculated over a specific time interval, commonly 100 years. GWP is expressed as a multiple of that for carbon dioxide (whose GWP is standardized to 1).

Governor: A device used to regulate motor speed, or, in a wind energy conversion system, to control the rotational speed of the rotor.

Grain Alcohol: Ethanol.

Grandfather clause: a clause in a contract which maintains the prior rule or policy where a new rule or policy would otherwise be applicable.

Green Certificates: Green certificates represent the environmental attributes of power produced from renewable resources. By separating the environmental attributes from the power, clean power generators are able to sell the electricity they produce to power providers at a competitive market value. The additional revenue generated by the sale of the green certificates covers the above-market costs associated with producing power made from renewable energy sources. Also known as green tags, renewable energy certificates, or tradable renewable certificates.

Green Power: A popular term for energy produced from clean, renewable energy resources.

Green Pricing: A practice engaged in by some regulated utilities (i.e. power providers) where electricity produced from clean, renewable resources is sold at a higher cost than that produced from fossil or nuclear power plants, supposedly because some buyers are willing to pay a premium for clean power.

Greenfield LNG facility: a new LNG facility constructed on a new site.

Greenhouse Effect: A popular term used to describe the heating effect due to the trapping of long wave (length) radiation by greenhouse gases produced from natural and human sources.

Greenhouse gas: Atmospheric gases that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect of these gases is a trapping of absorbed radiation and a tendency to warm the planet's surface. The greenhouse gases most relevant to the oil and gas industry are carbon dioxide, methane and nitrous oxide. ***OR,*** Those gases, such as water vapor, carbon dioxide, tropospheric ozone, methane, and low level ozone that are transparent to solar radiation, but opaque to long wave radiation, and which contribute to the greenhouse effect.

Greenwood: Freshly cut, unseasoned, wood.

Greywater: Waste water from a household source other than a toilet. This water can be used for landscape irrigation depending upon the source of the greywater.

Grid lines: Metallic contacts fused to the surface of the solar cell to provide a low resistance path for electrons to flow out to the cell interconnect wires.

Grid: A common term referring to an electricity transmission and distribution system. A network of pipelines through which gas is transported.

Grid-connected system: A solar electric or photovoltaic (PV) system in which the PV array acts like a central generating plant, supplying power to the grid. ***OR,*** Independent power systems that are connected to an electricity transmission and distribution system (referred to as the electricity grid) such that the systems can draw on the grid's reserve capacity in times of need, and feed electricity back into the grid during times of excess production.

Grid-interactive system: Same as grid-connected system.

Gross Calorific Value: The heat produced by combusting a specific quantity and volume of fuel in an oxygen-bomb colorimeter under specific conditions.

Gross freight: freight cost excluding the expenses relating to the running costs of the ship.

Gross gas withdrawal: the full volume of compounds extracted at the wellhead, including non-hydrocarbon gases and natural gas plant liquids.

Gross generation: The total amount of electricity produced by a power plant.

Gross tonnage: common measurement of the internal volume of a ship determined in accordance with prescribed methods and formulas and expressed in units of 100 cf (= 2.83 cm)

Gross withdrawals: Full well stream volume, including all natural gas plant liquid and nonhydrocarbon gases, but excluding lease condensate. Also includes amounts delivered as royalty payments or consumed in field operations.

Ground Loop: In geothermal heat pump systems, a series of fluid-filled plastic pipes buried in the shallow ground, or placed in a body of water, near a building. The fluid within the pipes is used to transfer heat between the building and the shallow ground (or water) in order to heat and cool the building.

Ground Reflection: Solar radiation reflected from the ground onto a solar collector.

Ground: A device used to protect the user of any electrical system or appliance from shock.

Grounding: contact by a ship with the bottom while she is moored or anchored or under way.

Ground-Source Heat Pump: (See Geothermal Systems)

Guy Wire: Cable use to secure a wind turbine tower to the ground in a safe, stable manner.

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Hague rules (1921): adopted by the International Law Association at the Hague Conference in 1921, international code for conditions for the carriage of cargo under a bill of lading.

Harbour dues: various local charges against all seagoing vessels entering a harbour, to cover maintenance of channel depths, buoys, lights; not all harbours assess this charge.

Hard aground: a vessel that has gone aground and is incapable of refloating under her own power. Also referred to as Hard and Fast.

Harmonic content: The number of frequencies in the output waveform in addition to the primary frequency (50 or 60 Hz.). Energy in these harmonic frequencies is lost and may cause excessive heating of the load.

Harmonic(s): A sinusoidal quantity having a frequency that is an integral multiple of the frequency of a periodic quantity to which it is related.

Head: A unit of pressure for a fluid, commonly used in water pumping and hydro power to express height a pump must lift water, or the distance water falls. Total head accounts for friction head losses, etc.

Heads of agreement (HOA): a preliminary agreement covering the outline terms for the sale and purchase of LNG or natural gas. See *Sales and purchase agreement (SPA)*.

Headstation: mainline receipt point on a pipeline.

Heat: A form of thermal energy resulting from combustion, chemical reaction, friction, or movement of electricity. As a thermodynamic

condition, heat, at a constant pressure, is equal to internal or intrinsic energy plus pressure times volume.

Heat Absorbing Window Glass: A type of window glass that contains special tints that cause the window to absorb as much as 45% of incoming solar energy, to reduce heat gain in an interior space. Part of the absorbed heat will continue to be passed through the window by conduction and re-radiation.

Heat Balance: Energy output from a system that equals energy input.

Heat Content: The amount of heat in a quantity of matter at a specific temperature and pressure.

Heat Engine: A device that produces mechanical energy directly from two heat reservoirs of different temperatures. A machine that converts thermal energy to mechanical energy, such as a steam engine or turbine.

Heat Exchanger: A device used to transfer heat from a fluid (liquid or gas) to another fluid where the two fluids are physically separated.

Heat Gain: The amount of heat introduced to a space from all heat producing sources, such as building occupants, lights, appliances, and from the environment, mainly solar energy.

Heat Loss: The heat that flows from the building interior, through the building envelope to the outside environment.

Heat Pipe: device that transfers heat by the continuous evaporation and condensation of an internal fluid.

Heat Pump Water Heaters: A water heater that uses electricity to move heat from one place to another instead of generating heat directly.

Heat Pump: An electricity powered device that extracts available heat from one area (the heat source) and transfers it to another (the heat sink) to either heat or cool an interior space or to extract heat energy from a fluid.

Heat rate: the measure of efficiency in converting input fuel to electricity. Heat rate is expressed as the number of Btu of fuel (for example, natural gas) per kilowatt hour (Btu/kWh). Heat rate for power plants depends on the individual plant design, its operating conditions and its level of electricity output. The lower the heat rate, the more efficient the plant. ***OR,*** the ratio of fuel energy input as heat per unit of network output; a measure of a power plant thermal efficiency, generally expressed as Btu per net kilowatt-hour.

Heat Recovery Ventilator: A device that captures the heat from the exhaust air from a building and transfers it to the supply/fresh air entering the building to preheat the air and increase overall heating efficiency.

Heat Register: The grilled opening into a room by which the amount of warm air from a furnace can be directed or controlled; may include a damper.

Heat Sink: A structure or media that absorbs heat.

Heat Source: A structure or media from which heat can be absorbed or extracted.

Heat Storage Capacity: The amount of heat that a material can absorb and store.

Heat Storage: A device or media that absorbs heat for storage for later use.

Heat Transfer Fluid: A gas or liquid used to move heat energy from one place to another; a refrigerant.

Heat Transfer: The flow of heat from one area to another by conduction, convection, and/or radiation. Heat flows naturally from a warmer to a cooler material or space.

Heat Transmission Coefficient: Any coefficient used to calculate heat transmission by conduction, convection, or radiation through materials or structures.

Heating Capacity (*also* **Specific Heat):** The quantity of heat necessary to raise the temperature of a specific mass of a substance by one degree.

Heating Degree Day(s) (HDD): The number of degrees per day that the daily average temperature (the mean of the maximum and minimum recorded temperatures) is below a base temperature, usually 65 degrees Fahrenheit, unless otherwise specified; used to determine indoor space heating requirements and heating system sizing. Total HDD is the cumulative total for the year/heating season. The higher the HDD for a location, the colder the daily average temperature(s).

Heating Fuel Units: Standardized weights or volumes for heating fuels.

Heating Fuels: Any gaseous, liquid, or solid fuel used for indoor space heating.

Heating Load: The rate of heat flow required to maintain a specific indoor temperature; usually measured in Btu per hour.

Heating Season: The coldest months of the year; months where average daily temperatures fall below 65 degrees Fahrenheit creating demand for indoor space heating.

Heating Seasonal Performance Factor (**HSPF**): The measure of seasonal or annual efficiency of a heat pump operating in the heating mode. It takes into account the variations in temperature that can occur within a season and is the average number of Btu of heat delivered for every watt-hour of electricity used by the heat pump over a heating season.

Heating Value: The amount of heat produced from the complete combustion of a unit of fuel. The higher (or gross) heating value is that when all products of combustion are cooled to the pre-combustion temperature, water vapor formed during combustion is condensed, and necessary corrections have been made. Lower (or net) heating value is obtained by subtracting from the gross heating value the latent heat of vaporization of the water vapor formed by the combustion of the hydrogen in the fuel. ***OR,*** There are two heating values: the gross (high) and the net (low) heating value. The gross value is that which is obtained when all of the products of combustion are cooled to standard conditions, and the latent heat of the water vapour formed is reclaimed. The net value is the gross value minus the latent heat of vapourisation of the water. *The average number of British thermal units per cubic foot of natural gas as determined from tests of fuel samples.*

Heating, Ventilation, And Air-Conditioning (**HVAC**) **System**: All the components of the appliance used to condition interior air of a building.

Heavy oil: Crude oil with an API gravity less than 20°. Heavy oil generally does not flow easily due to its elevated viscosity.

Hedge for accounting purposes: an accounting election, subject to certain criteria, allowing a breach of two fundamental principles of generally accepted accounting principles; either allowing gains and losses on derivatives at fair value to be deferred in equity; or allowing the measurement for financial assets and liabilities to be recorded at fair value through income.

Hedge for commercial purposes: taking a financial position by use of a derivative or non-derivative financial asset or liability whose fair value or cash flows are expected to be effective in reducing or eliminating changes in the fair value or cash flows of a risk or a range of risks.

Heliochemical Process: The utilization of solar energy through photosynthesis.

Heliodon: A device used to simulate the angle of the sun for assessing shading potentials of building structures or landscape features.

Heliostat: A device that tracks the movement of the sun; used to orient solar concentrating systems.

Heliothermal: Any process that uses solar radiation to produce useful heat.

Heliothermic: Site planning that accounts for natural solar heating and cooling processes and their relationship to building shape, orientation, and siting.

Heliothermometer: An instrument for measuring solar radiation.

Heliotropic: Any device (or plant) that follows the sun's apparent movement across the sky.

Hemispherical Bowl Technology: A solar energy concentrating technology that uses a linear receiver that tracks the focal area of a reflector or array of reflectors.

Henry Hub: pipeline interchange near Erath, Louisiana, US, where a number of interstate and intrastate pipelines interconnect through a header system. It is the standard delivery point for the Nymex natural gas futures contract in the US, the benchmark gas price in the US Gulf.

Hertz: A measure of the number of cycles or wavelengths of electrical energy per second; U.S. electricity supply has a standard frequency of 60 hertz.

Heterojunction: A region of electrical contact between two different materials.

High voltage disconnect hysteresis: The voltage difference between the high voltage disconnect set point and the voltage at which the full photovoltaic array current will be reapplied.

High voltage disconnect: The voltage at which a charge controller will disconnect the photovoltaic array from the batteries to prevent overcharging.

Higher Heating Value (**HHV**): The maximum heating value of a fuel sample,

which includes the calorific value of the fuel (bone dry) and the latent heat of vaporization of the water in the fuel. (See moisture content and net (lower) heating value, below.)

High-Intensity Discharge Lamp: A lamp that consists of a sealed arc tube inside a glass envelope, or outer jacket. The inner arc tube is filled with elements that emit light when ionized by electric current. A ballast is required to provide the proper starting voltage and to regulate current during operation.

High-Pressure Sodium Lamp: A type of High-Intensity Discharge (HID) lamp that uses sodium under high pressure as the primary light-producing element. These high efficiency lights produce a golden white color and are used for interior industrial applications, such as in warehouses and manufacturing, and for security, street, and area lighting.

Hole: The vacancy where an electron would normally exist in a solid; behaves like a positively charged particle.

Home Energy Rating Systems (**HERS**): A nationally recognized energy rating program that gives builders, mortgage lenders, secondary lending markets, homeowners, sellers, and buyers a precise evaluation of energy losing deficiencies in homes. Builders can use this system to gauge the energy quality in their home and also to have a star rating on their home to compare to other similarly built homes.

Homojunction: The region between an n-layer and a p-layer in a single material, photovoltaic cell.

Horizontal drilling: An advanced form of directional drilling in which the lateral hole is drilled horizontally. In this drilling technique, a well is progressively turned from vertical to horizontal so as to allow for greater exposure to an oil or natural gas reservoir. Horizontal laterals can be more than a mile long. In general, longer exposure lengths allow for more oil and natural gas to be recovered from a well and often can reduce the number of wells required to develop a field, thereby minimizing surface disturbance. Horizontal drilling technology has been extensively used since the 1980s and is appropriate for many, but not all, developments.

Horizontal Ground Loop: In this type of closed-loop geothermal heat pump installation, the fluid-filled plastic heat exchanger pipes are laid out in a plane parallel to the ground surface. The most common layouts either use two pipes, one buried at six feet, and the other at four feet, or two pipes placed side-by-side at five feet in the ground in a two-foot wide trench. The trenches must be at least four feet deep. Horizontal ground loops are generally most cost-effective for residential installations, particularly for new construction where sufficient land is available. *Also see* **closed-loop geothermal heat pump systems**.

Horizontal-Axis Wind Turbines: Turbines in which the axis of the rotor's rotation is parallel to the wind stream and the ground.

Horsepower (**HP**): A unit of rate of operation. Electrical hp: a measure of time rate of mechanical energy output; usually applied to electric motors as the maximum output; 1 electrical hp is equal to 0.746 kilowatts or 2,545 Btu per hour. Shaft hp: a measure of the actual mechanical energy per unit time delivered to a turning shaft; 1 shaft Hp is equal to 1 electrical Hp or 550 foot pounds per second. Boiler Hp: a measure to the maximum rate to heat output of a steam generator; 1 boiler Hp is equal to 33,480 Btu per hour steam output.

Horsepower Hour (**HPH**): One horsepower provided over one hour; equal to 0.745 kilowatt-hour or 2,545 Btu.

Hot Air Furnace: A heating unit where heat is distributed by means of convection or fans.

Hot Dry Rock: A geothermal energy resource that consists of high temperature rocks above 300 F (150 C) that may be fractured and have little or no water. To extract the heat, the rock must first be fractured, then water is injected into the rock and pumped out to extract the heat. In the western United States, as much as 95,000 square miles (246,050 square km) have hot dry rock potential.

Hot Water Heating Systems: (See Hydronic)

House Water and Power Committee: This committee has oversight over the generation and marketing of electric power from federal water projects by federally charted or Federal RPM authorities, measures and matters concerning water resources planning, compacts relating to use and apportionment of interstate waters, water rights or power movement programs, measures and matters pertaining to irrigation and reclamation projects and other water resources development

programs.

Hub Height: The height above the ground that a horizontal axis wind turbine's hub is located.

Hub: a contractual point where buyers and sellers execute transactions for gas. Hubs can be notional or physical, trans-regional (one or more transmission system operators (TSOs)) or within-country (one TSO). Hubs generally consist of a Hub Services Agreement (operator) and Standard Trading Contract (trader). Examples of notional hubs are the National Balancing Point (NBP) in the UK and the Title Transfer Facility (TTF) in the Netherlands. Physical hubs include the Henry Hub in the US and the Zeebrugge Terminal (ZBT) in Belgium. See *Market centre*.

Humidifier: A device used to maintain a specified humidity in a conditioned space.

Humidity: A measure of the moisture content of air; may be expressed as absolute, mixing ratio, saturation deficit, relative, or specific.

Hybrid System: A solar electric or photovoltaic system that includes other sources of electricity generation, such as wind or diesel generators. ***OR,*** A renewable energy system that includes two different types of technologies that produce the same type of energy; for e.g., a wind turbine and a solar photovoltaic array combined to meet a power demand.

Hydraulic fracturing fluids: Mixture of water and proppant along with minor amounts of chemical additives used to hydraulically fracture low permeability formations. Water and sand typically comprise up to 99.5 percent of the mixture.

Hydraulic fracturing: Hydraulic fracturing (also referred to as frac'ing or fracking) is an essential completion technique in use since the 1940s that facilitates production of oil and natural gas trapped in low-permeability reservoir rocks. The process involves pumping fluid at high pressure into the target formation, thereby creating small fractures in the rock that enable hydrocarbons to flow to the wellbore. View our hydraulic fracturing overview fact sheet for more details: www.powerincooperation.com/EN/Documents/COP_Hyd%20Fracturing%20Fluids.pdf.

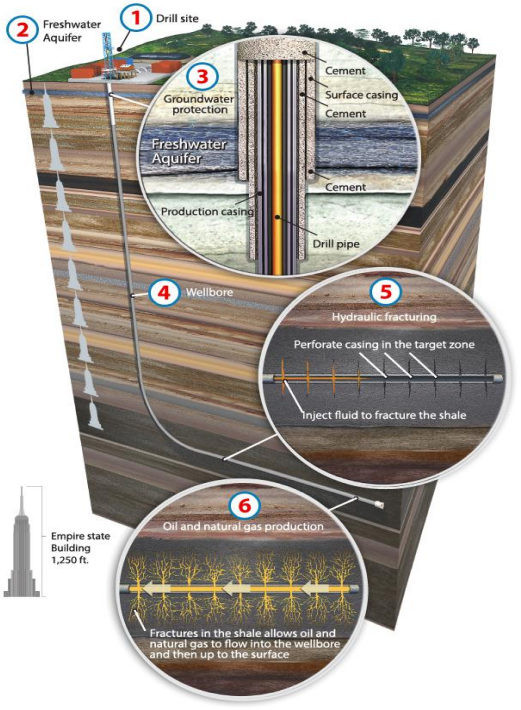

Figure: Illustration based on a typical Eagle Ford shale well in Texas

Hydrocarbons: An organic compound containing only carbon and hydrogen in gaseous, liquid, or solid phase and often occurring in nature as petroleum, natural gas, coal and bitumens or in refined products such as gasoline and jet fuel.

Hydroelectric Power Plant: A power plant that produces electricity by the force of water falling through a hydro turbine that spins a generator.

Hydrogen: A chemical element that can be used as a fuel since it has a very high energy content.

Hydrogenated Amorphous Silicon: Amorphous silicon with a small amount of incorporated hydrogen. The hydrogen neutralizes dangling bonds in the amorphous silicon, allowing charge carriers to flow more

freely.

Hydronic Heating Systems: A type of heating system where water is heated in a boiler and either moves by natural convection or is pumped to heat exchangers or radiators in rooms; radiant floor systems have a grid of tubing laid out in the floor for distributing heat. The temperature in each room is controlled by regulating the flow of hot water through the radiators or tubing.

Hydrothermal Fluids: These fluids can be either water or steam trapped in fractured or porous rocks; they are found from several hundred feet to several miles below the Earth's surface. The temperatures vary from about 90 F to 680 F (32 C to 360 C) but roughly 2/3 range in temperature from 150 F to 250 F (65.5 C to 121.1 C). The latter are the easiest to access and, therefore, the only forms being used commercially.

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ICE (Intercontinental Exchange): formerly the International Petroleum Exchange, an electronic marketplace for energy trading and price discovery. ICE provides market participants with direct access to energy futures and thousands of over-the-counter commodity products for oil and refined products, natural gas, power and emissions.

Ideal specific gravity: the ratio of the molecular weight of a gas to the molecular weight of air. Molecular weight of air = 28.9644.

Ignite: To heat a gaseous mixture to the temperature at which combustion takes place.

Ignition Point: The minimum temperature at which combustion of a solid or fluid can occur.

Illuminance: A measure of the amount of light incident on a surface; measured in foot-candles or Lux.

Illumination: The distribution of light on a horizontal surface. The purpose of all lighting is to produce illumination.

Imbalance penalties: penalties implemented by a pipeline to provide an incentive for shippers to maintain actual receipts and deliveries at nominated and confirmed levels.

Imbalance trading: process by which shippers can acquire gas from, or sell to, other customers to minimise or avoid cash-out.

Imports: Natural gas received in the Continental United States (including Alaska) from a foreign country.

Impoundment: A body of water confined by a dam, dike, floodgate or other artificial barrier.

Improved (enhanced) recovery: the operation whereby natural gas is recovered using any method other than those that rely primarily on the use of natural reservoir pressure, gas lift, or a pump.

Improved oil recovery (IOR): Term used to describe methods employed to improve the flow of hydrocarbons from the reservoir to the wellbore or to recover more oil or natural gas. *Enhanced oil recovery* **(**EOR) would be one form of IOR.

Impulse Turbine: A turbine that is driven by high velocity jets of water or steam from a nozzle directed to vanes or buckets attached to a wheel. (A pelton wheel is an impulse hydro turbine).

Incandescent: These lights use an electrically heated filament to produce light in a vacuum or inert gas-filled bulb.

Incident light: Light that shines onto the face of a solar cell or module.

Incident Solar Radiation: The amount of solar radiation striking a surface per unit of time and area.

Independent power producer (IPP): an unregulated power generator that has no franchised retail service territories. ***OR,*** A company or individual that is not directly regulated as a power provider. These entities produce power for their own use and/or sell it to regulated power providers.

Independent system operator (ISO): The entity responsible for maintaining system balance, reliability, and electricity market operation.

Indexing: tying the commodity price of natural gas in a contract to published prices of other commodities or price indices.

Indirect Solar Gain System: A passive solar heating system in which the sun warms a heat storage element, and the heat is distributed to the interior space by convection, conduction, and radiation.

Indirect Solar Water Heater: These systems circulate fluids other than water (such as diluted antifreeze) through the collector. The collected

heat is transferred to the household water supply using a heat exchanger. Also known as "closed-loop" systems.

Indium oxide: A wide band gap semiconductor that can be heavily doped with tin to make a highly conductive, transparent thin film. Often used as a front contact or one component of a heterojunction solar cell.

Induction Generator: A device that converts the mechanical energy of rotation into electricity based on electromagnetic induction. An electric voltage (electromotive force) is induced in a conducting loop (or coil) when there is a change in the number of magnetic field lines (or magnetic flux) passing through the loop. When the loop is closed by connecting the ends through an external load, the induced voltage will cause an electric current to flow through the loop and load. Thus rotational energy is converted into electrical energy.

Induction Motor: A motor in which a three phase (or any multiphase) alternating current (i.e. the working current) is supplied to iron-cored coils (or windings) within the stator. As a result, a rotating magnetic field is set up, which induces a magnetizing current in the rotor coils (or windings). Interaction of the magnetic field produced in this manner with the rotating field causes rotational motion to occur.

Induction: The production of an electric current in a conductor by the variation of a magnetic field in its vicinity.

Industrial Consumption: Natural gas used for heat, power, or chemical feedstock by manufacturing establishments or those engaged in mining or other mineral extraction as well as consumers in agriculture, forestry, and fisheries. Also included in industrial consumption are generators that produce electricity and/or useful thermal output primarily to support the above-mentioned industrial activities.

Industrial Process Heat: The thermal energy used in an industrial process.

Inert gas: a chemically inert gas, resistant to chemical reaction with other substances.

Inert Gas: A gas that does not react with other substances; e.g. argon or krypton; sealed between two sheets of glazing to decrease the U-value (increase the R-Value) of windows.

Infill wells: Wells drilled into the same reservoir as known producing wells so that oil or natural gas does not have to travel as far through the formation, thereby helping to improve or accelerate recovery.

Infrared radiation: Electromagnetic radiation whose wavelengths lie in the range from 0.75 micrometer to 1000 micrometers; invisible long wavelength radiation (heat) capable of producing a thermal or photovoltaic effect, though less effective than visible light.

Ingot: A casting of material, usually crystalline silicon, from which slices or wafers can be cut for use in a solar cell.

Injected gas: natural gas placed in underground storage or returned to the producing reservoir to maintain pressure.

Input voltage: This is determined by the total power required by the alternating current loads and the voltage of any direct current loads. Generally, the larger the load, the higher the inverter input voltage. This keeps the current at levels where switches and other components are readily available.

In-situ recovery: Techniques used to extract hydrocarbons from deposits of extra-heavy crude oil, bitumen or oil shale without removing the soil and other overburden materials.

Insolation: The solar power density incident on a surface of stated area and orientation, usually expressed as Watts per square meter or Btu per square foot per hour. See also diffuse insolation and direct insolation.

Installed Capacity: The total capacity of electrical generation devices in a power station or system.

Instantaneous Efficiency (of a Solar Collector): The amount of energy absorbed (or converted) by a solar collector (or photovoltaic cell or module) over a 15 minute period.

Insulation Blanket: A pre-cut layer of insulation applied around a water heater storage tank to reduce stand-by heat loss from the tank.

Insulation: Materials that prevent or slow down the movement of heat.

Insulator: A device or material with a high resistance to electricity flow.

Integral Collector Storage System: This simple passive solar hot water system consists of one or more storage tanks placed in an insulated box that has a glazed side facing the sun. An integral collector storage system is mounted on the ground or on the roof (make sure your roof structure is strong enough to support it). Some systems use "selective" surfaces on the tank(s). These surfaces absorb sun well but inhibit

radiative loss. Also known as bread box systems or batch heaters.

Integrated Heating Systems: A type of heating appliance that performs more than one function, for example space and water heating.

Integrated Resource Plan (**IRP**): A plan developed by an electric power provider, sometimes as required by a public regulatory commission or agency, that defines the short and long term capacity additions (supply side) and demand side management programs that it will undertake to meet projected energy demands.

Interconnect: A conductor within a module or other means of connection that provides an electrical interconnection between the solar cells.

Interconnection: A connection or link between power systems that enables them to draw on each other's reserve capacity in time of need.

Interconnector (the European): a 238 km pipeline providing a strategic link between the UK and continental Europe, connecting the two gas transmission systems at Bacton, in the UK, and Zeebrugge, in Belgium.

Intermittent Generators: Power plants, whose output depends on a factor(s) that cannot be controlled by the power generator because they utilize intermittent resources such as solar energy or the wind.

Internal Combustion Electric Power Plant: The generation of electric power by a heat engine which converts part of the heat generated by combustion of the fuel into mechanical motion to operate an electric generator.

Internal Gain: The heat produced by sources of heat in a building (occupants, appliances, lighting, etc).

Internal Mass: Materials with high thermal energy storage capacity contained in or part of a building's walls, floors, or freestanding elements.

Internal quantum efficiency (internal QE or IQE): A type of quantum efficiency. Refers to the efficiency with which light not transmitted through or reflected away from the cell can generate charge carriers that can generate current.

Internal Rate of Return: A widely used rate of return for performing economic analysis. This method solves for the interest rate that equates the equivalent worth of an alternative's cash receipts or savings to the equivalent worth of cash expenditures, including investments. The resultant interest rate is termed the internal rate of return (IRR).

International load line certificate: a certificate that gives details of the minimum freeboard granted to a particular ship and the position of the appropriate load lines to be marked on her sides. This certificate is issued by a government or duly appointed person or organisation such as a classification society.

Interruptible demand: the amount of customer demand that, in accordance with contractual arrangements, can be interrupted by direct control of the system operator, remote tripping, or by action of the customer at the direct request of the system operator.

Interruptible gas: gas sold to customers with a provision that permits curtailment or cessation of service at the discretion of the supplier; the opposite is firm gas.

Interruptible Load: Energy loads that can be shut off or disconnected at the supplier's discretion or as determined by a contractual agreement between the supplier and the customer.

Interruptible service: gas service that is subject to interruption at the option of the pipeline or local distribution company (LDC).

Interstate market: the market for natural gas that is consumed outside the state in which it is produced or is transported by an interstate pipeline.

Interstate Natural Gas Association of America (INGAA): trade organisation that advocates regulatory, and legislative and individual positions of importance to the interstate natural gas pipeline industry in the US.

Interstate pipeline: a natural gas pipeline company in the US that is engaged in the transportation of natural gas across state boundaries and is, therefore, subject to FERC jurisdiction.

Intransit Deliveries: Redeliveries to a foreign country of foreign gas received for transportation across U.S. Territory and deliveries of U.S. gas to a foreign country for transportation across its territory and redelivery to the United States.

Intransit Receipts: Receipts of foreign gas for transportation across U.S. territory and redelivery to a foreign country and redeliveries to the United States of U.S. gas transported across foreign territory.

Intrastate market: the market for natural gas consumed in the same state as it is produced.

Intrastate pipeline: a natural gas pipeline company that is engaged in the transportation of natural gas within the state in which the gas is produced. Subject to regulatory oversight of the applicable state.

Intrinsic layer: A layer of semiconductor material, used in a photovoltaic device, whose properties are essentially those of the pure, undoped, material.

Intrinsic semiconductor: An undoped semiconductor.

Inverted metamorphic multijunction (IMM) cell: A photovoltaic cell that is a multijunction device whose layers of semiconductors are grown upside down. This special manufacturing process yields an ultra-light and flexible cell that also converts solar energy with high efficiency.

Inverter: A device that converts direct current electricity (from for example a solar photovoltaic module or array) to alternating current for use directly to operate appliances or to supply power to a electricity grid.

Investment Tax Credit: A tax credit granted for specific types of investments.

Investor Owned Utility (**IOU**): A power provider owned by stockholders or other investors; sometimes referred to as a private power provider, in contrast to a public power provider that is owned by a government agency or cooperative.

Ion: An electrically charged atom or group of atoms that has lost or gained electrons; a loss makes the resulting particle positively charged; a gain makes the particle negatively charged.

Ionizer: A device that removes airborne particles from breathable air. Negative ions are produced and give up their negative charge to the particles. These new negative particles are then attracted to the positive particles surrounding them. This accumulation process continues until the particles become heavy enough to fall to the ground.

Irradiance: The direct, diffuse, and reflected solar radiation that strikes a surface. Usually expressed in kilowatts per square meter. Irradiance multiplied by time equals insolation.

Isolated Solar Gain System: A type of passive solar heating system where heat is collected in one area for use in another.

ISPRA guidelines: Guidelines for the assessment of photovoltaic power plants, published by the Joint Research Centre of the Commission of the European Communities, ISPRA, Italy.

I-Type Semiconductor: A semiconductor material that is left intrinsic, or undoped so that the concentration of charge carriers is characteristic of the material itself rather than of added impurities.

I-V curve: A graphical presentation of the current versus the voltage from a photovoltaic device as the load is increased from the short circuit (no load) condition to the open circuit (maximum voltage) condition. The shape of the curve characterizes cell performance.

j

Jacket: The enclosure on a water heater, furnace, or boiler.

Jack-up rig: An offshore rig with retractable steel legs that are placed on the ocean floor to raise the rig above the water line.

Japan Crude-Oil Cocktail (JCC): quoted by the Japanese finance ministry, it is designed to represent the average CIF price of all imported crude oil and raw oil in a specified trading period. It is usually quoted on a monthly basis.

Joint operating agreement (JOA): An agreement governing the rights and obligations of co-owners in a field or undeveloped acreage, which defines, amongst other things, how costs and revenues are to be shared among the parties and who is the operator.

Joist: A structural, load-carrying building member with an open web system that supports floors and roofs utilizing wood or specific steels and is designed as a simple span member.

JORC: The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves ('the JORC Code') is a professional code of practice that sets minimum standards for Public Reporting of minerals Exploration Results, Mineral Resources and Ore Reserves.

Joule: A metric unit of energy or work; the energy produced by a force of one Newton operating through a distance of one meter; 1 Joule per second equals 1 Watt or 0.737 foot-pounds; 1 Btu equals 1,055 Joules.

Joule's Law: The rate of heat production by a steady current in any part of

an electrical circuit that is proportional to the resistance and to the square of the current, or, the internal energy of an ideal gas depends only on its temperature.

Joule-Thomson (J-T) Effect: the change in temperature of a fluid that occurs when the fluid is allowed to expand in such a way that no external work is done and no heat transfer takes place. The case of most interest is cooling of a compressed gas upon J-T expansion. Note that the J-T effect is not limited to gases; also J-T expansion can, in some cases, produce an increase in temperature, rather than a decrease, although this is not frequently encountered.

Junction Box: A photovoltaic (PV) generator junction box is an enclosure on the module where PV strings are electrically connected and where protection devices can be located, if necessary.

Junction Diode: A semiconductor device with a junction and a built-in potential that passes current better in one direction than the other. All solar cells are junction diodes.

Junction: A region of transition between semiconductor layers, such as a p/n junction, which goes from a region that has a high concentration of acceptors (p-type) to one that has a high concentration of donors (n-type).

k

Kaplan Turbine: A type of turbine that has two blades whose pitch is adjustable. The turbine may have gates to control the angle of the fluid flow into the blades.

Kerf: The width of a cut used to create wafers from silicon ingots, often resulting in the loss of semiconductor material.

Kerosene: A type of heating fuel derived by refining crude oil that has a boiling range at atmospheric pressure from 400 degrees to 550 degrees F.

Kilovolt-Ampere (**kvA**): A unit of apparent power, equal to 1,000 volt-amperes; the mathematical product of the volts and amperes in an electrical circuit.

Kilowatt (kW): A standard unit of electrical power equal to 1000 watts, or to the energy consumption at a rate of 1000 joules per second.

Kilowatt year (kW-y): a unit of electrical capacity equivalent to 1 kilowatt of power used for 8,760 hours.

Kilowatt-hour (kWh): the basic unit for pricing electricity, equal to 1 kW of power supplied continuously for one hour (or the amount of electricity needed to light 10 100-watt light bulbs for one hour). ***OR,*** 1,000 thousand watts acting over a period of 1 hour. The kWh is a unit of energy. 1 kWh=3600 kJ. equivalent to 3,412 Btu.

Kinetic Energy: Energy available as a result of motion that varies directly in proportion to an object's mass and the square of its velocity.

Kneewall: A wall usually about 3 to 4 feet high located that is placed in the attic of a home, anchored with plates between the attic floor joists and the roof joist. Sheathing can be attached to these walls to enclose an attic space.

Knot: unit of speed in navigation, which is the rate of one nautical mile (6,080 feet or 1,852 meters) per hour.

l

Lagoon: In wastewater treatment or livestock facilities, a shallow pond used to store wastewater where sunlight and biological activity decompose the waste.

Laid-up tonnage: ships not in active service; a ship that is out of commission for fitting out, awaiting better markets, needing work for classification. See *Layup*

Lamp: A light source composed of a metal base, a glass tube filled with an inert gas or a vapor, and base pins to attach to a fixture.

Landman - The individual in an oil and gas company or agent who negotiates oil and gas leases with mineral owners, cures title defects and negotiates with other companies on agreements concerning the lease.

Landscaping: Features and vegetation on the outside of or surrounding a building for aesthetics and energy conservation.

Langley (L): Unit of solar irradiance. One gram calorie per square centimeter. 1 L = 85.93 kwh/m^2. ***OR,*** A unit or measure of solar radiation; 1 calorie per square centimeter or 3.69 Btu per square foot.

Latent Cooling Load: The load created by moisture in the air, including

from outside air infiltration and that from indoor sources such as occupants, plants, cooking, showering, etc.

Latent Heat of Vaporization: The quantity of heat produced to change a unit weight of a liquid to vapor with no change in temperature.

Latent Heat: The change in heat content that occurs with a change in phase and without change in temperature.

Lattice: The regular periodic arrangement of atoms or molecules in a crystal of semiconductor material.

Law(S) of Thermodynamics: The first law states that energy can not be created or destroyed; the second law states that when a free exchange of heat occurs between two materials, the heat always moves from the warmer to the cooler material.

Laytime: time allowed by the ship-owner to the voyage charterer or bill of lading holder in which to load and/or discharge the cargo. It is expressed as a number of days or hours.

Layup: to dismantle or unrig a ship for a prolonged period of unemployment.

LDC -Local Distribution Company

Lead-acid battery: An electrochemical battery that uses lead and lead oxide for electrodes and sulfuric acid for the electrolyte. ***OR,*** A general category that includes batteries with plates made of pure lead, lead-antimony, or lead-calcium immersed in an acid electrolyte.

Leading Edge: In reference to a wind energy conversion system, the area of a turbine blade surface that first comes into contact with the wind.

Leaking Electricity: Related to stand-by power, leaking electricity is the power needed for electrical equipment to remain ready for use while in a dormant mode or operation. Electricity is still used by many electrical devices, such as TVs, stereos, and computers, even when you think they are turned "off."

Lease Fuel: Natural gas used in well, field, and lease operations, such as gas used in drilling operations, heaters, dehydrators, and field compressors.

Lease: A contract between an owner (**lessor**) and a tenant (**lessee**), setting forth the compensation, terms, and conditions upon which the lessee may occupy or use property, real or personal, of the lessor. ***OR,*** A legal document executed between a mineral owner and a company or individual that conveys the right to explore for and develop hydrocarbons and/or other products for a specified period of time over a given area.

Lethe: A measure of air purity that is equal to one complete air change (in an interior space).

Levelized cost of energy (LCOE): The cost of energy of a solar system that is based on the system's installed price, its total lifetime cost, and its lifetime electricity production.

Levelized Life Cycle Cost: A total life cycle cost divided into equal amounts.

Life Cycle Analysis (LCA): LCA is an analytical methodology used to comprehensively quantify and interpret the environmental flows to and from the environment (including air emissions, water effluents, solid waste and the consumption/ depletion of energy and other resources) over the life cycle of a product or process. LCAs should be performed in adherence to the International Organization for Standardization (ISO) 14040 series of standards.

Life Cycle Cost: The sum of all the costs both recurring and nonrecurring, related to a product, structure, system, or service during its life span or specified time period. ***OR,*** The estimated cost of owning and operating a photovoltaic system for the period of its useful life.

Life: The period during which a system is capable of operating above a specified performance level.

Lift: The force that pulls a wind turbine blade, as opposed to drag.

Light Quality: A description of how well people in a lighted space can see to do visual tasks and how visually comfortable they feel in that space.

Light Trapping: The trapping of light inside a semiconductor material by refracting and reflecting the light at critical angles; trapped light will travel further in the material, greatly increasing the probability of absorption and hence of producing charge carriers.

Light-induced defects: Defects, such as dangling bonds, induced in an amorphous silicon semiconductor upon initial exposure to light.

Line Loss (or Drop): Electrical energy lost due to inherent inefficiencies in an electrical transmission and distribution system under specific conditions.

Line pack: creation of storage within the pipeline by increasing pressure above that which is required for transmission, but still within a safe

limit.

Line-commutated inverter: An inverter that is tied to a power grid or line. The commutation of power (conversion from direct current to alternating current) is controlled by the power line, so that, if there is a failure in the power grid, the photovoltaic system cannot feed power into the line.

Liquefaction of Gases: Any process in which gas is converted from the gaseous to the liquid phase.

Liquefaction plant: facility which converts natural gas at ambient temperature and pressure to liquefied natural gas.

Liquefied Natural Gas (LNG): Natural gas (primarily methane) that has been liquefied by reducing its temperature to –260 degrees Fahrenheit at atmospheric pressure. It remains a liquid at -116 degrees Fahrenheit and 673 psig. ***OR***, An odourless, colourless, non-corrosive and non-toxic product of natural gas consisting primarily of methane (CH4) that is in liquid form at near atmospheric pressure and has been cooled into a liquid state so that it takes up only 1/600 of the volume of natural gas, enabling it to be shipped economically to distant markets.

Liquefied petroleum gas (LPG): gaseous hydrocarbons at normal temperatures and pressures, but that readily turn into liquids under moderate pressure at normal temperatures; for example, Propane, butane or propane-butane mixtures derived from crude oil refining or natural gas fractionation. For convenience of transportation, these gases are liquefied through pressurization.

Liquid electrolyte battery: A battery containing a liquid solution of acid and water. Distilled water may be added to these batteries to replenish the electrolyte as necessary. Also called a flooded battery because the plates are covered with the electrolyte.

Liquid-based Solar Heating System: A solar heating system that uses a liquid as the heat transfer fluid.

Liquid-to-Air Heat Exchanger: A heat exchanger that transfers the heat contained in a liquid heat transfer fluid to air.

Liquid-To-Liquid Heat Exchanger: A heat exchanger that transfers heat contained in a liquid heat transfer fluid to another liquid.

Lithium-Sulfur Battery: A battery that uses lithium in the negative electrode and a metal sulfide in the positive electrode, and the electrolyte is molten salt; can store large amounts of energy per unit weight.

Live Steam: Steam available directly from a boiler under full pressure.

LNG cargo-containment systems: the method of storing LNG during marine transport. One of four methods is normally employed: Self-Supporting Prismatic Type 'B' (Conch/IHI), Dual Membrane (Gaz Transport), Single Membrane (Technigaz), and Self-Supporting Spherical Type 'B' (Kværner Moss).

LNG feedgas requirements to LNG plant: The amount of gas reserves required to economically support the development of an LNG liquefaction plant, allowing for gas lost in the process of production, liquefaction and transport of the LNG to end-markets (typically 10-15%).

LNG markets: there are two primary LNG markets: 1) the Atlantic basin includes Belgium, France, Italy, Spain, Portugal, Greece, Turkey and the east coast of the US; 2) the Pacific basin includes India, Japan (world's largest), South Korea, Taiwan, China and the west coast of the US.

LNG project characteristics: primary LNG project components are: 1) upstream development of long-term, natural gas supply for feedgas to an LNG plant; 2) downstream development of liquefaction, storage and loading facilities; 3) marine transportation; and 4) further downstream, development of receiving terminals for regasification and pipeline transportation to market. Defining economic characteristics of LNG projects include i. commercial activities organised around project components in which the buyer and seller are closely linked for 20-25 years; ii. significant front-end infrastructure investment for each tonne of LNG delivery capacity – the critical mass of infrastructure for an LNG project must be very large in order to achieve production quantities adequate for realisation of economies of scale and to secure project financing; and iii. long-term contracts based on large, proved gas reserves.

LNG refrigerant (for liquefaction) cycles: natural gas liquefaction requires removal of sensible and latent heat over a wide temperature range using a refrigerant. The refrigerant may be part of the natural

gas feed (an open-cycle process), or a separate fluid continuously re-circulated through the liquefier (a closed-cycle process). Three general types of refrigeration cycle are used:

- *Cascade refrigerant cycle*: feedstock natural gas is cooled, condensed and sub-cooled in heat exchange with propane, ethylene (or ethane) and finally methane in three discrete stages. The three refrigerant circuits generally have multistage refrigerant expansion and compression, each typically operating at three evaporation-temperature levels. After compression, propane is condensed with cooling water or air, ethylene is condensed with evaporating propane and methane is condensed with evaporating ethylene.
- *Expander cycle*: in its simplest form, process refrigeration in an expander cycle is provided by compression and expansion of a single-component gas stream. High-pressure cycle gas is cooled in counter-current heat exchange with returning cold-cycle gas. The cycle gas is expanded through an expansion turbine, reducing its temperature to a lower temperature than would be given by expansion through a Joule-Thomson valve.
- *Mixed-refrigerant cycle (MRC)*: uses a mixed refrigerant(s) instead of the multiple pure refrigerants in the cascade cycle. The mixture composition is specified so the liquid refrigerant evaporates over a temperature range similar to that of the natural gas being liquefied. A mixture of nitrogen and hydrocarbons (usually in the C1 to C5 range) is normally used to provide optimal refrigeration characteristics. MRC provides greater thermodynamic efficiency, lower power requirement and use of smaller machinery.

LNG storage tanks: vessels that are specially constructed to contain LNG. The tanks are generally constructed of nickel steel (steel containing 9% nickel) to withstand cryogenic temperatures and are insulated to maintain the LNG at –161°C. Some of the stored LNG boils off and the resulting vapour is used as fuel gas for the plant. There are three main designs of LNG storage tanks: single containment, double containment and full containment. The difference in these systems lies in the functionality of the secondary containment, when the primary containment is breached. For single containment, neither liquid nor vapour will be held by the secondary containment; for double containment, liquid will be contained and for full containment, liquid and vapour will be contained.

LNG value chain: in planning, funding and executing an LNG project, each element of the complex chain that links the natural gas in the ground to the ultimate consumer (from the wellhead to the burner tip) is considered. The main links are natural gas production, liquefaction, shipping, receiving terminal (including regasification), distribution of the regasified LNG and, lastly, consumption of the gas.

Load Analysis: Assessing and quantifying the discrete components that comprise a load. This analysis often includes time of day or season as a variable.

Load balancing: process of matching customers' demand for natural gas with producers' ability to supply.

Load circuit: The wire, switches, fuses, etc. that connect the load to the power source.

Load current (A): The current required by the electrical device.

Load Duration Curve: A curve that displays load values on the horizontal axis in descending order of magnitude against the percent of time (on the vertical axis) that the load values are exceeded.

Load Factor: The ratio of average energy demand (load) to maximum demand (peak load) during a specific period.

Load forecast: Predictions of future demand. For normal operations, daily and weekly forecasts of the hour-by-hour demand are used to help develop generation schedules to ensure that sufficient quantities and types of generation are available when needed. ***OR,*** An estimate of power demand at some future period.

Load Leveling: The deferment of certain loads to limit electrical power demand, or the production of energy during off-peak periods for storage and use during peak demand periods.

Load Management: To influence the demand on a power source.

Load Profile Or Shape: A curve on a chart showing power (kW) supplied (on the horizontal axis) plotted against time of occurrence (on the vertical axis) to illustrate the variance in a load in a specified time period.

Load resistance: The resistance presented by the load. See also resistance.

Load Shedding: Turning off or disconnecting loads to limit peak demand.

Load Shifting: A load management objective that moves loads from on-peak periods to off-peak periods.

Load: The demand on an energy producing system; the energy consumption or requirement of a piece or group of equipment. Usually expressed in terms of amperes or watts in reference to electricity. ***OR,*** The power required to run a defined circuit or system, such as a refrigerator, building, or an entire electricity distribution system.

Loaded leg: that portion (or subdivision) of a ship's voyage during which the ship is carrying cargo.

Loading days: the number of days allowed to load a cargo defined in the charter party.

Local Distribution Company (LDC): A legal entity engaged primarily in the retail sale and/or delivery of natural gas through a distribution system that includes mainlines (that is, pipelines designed to carry large volumes of gas, usually located under roads or other major right-of-ways) and laterals (that is, pipelines of smaller diameter that connect the end user to the mainline). Since the restructuring of the gas industry, the sale of gas and/or delivery arrangements may be handled by other agents, such as producers, brokers, and marketers that are referred to as "non-LDC." ***OR,*** a utility that takes natural gas from a local delivery point (generally called the city gate) and distributes it to local customers. A business entity that obtains its primary revenues from the operations of a local retail gas distribution.

LOCAL SOLAR TIME: A system of astronomical time in which the sun crosses the true north-south meridian at 12 noon, and which differs from local time according to longitude, time zone, and equation of time.

Locational marginal price (LMP): The price of a unit of energy at a particular electrical location at a given time. LMPs are influenced by the nearby generation, load level, and transmission constraints and losses.

Log Law: In reference to a wind energy conversion system, the wind speed profile in which wind speeds increase with the logarithmic of the height of the wind turbine above the ground.

Long ton (L/T): 2,240 pounds or 1,016.05 kilograms. See *Tonne, metric and Ton, long.* ***OR,*** A unit that equals 20 long hundredweight or 2,240 pounds. Used mainly in England.

Long-term gas contract: a supply contract in the physical market covering natural gas deliveries.

Long-Wave Radiation: Infrared or radiant heat.

Looping: laying additional pipeline beside and connected to an existing pipeline in order to increase the capacity of the system.

Loose Fill Insulation: Insulation made from rockwool fibers, fiberglass, cellulose fiber, vermiculite or perlite minerals, and composed of loose fibers or granules can be applied by pouring directly from the bag or with a blower.

Loss Of Load Probability (Lolp): A measure of the probability that a system demand will exceed capacity during a given period; often expressed as the estimated number of days over a long period, frequently 10 years or the life of the system.

Losses (Energy): A general term applied to the energy that is converted to a form that cannot be effectively used (lost) during the operation of an energy producing, conducting, or consuming system.

Lost and unaccounted-for gas: the difference between the quantity of natural gas received into a system and the quantity of natural gas delivered out of a system over a specific period of time.

Low Btu Gas: A fuel gas with a heating value between 90 and 200 Btu per cubic foot.

Low Flush Toilet: A toilet that uses less water than a standard one during flushing, for the purpose of conserving water resources.

Low voltage cutoff (LVC): The voltage level at which a charge controller will disconnect the load from the battery.

Low voltage disconnect hysteresis: The voltage difference between the low voltage disconnect set point and the voltage at which the load will be reconnected.

Low voltage disconnect: The voltage at which a charge controller will disconnect the load from the batteries to prevent over-discharging.

Low voltage warning: A warning buzzer or light that indicates the low battery voltage set point has been reached.

Low-E Coatings & (Window) Films: A coating applied to the surface of the glazing of a window to reduce heat transfer through the window.

Low-Emissivity Windows & (Window) Films: Energy-efficient windows

that have a coating or film applied to the surface of the glass to reduce heat transfer through the window.

Lower (Net) Heating Value: The lower or net heat of combustion for a fuel that assumes that all products of combustion are in a gaseous state. (See Net Heating Value below.)

Low-Flow Solar Water Heating Systems: he flow rate in these systems is 1/8 to 1/5 the rate of most solar water heating systems. The low-flow systems take advantage of stratification in the storage tank and theoretically allows for the use of smaller diameter piping to and from the collector and a smaller pump.

Low-Pressure Sodium Lamp: A type of lamp that produces light from sodium gas contained in a bulb operating at a partial pressure of 0.13 to 1.3 Pascal. The yellow light and large size make them applicable to lighting streets and parking lots.

Lumen: An empirical measure of the quantity of light. It is based upon the spectral sensitivity of the photosensors in the human eye under high (daytime) light levels. Photometrically it is the luminous flux emitted with a solid angle (1 steradian) by a point source having a uniform luminous intensity of 1 candela. As reference, a 100-watt incandescent lamp emits about 1600 lumens.

Lumens/Watt (LPW): A measure of the efficacy (efficiency) of lamps. It indicates the amount of light (lumens) emitted by the lamp for each unit of electrical power (Watts) used.

Luminaire: A complete lighting unit consisting of a lamp(s), housing, and connection to the power circuit.

Luminance: The physical measure of the subjective sensation of brightness; measured in lumens.

Lux: The unit of illuminance equivalent to 1lumen per square meter.

m

Magma: Molten or partially molten rock at temperatures ranging from 1,260 F to 2,880 F (700 C to 1600 C). Some magma bodies are believed to exist at drillable depths within the Earth's crust, although practical technologies for harnessing magma energy have not been developed. If ever utilized, magma represents a potentially enormous resource.

Magnetic Ballast: A type of florescent light ballast that uses a magnetic core to regulate the voltage of a florescent lamp.

Main: A distribution line that serves as a common source of supply for more than one service line.

Maintenance-free battery: A sealed battery to which water cannot be added to maintain electrolyte level.

Major interstate pipeline: in the US, a pipeline company whose combined sales for resale and gas system throughput, transported interstate or stored for a fee, exceeded 50 bcf in the previous year.

Majority carrier: Current carriers (either free electrons or holes) that are in excess in a specific layer of a semiconductor material (electrons in the n-layer, holes in the p-layer) of a cell.

Make-Up Air: Air brought into a building from outside to replace exhaust air.

Manifest: document containing a full statement of the ship's cargo, extracted from the bill of lading.

Manning scales: the minimum number of officers and crew members that can be engaged on a ship to be considered as sufficient hands with practical ability to meet every possible eventuality at sea.

Manual J: The standard method for calculating residential cooling loads developed by the Air-Conditioning and Refrigeration Institute (ARI) and the Air Conditioning Contractors of America (ACCA) based largely on the American Society of Heating, Refrigeration, and Air-Conditioning Engineer's (ASHRAE) "Handbook of Fundamentals."

Manufactured Gas: gas produced by certain processes from oil, coal or coke. ***OR,*** A gas obtained by destructive distillation of coal, or by the thermal decomposition of oil, or by the reaction of steam passing through a bed of heated coal or coke. Examples are coal gases, coke oven gases, producer gas, blast furnace gas, blue (water) gas, carbureted water gas. Btu content varies widely.

Marginal Cost: The cost of producing one additional unit of a product.

Marine Terminal: Point of import or export for tankers carrying liquefied natural gas (LNG).

Market centre: an interchange where multiple pipelines or electric transmission lines interconnect and form a hub. See *Hub.*

Market clearing price: the price at which supply equals demand.

Market-area storage: storage or hub facilities located near natural gas users (markets).

Market-based price: the price for natural gas as determined by the decisions of many buyers and sellers in a market.

Marketed Production: Gross withdrawals less gas used for repressuring quantities vented and flared, and nonhydrocarbon gases removed in treating or processing operations. Includes all quantities of gas used in field and processing plant operations.

Marketing affiliate: a marketer who is owned or controlled by a pipeline company. See *FERC Order 497*.

Masonry Stove: A type of heating appliance similar to a fireplace, but much more efficient and clean burning. They are made of masonry and have long channels through which combustion gases give up their heat to the heavy mass of the stove, which releases the heat slowly into a room. Often called Russian or Finnish fireplaces.

Masonry: Material such as brick, rock, or stone.

Mass Burn Facility: A type of municipal solid waste (MSW) incineration facility in which MSW is burned with only minor presorting to remove oversize, hazardous, or explosive materials. Mass burn facilities can be large, with capacities of 3000 tons (2.7 million kg) of MSW per day or more. They can be scaled down to handle the waste from smaller communities, and modular plants with capacities as low as 25 tons (22.7 thousand kg) per day have been built. Mass burn technologies represent over 75% of all the MSW-to-energy facilities constructed in the United States to date. The major components of a mass burn facility include refuse receiving and handling, combustion and steam generation, flue gas cleaning, power generation (optional), condenser cooling water, residue ash hauling and landfilling.

Master (Captain): highest officer aboard ship who oversees all ship operations; has general charge of the vessel, overall responsibility. Handles all ship's records and communications, and receives and implements instructions from home office; takes command of vessel in inclement weather and in crowded or narrow waters. See *Crew*

Maximum allowable operating pressure (MAOP): the maximum gas pressure at which a pipeline system or process facility is allowed to operate.

Maximum capacity of pipeline: the maximum amount of natural gas a segment of pipeline can contain at a given time.

Maximum daily quantity (MDQ): the maximum daily quantity of natural gas that can be nominated for delivery to a customer's premises.

Maximum demand: the greatest of all demands of the load that has occurred within a specified period of time.

Maximum power point (MPP): The point on the current-voltage (I-V) curve of a module under illumination, where the product of current and voltage is maximum. For a typical silicon cell, this is at about 0.45 volts.

Maximum power point tracker (MPPT): Means of a power conditioning unit that automatically operates the photovoltaic generator at its maximum power point under all conditions.

Maximum power tracking: Operating a photovoltaic array at the peak power point of the array's I-V curve where maximum power is obtained. Also called peak power tracking.

MBBL: One thousand barrels of crude oil, bitumen, condensate or natural gas liquids.

MBD: One thousand barrels per day.

MBOE: One thousand barrels of oil equivalent.

mcf, MCF, Mcf: a measurement of volume denoting one thousand cubic feet of natural gas. 1,000 cf of gas = 1.03 mmBtu (also, 1 kWh = 3,412 Btu). ***OR,*** with a heat content of 1,000,000 Btus, or 10 therms. In the United States, standard conditions are defined as gas at 14.7 psia and 60°F.

Mean Power Output (Of A Wind Turbine): The average power output of a wind energy conversion system at a given mean wind speed based on a Raleigh frequency distribution.

Mean Wind Speed: The arithmetic wind speed over a specified time period and height above the ground (the majority of U.S. National Weather Service anemometers are at 20 feet (6.1 meters).

Measurement and characterization: A field of research that involves assessing the characteristics of photovoltaic materials and devices.

Mechanical Systems: Those elements of building used to control the interior climate.

Median Wind Speed: The wind speed with 50 percent probability of

occurring.

Medium Btu Gas: Fuel gas with a heating value of between 200 and 300 Btu per cubic foot.

Medium Pressure: For valves and fittings, implies that they are suitable for working pressures between 125 to 175 pounds per square inch.

Megajoule (MJ or MMJ): equivalent to one million joules, or 3.6 MJ = 1kWh.

Megawatt (MW): a unit of electricity equal to 1,000 kilowatts, or 1 million watts; standard measure of electric power plant generating capacity.

Megawatt: One thousand kilowatts, or 1 million watts; standard measure of electric power plant generating capacity.

Megawatt-Hour: One thousand kilowatt-hours or 1 million watt-hours.

Mercury Vapor Lamp: A high-intensity discharge lamp that uses mercury as the primary light-producing element. Includes clear, phosphor coated, and self-ballasted lamps.

Met: An approximate unit of heat produced by a resting person, equal to about 18.5 Btu per square foot per hour.

Metal Halide Lamp: A high-intensity discharge lamp type that uses mercury and several halide additives as light-producing elements. These lights have the best Color Rendition Index (CRI) of the High-Intensity Discharge lamps. They can be used for commercial interior lighting or for stadium lights.

Meter: a mechanical device for automatically measuring and recording quantities of gas.

Methane (CH_4): A colorless, odorless, tasteless gas composed of one molecule of Carbon and four of hydrogen, which is highly flammable. It is the main constituent of "natural gas" that is formed naturally by methanogenic, anaerobic bacteria or can be manufactured, and which is used as a fuel and for manufacturing chemicals. ***OR,*** The simplest hydrocarbon and the main constituent of natural gas, it is also known as C1 in the carbon complexity chain. See *Natural gas*

Methanol (CH_3OH; Methyl Alcohol or Wood Alcohol): A clear, colorless, very mobile liquid that is flammable and poisonous; used as a fuel and fuel additive, and to produce chemicals.

Metric Ton (Tonne): A unit of mass equal to 1,000 kilograms or 2,204.6 pounds.

Metrology: The science of measurement.

Microclimate: The local climate of specific place or habitat, as influenced by landscape features.

Microgroove: A small groove scribed into the surface of a solar cell, which is filled with metal for contacts.

Micrometer: One millionth of a meter (10-6 m).

Mid-term gas contract: a supply contract in the physical market covering gas deliveries up to 18 months, although most midterm contracts are for one year or less. These contracts can be characterized by 1) variable prices, where the cost of the commodity is indexed over time to the futures price of some published spot price; 2) fixed reservation fee and service fee; and 3) mainly fixed volumes per day or per month with modest variation. These contracts are of long enough term to hedge price risk with financial instruments. These contracts are important for local distribution companies (LDCs) because they can extend over a heating season. See *Physical gas contract*

Mill: A common monetary measure equal to one-thousandth of a dollar or a tenth of a cent.

Mineral interest - An ownership of the minerals beneath a tract of land. If the surface ownership and the mineral ownership are different, the minerals are said to be "severed."

Minority carrier: A current carrier, either an electron or a hole that is in the minority in a specific layer of a semiconductor material; the diffusion of minority carriers under the action of the cell junction voltage is the current in a photovoltaic device.

Minority Carrier Lifetime: The average time a minority carrier exists before recombination.

Mixing Valve: A valve operated by a thermostat that can be installed in solar water heating systems to mix cold water with water from the collector loop to maintain a safe water temperature.

MMBBL: One million barrels of crude oil, bitumen, condensate or natural gas liquids.

MMBOE: One million barrels of oil equivalent.

MMBTU/ mmBtu**:** One million British thermal units.

MMCF: One million standard cubic feet of natural gas. In the United States,

standard conditions are defined as gas at 14.7 psia and 60°F.

Mmt/y, MTPA: million tonnes a year/per annum. Tonnes or Metric Ton is approximately 2.47 cubic meters of LNG.

Modified Degree-day Method: A method used to estimate building heating loads by assuming that heat loss and gain is proportional to the equivalent heat-loss coefficient for the building envelope.

Modified sine wave: A waveform that has at least three states (i.e., positive, off, and negative). Has less harmonic content than a square wave.

Modularity: The use of multiple inverters connected in parallel to service different loads.

Module Derate Factor: A factor that lowers the photovoltaic module current to account for field operating conditions such as dirt accumulation on the module.

Module: The smallest self-contained, environmentally protected structure housing interconnected photovoltaic cells and providing a single dc electrical output; also called a panel. See photovoltaic (PV) module.

Moisture Content: The water content of a substance (a solid fuel) as measured under specified conditions being the: Dry Basis, which equals the weight of the wet sample minus the weight of a (bone) dry sample divided by the weight of the dry sample times 100 (to get percent); Wet Basis, which is equal to the weight of the wet sample minus the weight of the dry sample divided by the weight of the wet sample times 100.

Moisture Control: The process of controlling indoor moisture levels and condensation.

mol%: the molar composition of a sample of natural gas expressed as a percentage of the whole.

Monoculture: The planting, cultivation, and harvesting of a single species of crop in a specified area.

Monolithic: Fabricated as a single structure.

Most-favoured nation clause: a contract clause that recognises a status accorded by one nation to another in international trade. Typically this means that the receiving nation will be granted all trade advantages, such as low tariffs, that any other nation receives. They will, therefore, always be treated at least as well as other nations.

Motor Speed: The number of revolutions that the motor turns in a given time period (i.e. revolutions per minute, rpm).

Motor: A machine supplied with external energy that is converted into force and/or motion.

Movable Insulation: A device that reduces heat loss at night and during cloudy periods and heat gain during the day in warm weather. A movable insulator could be an insulative shade, shutter panel, or curtain.

Movistor: Short for metal oxide varistor. Used to protect electronic circuits from surge currents such as those produced by lightning.

MTBE: Methyl Tertiary Butyl Ether (MTBE) is an ether compound used as a gasoline blending component to raise the oxygen content of gasoline. MTBE is made by combining isobutylene (from various refining and chemical processes) and methanol (usually made from natural gas).

Multicrystalline: A semiconductor (photovoltaic) material composed of variously oriented, small, individual crystals. Sometimes referred to as polycrystalline or semicrystalline.

Multijunction Device: A high-efficiency photovoltaic device containing two or more cell junctions, each of which is optimized for a particular part of the solar spectrum.

Multilateral institutions: a major source of LNG financing for developing countries; includes Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), International Bank for Reconstruction and Development (**IBRD**) and the International Finance Corporation (**IFC**). See *Export-credit agencies (**ECAs**)*

Multi-stage controller: A charging controller unit that allows different charging currents as the battery nears full state of charge.

Multi-Zone System: A building heating, ventilation, and/or air conditioning system that distributes conditioned air to individual zones or rooms.

Municipal Solid Waste (MSW): Waste material from households and businesses in a community that is not regulated as hazardous.

Municipal Waste to Energy Project (or Plant): A facility that produces fuel or energy from municipal solid waste.

Municipal Waste: As defined in the Energy Security Act (P.L. 96-294; 1980) as "any organic matter, including sewage, sewage sludge, and industrial or commercial waste, and mixtures of such matter and inorganic refuse from any publicly or privately operated municipal

waste collection or similar disposal system, or from similar waste flows (other than such flows which constitute agricultural wastes or residues, or wood wastes or residues from wood harvesting activities or production of forest products)."

Must-take gas: natural gas supplies committed to a purchaser under terms such as drainage protection or reservoir protection clauses or other provisions that absolutely obligate a purchaser to take natural gas from a supplier.

n

Nacelle: The cover for the gear box, drive train, generator, and other components of a wind turbine.

Name Plate: A metal tag attached to a machine or appliance that contains information such as brand name, serial number, voltage, power ratings under specified conditions, and other manufacturer supplied data.

Nanometer: One billionth of a meter.

National Balancing Point (NBP): a notional point on the UK Transco pipeline through which all gas is deemed to flow.

National Electrical Code (**NEC**): The NEC is a set of regulations that have contributed to making the electrical systems in the United States one of the safest in the world. The intent of the NEC is to ensure safe electrical systems are designed and installed. The National Fire Protection Association has sponsored the NEC since 1911. The NEC changes as technology evolves and component sophistication increases. The NEC is updated every three years. Following the NEC is required in most locations.

National Electrical Manufacturers Association (NEMA): This organization sets standards for some non-electronic products like junction boxes.

National Energy Board: Canadian regulatory body that oversees inter-provincial gas trade and pipelines. Located in Alberta.

National Rural Electric Cooperative Association (**NRECA**): This is a national organization dedicated to representing the interests of cooperative electric power providers and the consumers they serve. Members come from the 46 states that have an electric distribution cooperative.

Native gas: natural gas in place in a producing reservoir when the reservoir is converted into a gas-storage reservoir.

Natural Cooling: Space cooling achieved by shading, natural (unassisted, as opposed to forced) ventilation, conduction control, radiation, and evaporation; also called passive cooling.

Natural Draft: Draft that is caused by temperature differences in the air.

Natural gas (natgas): a naturally occurring mixture of hydrocarbon compounds and small quantities of various non-hydrocarbons existing in the gaseous phase or in solution with crude oil in natural underground reservoirs (porous rock formations) at reservoir conditions. The principal hydrocarbons usually contained in the mixture are methane, ethane, propane, butanes, and pentanes. Typical non-hydrocarbon bases that may be present in reservoir natural gas are carbon dioxide, helium, hydrogen sulphide, and nitrogen. Under reservoir conditions, natural gas and the liquefiable portions thereof occur either in a single gaseous phase in the reservoir or in solution with crude oil and are not distinguishable at that time as separate substances. The principal constituent is methane (CH4) and is the simplest of hydrocarbons. *Note*: The Energy Information Administration (**EIA**) measures wet natural gas and its two sources of production, associated/dissolved natural gas and non-associated natural gas; and dry natural gas, which is produced from wet natural gas. ***OR,*** A hydrocarbon gas obtained from underground sources, often in association with petroleum and coal deposits. It generally contains a high percentage of methane, varying amounts of ethane, and inert gases; used as a heating fuel.

Natural gas liquids (NGLs): A general term for highly volatile liquid products separated from natural gas in a gas processing plant. NGLs include ethane, propane, butane and condensate. ***OR,*** liquid hydrocarbons, such as ethane, propane, butane, pentane and natural gasoline, extracted from field gas.

Natural Gas Marketer: A company that arranges purchases and sales of natural gas. Unlike pipeline companies or local distribution companies, a marketer does not own physical assets commonly used

in the supply of natural gas, such as pipelines or storage fields. A marketer may be an affiliate of another company, such as a local distribution company, natural gas pipeline, or producer, but it operates independently of other segments of the company. In States with residential choice programs, marketers serve as alternative suppliers to residential users of natural gas, which is delivered by a local distribution company.

Natural Gas Steam Reforming Production: A two-step process where in the first step natural gas is exposed to a high-temperature steam to produce hydrogen, carbon monoxide, and carbon dioxide. The second step is to convert the carbon monoxide with steam to produce additional hydrogen and carbon dioxide.

Natural Ventilation: Ventilation that is created by the differences in the distribution of air pressures around a building. Air moves from areas of high pressure to areas of low pressure with gravity and wind pressure affecting the airflow. The placement and control of doors and windows alters natural ventilation patterns.

Natural-gas heating value: the amount of thermal energy released by the complete combustion of 1 cf of natural gas. Higher Heating Value (HHV) or Gross Heating Value (GHV) assumes that the water vapour produced in the combustion process is condensed to liquid. Net Heating Value (NHV) assumes the vapour produced in the combustion process stays in the gaseous phase.

Natural-gas processing: 1) the purification of field gas at gas-processing plants (or gas plants), or the fractionation of mixed natural gas liquids (NGLs) to natural gas products to meet specifications for use as pipeline quality gas. Gas processing includes removing liquids, solids, and vapours, absorbing impurities and odourising; 2) the process of separating NGLs by absorption, adsorption, refrigeration or cryogenics from a stream of natural gas.

Natural-gas producer: a natural gas producer is generally involved in exploration, drilling and refinement of natural gas.

Natural-gas resource base: an estimate of the amount of natural gas available, based on the combination of reserves, contingent resources and prospective resources. Reserves may include proved, probable and possible commercial reserves. Contingent resources include recoverable quantities from known accumulations that are not commercial. Prospective resources are those quantities of petroleum that are estimated to be recoverable from undiscovered accumulations.

Natural-gas storage: a means of providing a reserve of natural gas supplies to meet the seasonal demands of natural gas customers.

Natural-gas transportation system: the pipeline transportation system used to accept and transport natural gas.

NEC: See National Electrical Code.

NEMA: See National Electrical Manufacturers Association.

Net (Lower) Heating Value (NHV): The potential energy available in a fuel as received, taking into account the energy loss in evaporating and superheating the water in the fuel. Equal to the higher heating value minus 1050W where W is the weight of the water formed from the hydrogen in the fuel, and 1050 is the latent heat of vaporization of water, in Btu, at 77 degrees Fahrenheit.

Net acres: The percentage that a company owns in an acreage position with multiple owners. For example, a company that has a 50 percent interest in a lease covering 10,000 acres owns 5,000 net acres.

Net capacity (shipping): the number of tonnes of cargo that a vessel can carry when loaded in salt water to her summer freeboard marks. Also called cargo-carrying capacity, cargo deadweight and useful deadweight.

Net Energy Production (Or Balance): The amount of useful energy produced by a system less the amount of energy required to produce the fuel.

Net gas: total produced natural gas times net working interest in natural gas production.

Net Generation: Equal to gross generation less electricity consumption of a power plant.

Net Metering: The practice of using a single meter to measure consumption and generation of electricity by a small generation facility (such as a house with a wind or solar photovoltaic system). The net energy produced or consumed is purchased from or sold to the power provider, respectively.

Net Present Value: The value of a personal portfolio, product, or

investment after depreciation and interest on debt capital are subtracted from operating income. It can also be thought of as the equivalent worth of all cash flows relative to a base point called the present.

Net tonnage: the carrying capacity of vessels as prescribed by government regulations and determined by measuring the cubic contents of the space intended for revenue earning.

Netback price: the effective price to the producer of natural gas at a defined point, based on the market price for the natural gas less the charges for delivering the natural gas from the defined point to market.

NGV - Natural Gas Vehicle

Nickel cadmium battery: A battery containing nickel and cadmium plates and an alkaline electrolyte.

Nitrogen Dioxide: This compound of nitrogen and oxygen is formed by the oxidation of nitric oxide (NO) which is produced by the combustion of solid fuels.

Nitrogen Oxides (**NO_X**): The products of all combustion processes formed by the combination of nitrogen and oxygen.

Nocturnal Cooling: The effect of cooling by the radiation of heat from a building to the night sky.

Nominal Capacity: The approximate energy producing capacity of a power plant, under specified conditions, usually during periods of highest load.

Nominal Dollars: A measure used to express nominal price.

Nominal Price: The price paid for a product or service at the time of the transaction. Nominal prices are those that have not been adjusted to remove the effect of changes in the purchasing power of the dollar; they reflect buying power in the year in which the transaction occurred.

Nominal Price: The price paid for goods or services at the time of a transaction; a price that has not been adjusted to account for inflation.

Nominal voltage: A reference voltage used to describe batteries, modules, or systems (i.e., a 12-volt or 24-volt battery, module, or system).

Nomination: an order slip to an interstate pipeline, stating the volume of gas a supplier seeks to transport over a fixed period of time. Most nominations are now submitted electronically through pipeline EBB/Internet websites.

Non-associated gas: free natural gas not in contact with, or dissolved in, crude oil in the reservoir. LNG projects require large, proved reserves of non-associated gas to insure supply over long contract terms.

Noncombustible: A substance or gas that will not burn.

Non-firm purchase: purchase of a commodity such as natural gas on an as-available basis.

Nonhydrocarbon Gases: Typical nonhydrocarbon gases that may be present in reservoir natural gas, such as carbon dioxide, helium, hydrogen sulfide, and nitrogen.

No-notice service: a pipeline delivery service that allows customers to receive gas on demand without making prior nominations to meet peak service needs and without paying daily balancing and scheduling penalties.

Non-performance: a contractual breach.

Nonrenewable Fuels: Fuels that cannot be easily made or "renewed," such as oil, natural gas, and coal.

Non-Utility Generator/Power Producer: A class of power generator that is not a regulated power provider and that has generating plants for the purpose of supplying electric power required in the conduct of their industrial and commercial operations.

Nonutility Power Producers: A corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities for electric generation and is not an electric utility. Nonutility power producers include qualifying cogenerators, qualifying small power producers, and other nonutility generators (including independent power producers). Non-utility power producers are without a designated franchised service area and do not file forms listed in the Code of Federal Regulations, Title 18, Part 141.

Normal operating cell temperature (NOCT): The estimated temperature of a photovoltaic module when operating under 800 w/m2 irradiance, 20°C ambient temperature and wind speed of 1 meter per second. NOCT is used to estimate the nominal operating temperature of a module in its working environment.

Normal Recovery Capacity: A characteristic applied to domestic water heaters that is the amount of gallons raised 100 degrees Fahrenheit per hour (or minute) under a specified thermal efficiency.

N-Type Semiconductor: A semiconductor produced by doping an intrinsic semiconductor with an electron-donor impurity (e.g., phosphorous in silicon).

N-type silicon: Silicon material that has been doped with a material that has more electrons in its atomic structure than does silicon.

N-type: Negative semiconductor material in which there are more electrons than holes; current is carried through it by the flow of electrons.

Nuclear Energy: Energy that comes from splitting atoms of radioactive materials, such as uranium, and which produces radioactive wastes.

NYMEX: The New York Mercantile Exchange.

O

Occupancy Sensor: An optical, ultrasonic, or infrared sensor that turns room lights on when they detect a person's presence and off after the space is vacated.

Occupied Space: The space within a building or structure that is normally occupied by people, and that may be conditioned (heated, cooled and/or ventilated).

Ocean Energy Systems: Energy conversion technologies that harness the energy in tides, waves, and thermal gradients in the oceans.

Ocean Thermal Energy Conversion (**OTEC**): The process or technologies for producing energy by harnessing the temperature differences (thermal gradients) between ocean surface waters and that of ocean depths. Warm surface water is pumped through an evaporator containing a working fluid in a closed Rankine-cycle system. The vaporized fluid drives a turbine/generator. Cold water from deep below the surface is used to condense the working fluid. Open-Cycle OTEC technologies use ocean water itself as the working fluid. Closed-Cycle OTEC systems circulate a working fluid in a closed loop. A working 10 kilowatt, closed-cycle prototype was developed by the Pacific International Center for High Technology Research in Hawaii with US Department of Energy funding, but was not commercialized.

Odourising: a process whereby an additive is injected to natural gas to provide a readily perceptible odour at a very low concentration in air as a warning indication of the presence of natural gas. Also called stenching.

Offload (shipping): discharge of cargo from a ship.

Off-peak gas: natural gas supplied during periods of relatively low system demands.

Off-Peak: The period of low energy demand, as opposed to maximum, or peak, demand.

Offshore Reserves and Production: Unless otherwise indicated, reserves and production that are in either State or Federal domains, located seaward of the coastline.

Off-system supply: natural gas supply purchased from an entity other than the delivering pipeline or local distribution company.

Offtake point: the point in a natural gas distribution system where natural gas is taken by supply pipe to a major customer.

Ofgem: UK regulatory body that oversees electricity and gas trade, pipelines and the power grid. Located in London. Combines the former Offer and Ofgas regulators.

Ohm: A measure of the electrical resistance of a material equal to the resistance of a circuit in which the potential difference of 1 volt produces a current of 1 ampere.

Ohm's Law: In a given electrical circuit, the amount of current in amperes (i) is equal to the pressure in volts (V) divided by the resistance, in ohms (R).

Oil (Fuel): A product of crude oil that is used for space heating, diesel engines, and electrical generation.

Oil equivalent gas (OEG): See *Barrel of oil equivalent (boe)*

Oil sands: Geologic formation comprised predominantly of sand grains and bitumen, a highly viscous form of crude oil.

Oil Well (Casing head) Gas: Natural gas produced along with crude oil from oil wells. It contains either dissolved or associated gas or both.

One Sun: The maximum value of natural solar insolation.

One-axis tracking: A system capable of rotating about one axis.

On-Peak Energy: Energy supplied during periods of relatively high system demands as specified by the supplier.

On-Site Generation: Generation of energy at the location where all or most of it will be used.

Onsystem Sales: Sales to customers where the delivery point is a point on, or directly interconnected with, a transportation, storage and/or distribution system operated by the reporting company.

Open Access: The ability to send or wheel electric power to a customer over a transmission and distribution system that is not owned by the power generator (seller).

Open-access transportation: natural gas transportation service available to all shippers. Subject to capacity availability, in a manner that is not unduly discriminatory.

Open-circuit voltage (Voc): The maximum possible voltage across a photovoltaic cell; the voltage across the cell in sunlight when no current is flowing.

Open-Loop Geothermal Heat Pump System: Open-loop (also known as "direct") systems circulate water drawn from a ground or surface water source. Once the heat has been transferred into or out of the water, the water is returned to a well or surface discharge (instead of being recirculated through the system). This option is practical where there is an adequate supply of relatively clean water, and all local codes and regulations regarding groundwater discharge are met.

Operating Cycle: The processes that a work input/output system undergoes and in which the initial and final states are identical.

Operating lease: an agreement whereby the lessor conveys the right to use an asset for an agreed period of time to the lessee (in return for a payment or series of payments).

Operating point: The current and voltage that a photovoltaic module or array produces when connected to a load. The operating point is dependent on the load or the batteries connected to the output terminals of the array.

Operational balancing agreements (OBAs): agreements between pipelines and parties at delivery or receipt points, whereby the parties agree to specified procedures for balancing discrepancies between the nominated levels of service and the actual quantities.

Operational-flow orders (OFOs): orders that are issued by a pipeline to protect the operational integrity of the line.

Operator: The entity responsible for managing operations in a field or undeveloped acreage position. ***OR*** The party responsible for exploration, development or production projects.

Orientation: The alignment of a building along a given axis to face a specific geographical direction. The alignment of a solar collector, in number of degrees east or west of true south. ***OR,*** Placement with respect to the cardinal directions, N, S, E, W; azimuth is the measure of orientation from north.

Outage: A discontinuance of electric power supply.

Outer continental shelf (OCS): that portion of a continental land mass that constitutes the slope down to the ocean floor. The outer continental shelves are heavily sedimented and are believed to contain a large portion of the earth's undiscovered gas.

Outer Continental Shelf: Offshore Federal domain.

Outgas: See gassing.

Outgassing: The process by which materials expel or release gasses.

Outside Air: Air that is taken from the outdoors.

Outside Coil: The heat-transfer (exchanger) component of a heat pump, located outdoors, from which heat is collected in the heating mode, or expelled in the cooling mode.

Overcharge: Forcing current into a fully charged battery. The battery will be damaged if overcharged for a long period.

Overhang: A building element that shades windows, walls, and doors from direct solar radiation and protects these elements from precipitation.

Overload: To exceed the design capacity of a device.

Ovonic: A device that converts heat or sunlight directly to electricity, invented by StandfordOvshinsky, that has a unique glass composition that changes from an electrically non-conducting state to a semiconducting state.

Own-use exemption: the exemption to applying fair-value accounting, under International Financial Reporting Standards, to contracts that were entered into and continue to be held for the purpose of the receipt or delivery of a non-financial item in accordance with the entity's expected purchase, sale or usage requirements.

Oxygenates: Gasoline fuel additives such as ethanol, ETBE, or MTBE that add extra oxygen to gasoline to reduce carbon monoxide pollution

produced by vehicles.

p

P&I (shipping): protection and indemnity insurance.

P/N: A semiconductor photovoltaic device structure in which the junction is formed between a p-type layer and an n-type layer.

Packing factor: The ratio of array area to actual land area or building envelope area for a system; or, the ratio of total solar cell area to the total module area, for a module. ***OR,*** The ratio of solar collector array area to actual land area.

Pane (Window): The area of glass that fits in the window frame.

Panel (Solar): A term generally applied to individual solar collectors, and typically to solar photovoltaic collectors or modules.

Panel Radiator: A mainly flat surface for transmitting radiant energy.

Panel: See photovoltaic (PV) panel.

Panemone: A drag-type wind machine that can react to wind from any direction.

Parabolic Aluminized Reflector Lamp: A type of lamp having a lens of heavy durable glass that focuses the light. They have longer lifetimes with less lumen depreciation than standard incandescent lamps.

Parabolic Dish: A solar energy conversion device that has a bowl shaped dish covered with a highly reflective surface that tracks the sun and concentrates sunlight on a fixed absorber, thereby achieving high temperatures, for process heating or to operate a heat (Stirling) engine to produce power or electricity.

Parabolic Trough: A solar energy conversion device that uses a trough covered with a highly reflective surface to focus sunlight onto a linear absorber containing a working fluid that can be used for medium temperature space or process heat or to operate a steam turbine for power or electricity generation.

Parallel connection: A way of joining solar cells or photovoltaic modules by connecting positive leads together and negative leads together; such a configuration increases the current, but not the voltage.

Parallel: A configuration of an electrical circuit in which the voltage is the same across the terminals. The positive reference direction for each resistor current is down through the resistor with the same voltage across each resistor.

Particulates: The fine liquid or solid particles contained in combustion gases. The quantity and size of particulates emitted by cars, power and industrial plants, wood stoves, etc. are regulated by the U.S. Environmental Protection Agency.

Passivation: A chemical reaction that eliminates the detrimental effect of electrically reactive atoms on a solar cell's surface.

Passive Solar (Building) Design: A building design that uses structural elements of a building to heat and cool a building, without the use of mechanical equipment, which requires careful consideration of the local climate and solar energy resource, building orientation, and landscape features, to name a few. The principal elements include proper building orientation, proper window sizing and placement and design of window overhangs to reduce summer heat gain and ensure winter heat gain, and proper sizing of thermal energy storage mass (for example a Trombe wall or masonry tiles). The heat is distributed primarily by natural convection and radiation, though fans can also be used to circulate room air or ensure proper ventilation.

Passive Solar Heater: A solar water or space-heating system in which solar energy is collected, and/or moved by natural convection without using pumps or fans. Passive systems are typically integral collector/storage (ICS; or batch collectors) or thermos-syphon systems. The major advantage of these systems is that they do not use controls, pumps, sensors, or other mechanical parts, so little or no maintenance is required over the lifetime of the system.

Passive Solar Home: A house built using passive solar design techniques.

Passive/Natural Cooling: To allow or augment the natural movement of cooler air from exterior, shaded areas of a building through or around a building.

Payback Period: The amount of time required before the savings resulting from your system equal the system cost.

Peak Clipping/Shaving: The process of implementing measures to reduce peak power demands on a system.

Peak demand/load: The maximum energy demand or load in a specified

time period.

Peak Power: Power generated that operates at a very low capacity factor; generally used to meet short-lived and variable high demand periods.

Peak power current: Amperes produced by a photovoltaic module or array operating at the voltage of the I-V curve that will produce maximum power from the module.

Peak power point: Operating point of the I-V (current-voltage) curve for a solar cell or photovoltaic module where the product of the current value times the voltage value is a maximum.

Peak power tracking: See maximum power tracking.

Peak shaving LNG Facility: A facility for both storing and vaporizing LNG intended to operate on an intermittent basis to meet relatively short-term peak gas demands. A peak shaving facility may also have liquefaction capacity, which is usually quite small compared to vaporization capacity at such facility.

Peak Shifting: The process of moving existing loads to off-peak periods.

Peak Sun Hours: The equivalent number of hours per day when solar irradiance averages 1 kW/m^2. For example, six peak sun hours means that the energy received during total daylight hours equals the energy that would have been received had the irradiance for six hours been 1 kW/m^2.

Peak watt: A unit used to rate the performance of solar cells, modules, or arrays; the maximum nominal output of a photovoltaic device, in watts (Wp) under standardized test conditions, usually 1,000 watts per square meter of sunlight with other conditions, such as temperature specified.

Peak Wind Speed: The maximum instantaneous wind speed (or velocity) that occurs within a specific period of time or interval.

Peak-day send-out: the largest volume of natural gas delivered on any one day during the year.

Peaking Capacity: Power generation equipment or system capacity to meet peak power demands.

Peaking Hydropower: A hydropower plant that is operated at maximum allowable capacity for part of the day and is either shut down for the remainder of the time or operated at minimal capacity level.

Peak-shaving (or peak-lopping): the process of drawing gas during peak-use periods from storage or peak-load plants to supplement the normal amounts delivered to customers.

Pellet Stove: A space heating device that burns pellets; are more efficient, clean burning, and easier to operate relative to conventional cord wood burning appliances.

Pellets: Solid fuels made from primarily wood sawdust that is compacted under high pressure to form small (about the size of rabbit feed) pellets for use in a pellet stove.

Pelton Turbine: A type of impulse hydropower turbine where water passes through nozzles and strikes cups arranged on the periphery of a runner, or wheel, which causes the runner to rotate, producing mechanical energy. The runner is fixed on a shaft, and the rotational motion of the turbine is transmitted by the shaft to a generator. Generally used for high head, low flow applications.

Penstock: A component of a hydropower plant; a pipe that delivers water to the turbine.

Perfluorocarbon Tracer Gas Technique (**PFT**): An air infiltration measurement technique developed by the Brookhaven National Laboratory to measure changes over time (one week to five months) when determining a building's air infiltration rate. This test cannot locate exact points of infiltration, but it does reveal long-term infiltration problems.

Performance Ratings: Solar collector thermal performance ratings based on collector efficiencies, usually expressed in Btu per hour for solar collectors under standard test or operating conditions for solar radiation intensity, inlet working fluid temperatures, and ambient temperatures.

Perimeter Heating: A term applied to warm-air heating systems that deliver heated air to rooms by means of registers or baseboards located along exterior walls.

Permeability: The permeability of a rock is the measure of the resistance to the flow of fluid through the rock. High permeability means fluid passes through the rock easily.

Permeance: A unit of measurement for the ability of a material to retard the diffusion of water vapor at 73.4 F (23 C). A perm, short for permeance, is the number of grains of water vapor that pass through a

square foot of material per hour at a differential vapor pressure equal to one inch of mercury.

Petrochemicals feedstock: feedstock derived from petroleum, used to manufacture chemicals, synthetic rubber, and plastics.

Phantom Load: Any appliance that consumes power even when it is turned off. Examples of phantom loads include appliances with electronic clocks or timers, appliances with remote controls, and appliances with wall cubes (a small box that plugs into an AC outlet to power appliances).

Phase Change: The process of changing from one physical state (solid, liquid, or gas) to another, with a necessary or coincidental input or release of energy.

Phase: Alternating current is carried by conductors and a ground to residential, commercial, or industrial consumers. The waveform of the phase power appears as a single continuous sine wave at the system frequency whose amplitude is the rated voltage of the power.

Phase-Change Material: A material that can be used to store thermal energy as latent heat. Various types of materials have been and are being investigated such as inorganic salts, eutectic compounds, and paraffins, for a variety of applications, including solar energy storage (solar energy heats and melts the material during the day and at night it releases the stored heat and reverts to a solid state).

Phosphorous (P): A chemical element used as a dopant in making n-type semiconductor layers.

Photobiological Hydrogen Production: A hydrogen production process that process uses algae. Under certain conditions, the pigments in certain types of algae absorb solar energy. An enzyme in the cell acts as a catalyst to split water molecules. Some of the bacteria produces hydrogen after they grow on a substrate.

Photocurrent: An electric current induced by radiant energy.

Photoelectric cell: A device for measuring light intensity that works by converting light falling on, or reach it, to electricity, and then measuring the current; used in photometers.

Photoelectrochemical Cell: A type of photovoltaic device in which the electricity induced in the cell is used immediately within the cell to produce a chemical, such as hydrogen, which can then be withdrawn for use.

Photoelectrolysis Hydrogen Production: The production of hydrogen using a photoelectron-chemical cell.

Photogalvanic Processes: The production of electrical current from light.

Photon: A particle of light that acts as an individual unit of energy.

Photovoltaic (PV): Pertaining to the direct conversion of light into electricity.

Photovoltaic (Pv; Solar) Array: A group of solar photovoltaic modules connected together. ***OR,*** An interconnected system of PV modules that function as a single electricity-producing unit. The modules are assembled as a discrete structure, with common support or mounting. In smaller systems, an array can consist of a single module.

Photovoltaic (Solar) Cell: Treated semiconductor material that converts solar irradiance to electricity. ***OR,*** The smallest semiconductor element within a PV module to perform the immediate conversion of light into electrical energy (direct current voltage and current). Also called a solar cell.

Photovoltaic (PV) conversion efficiency: The ratio of the electric power produced by a photovoltaic device to the power of the sunlight incident on the device.

photovoltaic (PV) device: A solid-state electrical device that converts light directly into direct current electricity of voltage-current characteristics that are a function of the characteristics of the light source and the materials in and design of the device. Solar photovoltaic devices are made of various semiconductor materials including silicon, cadmium sulfide, cadmium telluride, and gallium arsenide, and in single crystalline, multicrystalline, or amorphous forms.

Photovoltaic (PV) effect: The phenomenon that occurs when photons, the "particles" in a beam of light, knock electrons loose from the atoms they strike. When this property of light is combined with the properties of semiconductors, electrons flow in one direction across a junction, setting up a voltage. With the addition of circuitry, current will flow and electric power will be available.

Photovoltaic (PV) generator: The total of all PV strings of a PV power supply system, which are electrically interconnected.

Photovoltaic (PV) module: The smallest environmentally protected, essentially planar assembly of solar cells and ancillary parts, such as interconnections, terminals, (and protective devices such as diodes) intended to generate direct current power under unconcentrated sunlight. The structural (load carrying) member of a module can either be the top layer (superstrate) or the back layer (substrate).

Photovoltaic (PV) panel: often used interchangeably with PV module (especially in one-module systems), but more accurately used to refer to a physically connected collection of modules (i.e., a laminate string of modules used to achieve a required voltage and current).

Photovoltaic (Solar) Module Or Panel: A solar photovoltaic product that generally consists of groups of PV cells electrically connected together to produce a specified power output under standard test conditions, mounted on a substrate, sealed with an encapsulant, and covered with a protective glazing. Maybe further mounted on an aluminum frame. A junction box, on the back or underside of the module is used to allow for connecting the module circuit conductors to external conductors.

Photovoltaic (PV) system: A complete set of components for converting sunlight into electricity by the photovoltaic process, including the array and balance of system components. ***OR,*** A complete PV power system composed of the module (or array), and balance-of-system (BOS) components including the array supports, electrical conductors/wiring, fuses, safety disconnects, and grounds, charge controllers, inverters, battery storage, etc.

Photovoltaic Device: A solid-state electrical device that converts light directly into direct current electricity of voltage-current characteristics that are a function of the characteristics of the light source and the materials in and design of the device. Solar photovoltaic devices are made of various semi-conductor materials including silicon, cadmium sulfide, cadmium telluride, and gallium arsenide, and in single crystalline, multi-crystalline, or amorphous forms.

Photovoltaic Peak Watt: see Peak Watt.

Photovoltaic-thermal (PV/T) system: A photovoltaic system that, in addition to converting sunlight into electricity, collects the residual heat energy and delivers both heat and electricity in usable form. Also called a total energy system or solar thermal system. ***OR,*** A solar energy system that produces electricity with a PV module, and collects thermal energy from the module for heating. There are no commercially available systems available (as of 11/97).

Physical contract: a natural gas contract where delivery and receipt are expected.

Physical vapor deposition: A method of depositing thin semiconductor photovoltaic films. With this method, physical processes, such as thermal evaporation or bombardment of ions, are used to deposit elemental semiconductor material on a substrate.

P-I-N: A semiconductor photovoltaic (PV) device structure that layers an intrinsic semiconductor between a p-type semiconductor and an n-type semiconductor; this structure is most often used with amorphous silicon PV devices.

Pipeline - A string of interconnected pipe providing a route for natural gas to travel from the wellhead to market. Without pipelines, natural gas cannot be transported and sold at market to provide royalty payments, clean energy and economic benefits to the community. ***OR,*** A continuous pipe conduit, complete with such equipment as valves, compressor stations, communications systems, and meters, for transporting natural and/or supplemental gas from one point to another, usually from a point in or beyond the producing field or processing plant to another pipeline or to points of utilization. Also refers to a company operating such facilities. ***OR***, a tube for the transportation of crude oil or natural gas between two points, either offshore or onshore. ***OR,*** All parts of those physical facilities through which gas is moved in transportation, including pipe, valves, and other appurtenances attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

Pipeline Capacity: The maximum quantity of gas that can be moved through a pipeline system at any given time based on existing service conditions such as available horsepower, pipeline diameter(s), maintenance schedules, regional demand for natural gas, etc.

Pipeline constrained: a condition in which the capacity of gas pipelines is

less than the demand for throughput.

Pipeline Fuel: Gas consumed in the operation of pipelines, primarily in compressors.

Pipeline interconnection: a point at which facilities of two or more pipelines interconnect.

Pipeline-quality natural gas: natural gas that meets the specifications of a pipeline.

Pitch Control: A method of controlling a wind turbine's speed by varying the orientation, or pitch, of the blades, and thereby altering its aerodynamics and efficiency.

Plant Fuel: Natural gas used as fuel in natural gas processing plants.

Plates: A metal plate, usually lead or lead compound, immersed in the electrolyte in a battery.

Play: An area in which hydrocarbon accumulations or prospects with similar characteristics occur, such as the Lower Tertiary play in the deep water Gulf of Mexico or the Marcellus play in the eastern United States.

Plenum: The space between a hanging ceiling and the floor above or roof; usually contains HVAC ducts, electrical wiring, fire suppression system piping, etc.

Plug: A permanent plug, usually cement, set in a borehole to block the flow of fluids, to isolate sections of the well or to permanently plug a dry hole or depleted well.

Plug Flow Digester: A type of anaerobic digester that has a horizontal tank in which a constant volume of material is added and forces material in the tank to move through the tank and be digested.

Plug-and-play PV system: A commercial, off-the-shelf photovoltaic system that is fully inclusive with little need for individual customization. The system can be installed without special training and using few tools. The homeowner plugs the system into a PV-ready circuit and an automatic PV discovery process initiates communication between the system and the utility. The system and grid are automatically configured for optimal operation.

Pocket plate: A plate for a battery in which active materials are held in a perforated metal pocket.

Point-Contact Cell: A high efficiency silicon photovoltaic concentrator cell that employs light trapping techniques and point-diffused contacts on the rear surface for current collection.

Polycrystalline: A semiconductor (photovoltaic) material composed of variously oriented, small, individual crystals. See multicrystalline.

Polycrystalline Silicon: A material used to make photovoltaic cells, which consist of many crystals unlike single-crystal silicon.

Polycrystalline Thin Film: A thin film made of multicrystalline material.

Polyethylene: A registered trademark for plastic sheeting material that can be used as a vapor retarder. This plastic is used to make grocery bags. It is a long chain of carbon atoms with 2 hydrogen atoms attached to each carbon atom.

Polystyrene: (See Foam Insulation)

Pooling - A term frequently used interchangeably with "unitization;" more properly, it refers to the combining of small or irregular tracts into a unit large enough to meet state spacing regulations for drilling permits. "Unitization" is a term used to describe the combined operations of all or some portion of a producing reservoir.

Porosity: The measure of a rock's ability to hold a fluid. Porosity is normally expressed as a percentage of the total rock which is taken up by pore space.

Porous Media: A solid that contains pores; normally, it refers to interconnected pores that can transmit the flow of fluids. (The term refers to the aquifer geology when discussing sites for CAES.)

Portfolio Standard: The requirement that an electric power provider generate or purchase a specified percentage of the power it supplies/sells from renewable energy resources, and thereby guarantee a market for electricity generated from renewable energy resources.

Possible reserves: Additional reserves that are less certain to be recovered than probable reserves.

Postage-stamp rate: transportation rate for a given area (can be a large part of a pipeline's system) that does not vary according to distance from the source of supply. Typically, postage stamps for letters are at a fixed price, regardless of destination.

Potable Water: Water that is suitable for drinking, as defined by local health officials.

Potential Energy: Energy available due to position.

Pound of Steam: One pound of water in vapor phase; is NOT steam pressure, which is expressed as pounds per square inch (psi).

Pounds per square inch absolute (psia): the total pressure in a system including atmospheric pressure. ***OR,*** A unit of pressure [hydraulic (liquid) or pneumatic (gas)] that does not include atmospheric pressure.

Pounds per square inch gauge (psig): the pressure measured by a pressure gauge. The following formula is used to convert gauge pressure to absolute pressure: P(psia) = P(psig) + atmospheric pressure.

Power (Output) Curve: A plot of a wind energy conversion device's power output versus wind speed.

Power (Solar) Tower: A term used to describe solar thermal, central receiver, power systems, where an array of reflectors focus sunlight onto a central receiver and absorber mounted on a tower.

Power Coefficient: The ratio of power produced by a wind energy conversion device to the power in a reference area of the free windstream.

Power Conditioning: The process of modifying the characteristics of electrical power (for e.g., inverting dc to ac).

Power conditioning equipment: Electrical equipment, or power electronics, used to convert power from a photovoltaic array into a form suitable for subsequent use. A collective term for inverter, converter, battery charge regulator, and blocking diode.

Power conversion efficiency: The ratio of output power to input power of the inverter.

Power density: The ratio of the power available from a battery to its mass (W/kg) or volume (W/l). ***OR,*** The amount of power per unit area of a free windstream.

Power factor (PF): The ratio of actual power being used in a circuit, expressed in watts or kilowatts, to the power that is apparently being drawn from a power source, expressed in volt-amperes or kilovolt-amperes.

Power Generation Mix: The proportion of electricity distributed by a power provider that is generated from available sources such as coal, natural gas, petroleum, nuclear, hydropower, wind, or geothermal.

Power Provider: A company or other organizational unit that sells and distributes electrical power (e.g., private or public electrical utility), either to other distribution and wholesale businesses or to end-users. Sometimes power providers also generate the power they sell.

Power Transmission Line: An electrical conductor/cable that carries electricity from a generator to other locations for distribution.

Power: Energy that is capable or available for doing work; the time rate at which work is performed, measured in horsepower, Watts, or Btu per hour. Electric power is the product of electric current and electromotive force.

Preheater (Solar): A solar heating system that preheats water or air that is then heated more by another heating appliance.

Present Value: The amount of money required to secure a specified cash flow at a future date at a specified return.

Pressure Drop: The loss in static pressure of a fluid (liquid or gas) in a system due to friction from obstructions in pipes, from valves, fittings, regulators, burners, etc., or by a breech or rupture of the system.

Pressurization Testing: A technique used by energy auditors, using a blower door, to locate areas of air infiltration by exaggerating the defects in the building shell. This test only measures air infiltration at the time of the test. It does not take into account changes in atmospheric pressure, weather, wind velocity, or any activities the occupants conduct that may affect air infiltration rates over a period of time.

Price indexation: a practice whereby a contract price is linked to another, generally more liquid or less complex product price or economic indicator. This allows the resulting price to vary in accordance with another factor. Gas contract prices are often linked to major crude oil indices, derivative prices, such as certain fuel oil prices, or, less frequently, energy or economic growth indicators, such as a country's GDP.

Primary Air: The air that is supplied to the combustion chamber of a furnace.

Primary battery: A battery whose initial capacity cannot be restored by charging.

Prime Mover: Any machine capable of producing power to do work.

Probable reserves: Additional reserves that are less certain to be recovered than proved reserves but which, together with proved reserves, are as likely as not to be recovered.

Process Heat: Thermal energy that is used in agricultural and industrial operations.

Processing: The separation of oil, gas and natural gas liquids and the removal of impurities.

Produced water: Water produced in connection with oil and natural gas exploration and development activities.

Producer Gas: Low or medium Btu content gas, composed mainly of carbon monoxide, nitrogen (2), and hydrogen (2) made by the gasification of wood or coal.

Production costs (lifting costs): costs incurred to operate and maintain oil or gas wells and related equipment and facilities, including depreciation and applicable operating costs of support equipment and facilities and other costs of operating and maintaining those wells and related equipment and facilities. They become part of the cost of oil and gas produced.

Production sharing contract (PSC): An agreement between a host government and the owners (or co-owners) of a well or field regarding the percentage of production each party will receive after the parties have recovered a specified amount of capital and operational expenses. *contract between a government and a company, granting the company a contractual right to explore and produce hydrocarbons in a specified area in enabling the company to recover its costs and a certain profit.*

Productive well: A well that is capable of producing hydrocarbons in sufficient quantities to justify commercial exploitation.

Products Of Combustion: The elements and compounds that result from the combustion of a fuel.

Programmable Thermostat: A type of thermostat that allows the user to program into the devices' memory a pre-set schedule of times (when certain temperatures occur) to turn on HVAC equipment.

Project financing: most commonly used method to finance construction of industrial infrastructure, because of the non-recourse (to project sponsors) nature of the debt financing supporting the project. Typically, the developer pledges the value of the plant and part or all of its expected revenues as collateral to secure financing from private lenders. In the event of financial distress, the debt holders have recourse only to the project assets in place at that time.

Projected area: The net south-facing glazing area projected on a vertical plane. ***OR,*** also, the solid area covered at any instant by a wind turbine's blades from the perspective of the direction of the windstream (as opposed to the swept area).

Project-financed pipeline: pipeline funded by pledging only cash flow generated by the pipeline expected revenues to cover the principal and interest on the debt.

Propane: A hydrocarbon gas, C_3H_8, occurring in crude oil, natural gas, and refinery cracking gas. It is used as a fuel, a solvent, and a refrigerant. Propane liquefies under pressure and is the major component of liquefied petroleum gas (LPG).

Propane-air: A mixture of propane and air resulting in a gaseous fuel suitable for pipeline distribution.

Propeller (Hydro) Turbine: A turbine that has a runner with attached blades similar to a propeller used to drive a ship. As water passes over the curved propeller blades, it causes rotation of the shaft.

Proppant: Sand or man-made, sand-sized particles pumped into a formation during a hydraulic fracturing treatment to keep fractures open so that oil and natural gas can flow through the fractures to the wellbore.

Proved developed reserves: Proved reserves that can be expected to be recovered through existing wells with existing equipment and operating methods or in which the cost of the required equipment is relatively minor compared to the cost of a new well.

Proved Reserves - The quantity of oil and natural gas estimated to be recoverable from known fields under existing economic and operating conditions. This is determined on the basis of drilling results, production and historical trends.

Proved reserves: Proved oil and gas reserves are those quantities of oil and gas which, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be economically producible –

as defined by the U.S. Securities and Exchange Commission regulations and the ConocoPhillips Policy for Reserves Estimation, Accounting and Reporting.

Proximate Analysis: A commonly used analysis for reporting fuel properties; may be on a dry (moisture free) basis, as "fired", or on an ash and moisture free basis. Fractions usually reported include: volatile matter, fixed carbon, moisture, ash, and heating value (higher heating value).

PSI: Pounds of pressure per square inch.

PSIA: Pounds/force per square inch absolute.

PSIG: Pounds/force per square inch gauge.

Psychrometer: An instrument for measuring relative humidity by means of wet and dry-bulb temperatures.

Psychrometrics: The analysis of atmospheric conditions, particularly moisture in the air.

P-type semiconductor: A semiconductor in which holes carry the current; produced by doping an intrinsic semiconductor with an electron acceptor impurity (e.g., boron in silicon).

Public Utilities Regulatory Policy Act (PURPA) OF 1978: A law that requires electric utilities to purchase electricity produced from qualifying power producers that use renewable energy resources or are cogenerators. Power providers are required to purchase power at a rate equal to the avoided cost of generating the power themselves. (See Avoided Costs and Qualifying Facility)

Public Utility Holding Company Act (**PUHCA**) **of 1935**: A law to protect consumers and investors. It placed geographic restrictions on mergers and limitations on diversification into non-utility lines of business and takeovers of electric and gas utilities, and also established regulated monopoly markets or service territories for utilities.

Public Utility OR Services Commissions (PUC or PSC): These are state government agencies responsible for the regulation of public utilities within a state or region. A state legislature oversees the PUC by reviewing changes to power generator laws, rules and regulations and approving the PUC's budget. The commission usually has five Commissioners appointed by the Governor or legislature. PUCs typically regulate: electric, natural gas, water, sewer, telephone services, trucks, buses, and taxicabs within the commission's operating region. The PUC tries to balance the interests of consumers, environmentalists, utilities, and stockholders. The PUC makes sure a region's citizens are supplied with adequate, safe power provider service at reasonable rates.

Pulse-Width-Modulated (PWM) Wave Inverter: A type of power inverter that produce a high quality (nearly sinusoidal) voltage, at minimum current harmonics.

Pumped Storage Facility: A type of power generating facility that pumps water to a storage reservoir during off-peak periods, and uses the stored water (by allowing it to fall through a hydro turbine) to generate power during peak periods. The pumping energy is typically supplied by lower cost base power capacity, and the peaking power capacity is of greater value, even though there is a net loss of power in the process.

PV: See photovoltaic(s).

Pyranometer: A device used to measure total incident solar radiation (direct beam, diffuse, and reflected radiation) per unit time per unit area. ***OR,*** An instrument used for measuring global solar irradiance.

Pyrheliometer: An instrument used for measuring direct beam solar irradiance (radiation). Uses an aperture of 5.7° to transcribe the solar disc.

Pyrolysis: The transformation on a compound or material into one or more substances by heat alone (without oxidation). Often called destructive distillation. Pyrolysis of biomass is the thermal degradation of the material in the absence of reacting gases, and occurs prior to or simultaneously with gasification reactions in a gasifier. Pyrolysis products consist of gases, liquids, and char generally. The liquid fraction of pyrolisized biomass consists of an insoluble viscous tar, and pyroligneous acids (acetic acid, methanol, acetone, esters, aldehydes, and furfural). The distribution of pyrolysis products varies depending on the feedstock composition, heating rate, temperature, and pressure.

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QUAD: One quadrillion Btu. (1,000,000,000,000,000 Btu)

Qualification test: A procedure applied to a selected set of photovoltaic modules involving the application of defined electrical, mechanical, or thermal stress in a prescribed manner and amount. Test results are subject to a list of defined requirements.

Qualifying Facility: A category of electric power producer established under the Public Utility Regulatory Policy Act (PURPA) of 1978, that includes small-power producers (SPP) who use renewable sources of energy such as biomass, geothermal, hydroelectricity, solar (thermal and photovoltaic), and wind, or cogenerators who produce both heat and electricity using any type of fuel. PURPA requires utilities to purchase electricity from these power producers at a rate approved by a state utility regulatory agency under Federal guidelines. PURPA also requires power providers to sell electricity to these producers. Some states have developed their own programs for SPPs and utilities.

Quantum efficiency (QE): The ratio of the number of charge carriers collected by a photovoltaic cell to the number of photons of a given energy shining on the cell. Quantum efficiency relates to the response of a solar cell to the different wavelengths in the spectrum of light shining on the cell. QE is given as a function of either wavelength or energy. Optimally, a solar cell should generate considerable electrical current for wavelengths that are most abundant in sunlight.

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Radiant Barrier: A thin, reflective foil sheet that exhibits low radiant energy transmission and under certain conditions can block radiant heat transfer; installed in attics to reduce heat flow through a roof assembly into the living space.

Radiant Ceiling Panels: Ceiling panels that contain electric resistance heating elements embedded within them to provide radiant heat to a room.

Radiant Energy: Energy that transmits away from its source in all directions.

Radiant Floor: A type of radiant heating system where the building floor contains channels or tubes through which hot fluids such as air or water are circulated. The whole floor is evenly heated. Thus, the room heats from the bottom up. Radiant floor heating eliminates the draft and dust problems associated with forced air heating systems.

Radiant Heating System: A heating system where heat is supplied (radiated) into a room by means of heated surfaces, such as electric resistance elements, hot water (hydronic) radiators, etc.

Radiation: The transfer of heat through matter or space by means of electromagnetic waves.

Radiative Cooling: The process of cooling by which a heat absorbing media absorbs heat from one source and radiates the heat away.

Radiator Vent: A device that releases pressure within a radiator when the pressure inside exceeds the operating limits of the vent.

Radiator: A room heat delivery (or exchanger) component of a hydronic (hot water or steam) heating system; hot water or steam is delivered to it by natural convection or by a pump from a boiler.

Radioactive Waste: Materials left over from making nuclear energy. Radioactive waste can living organisms if it is not stored safely.

Radon: A naturally occurring radioactive gas found in the U.S. in nearly all types of soil, rock, and water. It can migrate into most buildings. Studies have linked high concentrations of radon to lung cancer.

Rafter: A construction element used for ceiling support.

Rammed Earth: A construction material made by compressing earth in a form; used traditionally in many areas of the world and widely throughout North Africa and the Middle East.

Ramp rate: The ability of a generating unit to change its output over some unit of time, often measured in MW/min.

Ramp: A change in generation output.

Rankine cycle: A thermodynamic cycle used in steam turbines to convert heat energy into work. Concentrating solar power plants often rely on the Rankine cycle. In CSP systems, mirrors focus sunlight on a heat-transfer fluid. This is used to create steam, which spins a turbine to generate electricity. ***OR,*** The thermodynamic cycle that is an ideal standard for comparing performance of heat-engines, steam power plants, steam turbines, and heat pump systems that use a condensable vapor as the working fluid; efficiency is measured as work done divided by sensible heat supplied.

Rate Schedule: A mechanism used by electric utilities to determine prices

for electricity; typically defines rates according to amounts of power demanded/consumed during specific time periods.

Rated battery capacity: The term used by battery manufacturers to indicate the maximum amount of energy that can be withdrawn from a battery under specified discharge rate and temperature. See also battery capacity.

Rated Life: The length of time that a product or appliance is expected to meet a certain level of performance under nominal operating conditions; in a luminaire, the period after which the lumen depreciation and lamp failure is at 70% of its initial value.

Rated module current (A): The current output of a photovoltaic module measured at standard test conditions of 1,000 w/m2 and 25°C cell temperature.

Rated power: The power output of a device under specific or nominal operating conditions. ***OR,*** Rated power of the inverter. However, some units cannot produce rated power continuously. See also duty rating.

Ratio of specific heats: for gases, it is the ratio of the specific heat at constant pressure to the specific heat at constant volume. The ratio is important in thermodynamic equations, such as compressor horsepower calculations, and is given the symbol k where k = Cp/Cv. The ratio k lies between 1.2 and 1.4 for most gases.

Rayleigh Frequency Distribution: A mathematical representation of the frequency or ratio that specific wind speeds occur within a specified time interval.

Reactive power: The electrical power that oscillates between the magnetic field of an inductor and the electrical field of a capacitor. Reactive power is never converted to non-electrical power. Calculated as the square root of the difference between the square of the kilovolt-amperes and the square of the kilowatts. Expressed as reactive volt-amperes. ***OR,*** The sine of the phase angle between the current and voltage waveforms in an alternating current system. See also power factor.

Real Price: The unit price of a good or service estimated from some base year in order to provide a consistent means of comparison.

Real specific gravity: the density ratio between a gas and air determined by measurement at the same temperature and pressure.

Reasonable certainty: A high degree of certainty. Much more likely to be achieved than not.

REC (regional electricity company): term used in the UK to describe electricity-distribution companies.

Receipts: Deliveries of fuel to an electric plant; purchases of fuel; all revenues received by an exporter for the reported quantity exported.

Receiver: The component of a central receiver solar thermal system where reflected solar energy is absorbed and converted to thermal energy.

Receiving Terminal: Coastal plant that accepts deliveries of liquefied natural gas and processes it back into gaseous form for injection into the pipeline system. Also known as regasification terminal.

Recirculated Air: Air that is returned from a heated or cooled space, reconditioned and/or cleaned, and returned to the space.

Recirculation Systems: A type of solar heating system that circulate warm water from storage through the collectors and exposed piping whenever freezing conditions occur; obviously a not very efficient system when operating in this mode.

Recombination: The action of a free electron falling back into a hole. Recombination processes are either radiative, where the energy of recombination results in the emission of a photon, or nonradiative, where the energy of recombination is given to a second electron which then relaxes back to its original energy by emitting phonons. Recombination can take place in the bulk of the semiconductor, at the surfaces, in the junction region, at defects, or between interfaces.

Recompletion: The process of entering an existing wellbore and performing work designed to establish production from a new zone.

Recordable cases: As related to health, safety and environment (HSE), recordable cases include occupational death, nonfatal occupational illness and those nonfatal occupational injuries which involve one or more of the following: loss of consciousness, restriction of work or motion, transfer to another job or medical treatment (other than first aid).

Recoverable gas reserves: the quantity of natural gas determined to be economically recoverable from a reservoir or reservoirs over a specific period of time.

Rectifier: An electrical device for converting alternating current to direct

current. The chamber in a cooling device where water is separated from the working fluid (for example ammonia). See also inverter.

Recuperator: A heat exchanger in which heat is recovered from the products of combustion.

Recurrent Costs: Costs that are repetitive and occur when an organization produces similar goods or services on a continuing basis.

Recycling: The process of converting materials that are no longer useful as designed or intended into a new product.

Refill Season: Typically begins in April and lasts through the end of September.

Refinery Gas: Non-condensate gas collected in petroleum refineries.

Reflectance: The amount (percent) of light that is reflected by a surface relative to the amount that strikes it.

Reflective Coatings: Materials with various qualities that are applied to glass windows before installation. These coatings reduce radiant heat transfer through the window and also reflects outside heat and a portion of the incoming solar energy, thus reducing heat gain. The most common type has a sputtered coating on the inside of a window unit. The other type is a durable "hard-coat" glass with a coating, baked into the glass surface.

Reflective Glass: A window glass that has been coated with a reflective film and is useful in controlling solar heat gain during the summer.

Reflective Insulation (*see also* **Radiant Barrier**): An aluminum foil fabricated insulator with backings applied to provide a series of closed air spaces with highly reflective surfaces.

Reflective Window Films: A material applied to window panes that controls heat gain and loss, reduces glare, minimizes fabric fading, and provides privacy. These films are retrofitted on existing windows.

Reflector Lamps: A type of incandescent lamp with an interior coating of aluminum that reflects light to the front of the bulb. They are designed to spread light over specific areas.

Refraction: The change in direction of a ray of light when it passes through one media to another with differing optical densities.

Refrigerant: The compound (working fluid) used in air conditioners, heat pumps, and refrigerators to transfer heat into or out of an interior space. This fluid boils at a very low temperature enabling it to evaporate and absorb heat.

Refrigeration Capacity: A measure of the effective cooling capacity of a refrigerator, expressed in Btu per hour or in tons, where one (1) ton of capacity is equal to the heat required to melt 2,000 pounds of ice in 24 hours or 12,000 Btu per hour.

Refrigeration Cycle: The complete cycle of stages (evaporation and condensation) of refrigeration or of the refrigerant.

Refrigeration: The process of the absorption of heat from one location and its transfer to another for rejection or recuperation.

Refuse-Derived Fuel (**RDF**): A solid fuel produced by shredding municipal solid waste (MSW). Noncombustible materials such as glass and metals are generally removed prior to making RDF. The residual material is sold as-is or compressed into pellets, bricks, or logs. RDF processing facilities are typically located near a source of MSW, while the RDF combustion facility can be located elsewhere. Existing RDF facilities process between 100 and 3,000 tons per day.

Regasification plant: a plant that accepts deliveries of liquefied natural gas and vapourises it back to its gaseous form by applying heat so that the gas can be delivered into a pipeline system.

Regenerative Cooling: A type of cooling system that uses a charging and discharging cycle with a thermal or latent heat storage subsystem.

Regenerative Heating: The process of using heat that is rejected in one part of a cycle for another function or in another part of the cycle.

Regulation: the governmental function of controlling or directing economic entities through the process of rulemaking and adjudication; a rule or law established by the federal or state government that sets procedures.

Regulator: Prevents overcharging of batteries by controlling charge cycle-usually adjustable to conform to specific battery needs.

Regulatory out clause: a contractual provision whereby a party is excused from performance because of the actions of a jurisdictional regulatory agency.

Relamping: The replacement of a non-functional or ineffective lamp with a new, more efficient lamp.

Relative Humidity: A measure of the percent of moisture actually in the air compared with what would be in it if it were fully saturated at that

temperature. When the air is fully saturated, its relative humidity is 100 percent.

Reliability: This is the concept of how long a device or process can operate properly without needing maintenance or replacement. ***OR,*** A measure, expressed as a percentage, of the time (excluding routine maintenance time) a facility (for example, process plant, pipeline, transmission line or generating unit) is capable of providing service.

Remote gas: natural gas in fields where infrastructure for transportation of gas is some distance away, making production of the gas field more complex. See *Stranded gas*

Remote systems: see *Stand-Alone Systems*.

Renewable Energy: Energy derived from resources that are regenerative or for all practical purposes cannot be depleted. Types of renewable energy resources include moving water (hydro, tidal and wave power), thermal gradients in ocean water, biomass, geothermal energy, solar energy, and wind energy. Municipal solid waste (MSW) is also considered to be a renewable energy resource.

Repressuring: The injection of gas into oil or gas formations to effect greater ultimate recovery.

Reserve capacity: The amount of generating capacity a central power system must maintain to meet peak loads.

Reserves to production ratio (R/P): an estimate used to project the productive life of an oil or gas field (or company) based upon the size of the field compared with the annual production capacity.

Reserves: Estimated remaining quantities of oil and gas and related substances anticipated to be economically producible, as of a given date, by application of development projects to known accumulations. In addition, there must exist, or there must be a reasonable expectation that there will exist, the legal right to produce or a revenue interest in production, installed means of delivering oil and gas or related substances to market and all permits and financing required to implement the project.

Reservoir: A porous and permeable underground formation containing a natural accumulation of producible oil and/or gas that is confined by impermeable rock or water barriers and is individual and separate from other reservoirs.

Residential Consumption: Gas used in private dwellings, including apartments, for heating, air-conditioning, cooking, water heating, and other household uses.

Residue gas: that portion of the natural gas stream that remains after the extraction of ethane and heavier liquids and liquefiable hydrocarbons, and impurities during processing, minus fuel, incidental losses, by-passed natural gas and natural gas reserved by a seller under a gas purchase agreement.

Resistance (R): The property of a conductor, which opposes the flow of an electric current resulting in the generation of heat in the conducting material. The measure of the resistance of a given conductor is the electromotive force needed for a unit current flow. The unit of resistance is ohms. ***OR,*** The inherent characteristic of a material to inhibit the transfer of energy. In electrical conductors, electrical resistance results in the generation of heat. Electrical resistance is measured in Ohms. The heat transfer resistance properties of insulation products are quantified as the R-value.

Resistance Heating: A type of heating system that provides heat from the resistance of an electrical current flowing through a conductor.

Resistive voltage drop: The voltage developed across a cell by the current flow through the resistance of the cell.

Resistor: An electrical device that resists electric current flow.

Resource Recovery: The process of converting municipal solid waste to energy and/or recovering materials for recycling.

Resources: Quantities of oil and gas estimated to exist in naturally occurring accumulations. A portion of the resources may be estimated to be recoverable, and another portion may be considered to be unrecoverable. Resources include both discovered and undiscovered accumulations.

Restructuring: The process of changing the structure of the electric power industry from one of guaranteed monopoly over service territories, as established by the Public Utility Holding Company Act of 1935, to one of open competition between power suppliers for customers in any area.

Retail Wheeling: A term for the process of transmitting electricity over transmission lines not owned by the supplier of the electricity to a

retail customer of the supplier. With retail wheeling, an electricity consumer can secure their own supply of electricity from a broker or directly from the generating source. The power is then wheeled at a fixed rate, or at a regulated "non-discriminatory" rate set by a utility commission.

Retrofit: The process of modifying a building's structure.

Return Air: Air that is returned to a heating or cooling appliance from a heated or cooled space.

Return Duct: The central heating or cooling system contains a fan that gets its air supply through these ducts, which ideally should be installed in every room of the house. The air from a room will move towards the lower pressure of the return duct.

Return on capital employed (ROCE): ROCE is a measure of the profitability of a company's capital employed in its business compared with that of its peers. ROCE is calculated as a ratio, with the numerator of net income plus after-tax interest expense and the denominator of average total equity plus total debt. The net income is adjusted for nonoperational or special items impacts.

Reverse current protection: Any method of preventing unwanted current flow from the battery to the photovoltaic array (usually at night). See also blocking diode.

Reverse Thermo-siphoning: When heat seeks to flow from a warm area (e.g., heated space) to a cooler area, such as a solar air collector at night without a reverse flow damper.

Reversing Valve: A component of a heat pump that reverses the refrigerant's direction of flow, allowing the heat pump to switch from cooling to heating or heating to cooling.

R-Factor: See R-Value.

Ribbon (photovoltaic) cells: A type of photovoltaic device made in a continuous process of pulling material from a molten bath of photovoltaic material, such as silicon, to form a thin sheet of material.

Right of first refusal: process that allows any long-term firm gas-transportation customer, including formerly bundled city-gate sales customers, to continue receiving firm gas-transportation service by paying up to the maximum rate and matching the length of a term offered by another customer who is seeking service.

Rigid Insulation Board: An insulation product made of a fibrous material or plastic foams, pressed or extruded into board-like forms. It provides thermal and acoustical insulation strength with low weight, and coverage with few heat loss paths.

Rock Bin: A container that holds rock used as the thermal mass to store solar energy in a solar heating system.

Rock Wool: A type of insulation made from virgin basalt, an igneous rock, and spun into loose fill or a batt. It is fire resistant and helps with soundproofing.

Rollover clause: a contract clause that permits a contract to extend beyond the initial term.

Roof Pond: A solar energy collection device consisting of containers of water located on a roof that absorb solar energy during the day so that the heat can be used at night or that cools a building by evaporation at night.

Roof Ventilator: A stationary or rotating vent used to ventilate attics or cathedral ceilings; usually made of galvanized steel, or polypropylene.

Roof: A building element that provides protection against the sun, wind, and precipitation.

Root Mean Square (RMS): The square root of the average square of the instantaneous values of an ac output. For a sine wave the RMS value is 0.707 times the peak value. The equivalent value of alternating current, I, that will produce the same heating in a conductor with resistance, R, as a dc current of value I.

Rotor: An electric generator consists of an armature and a field structure. The armature carries the wire loop, coil, or other windings in which the voltage is induced, whereas the field structure produces the magnetic field. In small generators, the armature is usually the rotating component (rotor) surrounded by the stationary field structure (stator). In large generators in commercial electric power plants the situation is reversed. In a wind energy conversion device, the blades and rotating components.

Royalty - The share of production or proceeds reserved to a mineral owner under the terms of a mineral lease. Normally, royalty interests are free of all costs of production except production taxes and transportation costs. It is established in the lease by reserving a royalty which is

usually expressed as a fraction of production.

Run-of-River Hydropower: A type of hydroelectric facility that uses the river flow with very little alteration and little or no impoundment of the water.

Rural Electrification Administration (**REA**): An agency of the U.S. Dept. of Agriculture that makes loans to states and territories in the U.S. for rural electrification and the furnishing of electric energy to persons in rural areas who do not receive central station service. It also furnishes and improves electric and telephone service in rural areas, assists electric borrowers to implement energy conservation programs and on-grid and off-grid renewable energy systems, and studies the condition and progress of rural electrification.

R-Value: A measure of the capacity of a material to resist heat transfer. The R-Value is the reciprocal of the conductivity of a material (U-Value). The larger the R-value of a material, the greater its insulating properties.

S

Sacrificial anode: A piece of metal buried near a structure that is to be protected from corrosion. The metal of the sacrificial anode is intended to corrode and reduce the corrosion of the protected structure. ***OR,*** A metal rod placed in a water heater tank to protect the tank from corrosion. Anodes of aluminum, magnesium, or zinc are the more frequently metals. The anode creates a galvanic cell in which magnesium or zinc will be corroded more quickly than the metal of the tank giving the tank a negative charge and preventing corrosion.

Safety Disconnect: An electronic (automatic or manual) switch that disconnects one circuit from another circuit. These are used to isolate power generation or storage equipment from conditions such as voltage spikes or surges, thus avoiding potential damage to equipment.

Sale for resale: a sale of natural gas to a customer who will in turn sell that gas to someone else.

Sales and purchase agreement (SPA): a definitive contract between a seller and buyer for the sale and purchase of a quantity of natural gas or LNG for delivery during a specified period at a specified price. See *Annual delivery programme (ADP)* and *Heads of agreement (HOA)*.

Sales gas: natural gas treated and conditioned to meet gas purchaser specifications.

Salt Gradient Solar Ponds: Consist of three main layers. The top layer is near ambient and has low salt content. The bottom layer is hot, typically 160 F to 212 F (71 C to 100 C), and is very salty. The important gradient zone separates these zones. The gradient zone acts as a transparent insulator, permitting the sunlight to be trapped in the hot bottom layer (from which useful heat is withdrawn). This is because the salt gradient, which increases the brine density with depth, counteracts the buoyancy effect of the warmer water below (which would otherwise rise to the surface and lose its heat to the air). An organic Rankine cycle engine is used to convert the thermal energy to electricity.

Satellite power system (SPS): Concept for providing large amounts of electricity for use on the Earth from one or more satellites in geosynchronous Earth orbit. A very large array of solar cells on each satellite would provide electricity, which would be converted to microwave energy and beamed to a receiving antenna on the ground. There, it would be reconverted into electricity and distributed the same as any other centrally generated power, through a grid.

SCADA (**supervisory control and data acquisition**) system: a computerized automation system that brings together the following technologies: telemetry, telecontrol, supervisory control, and data acquisition, analysis and presentation. When a SCADA system is employed in an LNG process plant or pipeline, information from remote data gathering devices is made available to a central location. Moreover, information gathered can be used by a human operator as the basis for issuing commands to the remote locations.

SCF – Standard Cubic Feet

Scheduling: process by which nominations are first consolidated by receipt point and by contract, and verified with upstream and downstream parties. If the verified capacity is greater than or equal to the total nominated quantities, all nominated quantities are scheduled. If verified capacity is less than nominated quantities, nominated

quantities will be allocated according to scheduling priorities. ***OR,*** The general practice of ensuring that a generator is committed and available when needed. It also can refer to scheduling of imports or exports of energy into or out of a balancing area.

Schottky barrier: A cell barrier established as the interface between a semiconductor, such as silicon, and a sheet of metal.

Scribing: The cutting of a grid pattern of grooves in a semiconductor material, generally for the purpose of making interconnections.

Sealed battery: A battery with a captive electrolyte and a resealing vent cap, also called a valve-regulated battery. Electrolyte cannot be added.

Sealed Combustion Heating System: A heating system that uses only outside air for combustion and vents combustion gases directly to the outdoors. These systems are less likely to backdraft and to negatively affect indoor air quality.

Seasonal depth of discharge: An adjustment factor used in some system sizing procedures which "allows" the battery to be gradually discharged over a 30-90 day period of poor solar insolation. This factor results in a slightly smaller photovoltaic array.

Seasonal Energy Efficiency Ratio (**SEER**): A measure of seasonal or annual efficiency of a central air conditioner or air conditioning heat pump. It takes into account the variations in temperature that can occur within a season and is the average number of Btu of cooling delivered for every watt-hour of electricity used by the heat pump over a cooling season.

Seasonal Performance Factor (**SPF**): Ratio of useful energy output of a device to the energy input, averaged over an entire heating season.

Seasoned Wood: Wood, used for fuel, that has been air dried so that it contains 15 to 20 percent moisture content (wet basis).

Seaworthiness certificate: certificate issued by a classification society surveyor to allow a vessel to proceed after she has met with a mishap that may have affected her seaworthiness. It is frequently issued to enable a vessel to proceed, after temporary repairs have been effected, to another port where permanent repairs are then carried out.

Seaworthiness: statement on the condition of the vessel for the trade or service in which it is employed.

Second Law Efficiency: The ratio of the minimum amount of work or energy required to perform a task to the amount actually used.

Second Law of Thermodynamics: This law states that no device can completely and continuously transform all of the energy supplied to it into useful energy.

Secondary battery: A battery that can be recharged.

Secondary market: in the gas industry, this is the market for reselling unneeded pipeline-transportation capacity.

Seebeck Effect: The generation of an electric current, when two conductors of different metals are joined at their ends to form a circuit, with the two junctions kept at different temperatures.

Seismic - A tool for identifying underground accumulations of oil or natural gas by sending and measuring the return of energy or sound waves. It is a computer-assisted process that maps sedimentary structures to assist in planning drilling programs.

Selectable Load: Any device, such as lights, televisions, and power tools, which is plugged into your central power source and used only intermittently.

Selective Absorber: A solar absorber surface that has high absorbance at wavelengths corresponding to that of the solar spectrum and low emittance in the infrared range.

Selective Surface Coating: A material with high absorbance and low emittance properties applied to or on solar absorber surfaces.

Self-discharge: The rate at which a battery, without a load, will lose its charge.

Semiconductor: Any material that has a limited capacity for conducting an electric current. Certain semiconductors, including silicon, gallium arsenide, copper indium diselenide, and cadmium telluride, are uniquely suited to the photovoltaic conversion process.

Semicrystalline: See multicrystalline.

Senate Committee on Energy and Natural Resources: This committee has jurisdiction on: coal production, distribution and utilization; energy policy; energy research, conservation, and development; hydroelectric power; irrigation; mineral conservation; nonmilitary development of nuclear energy; solar energy systems; and over territorial possessions, including trusteeships of the United States.

Senate Subcommittee on Energy Research, Development, Production and Regulation: This committee has jurisdiction on the oversight and legislative responsibilities for: coal, nuclear, and non-nuclear energy commercialization projects; DOE National Laboratories; global climate change; new technologies research and development; commercialization of new technologies including, solar energy systems; Federal energy conservation programs; energy information; and power provider policy.

Send-out capacity: the volume of natural gas that can be converted by a liquefaction facility and subsequently shipped over a specified period of time.

Sensible Cooling Effect: The difference between the total cooling effect and the dehumidifying effect.

Sensible Cooling Load: The interior heat gain due to heat conduction, convection, and radiation from the exterior into the interior, and from occupants and appliances.

Sensible Heat Storage: A heat storage system that uses a heat storage medium, and where the additional or removal of heat results in a change in temperature.

Sensible Heat: The heat absorbed or released when a substance undergoes a change in temperature.

Separator: a vessel used to separate a multiphase mixture of fluids into its separate phases, for example, vapour, oil, water, solids.

Series: A configuration of an electrical circuit in which the positive lead is connected to the negative lead of another energy producing, conducting, or consuming device. The voltages of each device are additive, whereas the current is not.

Series Connection: A way of joining photovoltaic cells by connecting positive leads to negative leads; such a configuration increases the voltage.

Series controller: A charge controller that interrupts the charging current by open-circuiting the photovoltaic (PV) array. The control element is in series with the PV array and battery.

Series regulator: Type of battery charge regulator where the charging current is controlled by a switch connected in series with the photovoltaic module or array.

Series resistance: Parasitic resistance to current flow in a cell due to mechanisms such as resistance from the bulk of the semiconductor material, metallic contacts, and interconnections.

Setback Thermostat: A thermostat that can be set to automatically lower temperatures in an unoccupied house and raise them again before the occupant returns.

Shading Coefficient: A measure of window glazing performance that is the ratio of the total solar heat gain through a specific window to the total solar heat gain through a single sheet of double-strength glass under the same set of conditions; expressed as a number between 0 and 1.

Shale Gas: Methane and other gases produced from wells that are open to shale or similar fine grained rocks. Shale gas is generated from organic matter present within the shale reservoir.

Shale: A very fine-grained sedimentary rock that is formed by the consolidation of clay, mud or silt and that usually has a finely stratified or laminated structure. Certain shale formations, such as the Eagle Ford and the Barnett, contain large amounts of oil and natural gas.

Shallow-cycle battery: A battery with small plates that cannot withstand many discharges to a low state-of-charge.

Sheathing: A construction element used to cover the exterior of wall framing and roof trusses.

Shelf life of batteries: The length of time, under specified conditions, that a battery can be stored so that it keeps its guaranteed capacity.

Ship-or-pay clause: contract clause requiring payment for the transportation of the natural gas even in case the natural gas is not transported.

Shipper: any gas-market participant that holds a contract to transport gas on a pipeline or local distribution company.

Short Circuit Current: The current flowing freely through an external circuit that has no load or resistance; the maximum current possible.

Short Circuit: An electric current taking a shorter or different path than intended.

Short-circuit current (Isc): The current flowing freely through an external circuit that has no load or resistance; the maximum current possible.

Short-term supplies: natural gas purchases usually involving 30-day, short-term contract or spot gas.

Shrinkage: the reduction in volume of wet natural gas caused by the removal of natural gas liquids, hydrogen sulphide, carbon dioxide, water vapour and other impurities from the gas.

Shunt controller: A charge controller that redirects or shunts the charging current away from the battery. The controller requires a large heat sink to dissipate the current from the short-circuited photovoltaic array. Most shunt controllers are for smaller systems producing 30 amperes or less.

Shunt Load: An electrical load used to safely use excess generated power when not needed for its primary uses. A shunt load in a residential photovoltaic system might be domestic water heating, such that when power is not needed for typical building loads, such as operating lights or running HVAC system fans and pumps, it still provides value and is used in a constructive, safe manner.

Shunt regulator: Type of a battery charge regulator where the charging current is controlled by a switch connected in parallel with the photovoltaic (PV) generator. Shorting the PV generator prevents overcharging of the battery.

Shut In Well - A well which is producing or capable of producing but is not produced. Reasons for wells being shut in may be lack of pipeline access to market or economically unfavorable market prices.

Shutter: An interior or exterior movable panel that operates on hinges or slides into place, used to protect windows or provide privacy.

Siding: A construction element applied to the outermost surface of an exterior wall.

Siemens process: A commercial method of making purified silicon.

Sigma Heat: The sum of sensible heat and latent heat in a substance above a base temperature, typically 32 degrees Fahrenheit.

Silicon (Si): A semi-metallic chemical element, of atomic number 14, that makes an excellent semiconductor material for photovoltaic devices; commonly found in sand. It crystallizes in face-centered cubic lattice like a diamond. It's commonly found in sand and quartz (as the oxide).

Simple Cs (Caulk and Seal): A technique for insulating and sealing exterior walls that reduces vapor diffusion through air leakage points by installing pre-cut blocks of rigid foam insulation over floor joists, sheet subfloor, and top plates before drywall is installed.

Sine wave inverter: An inverter that produces utility-quality, sine wave power forms.

Sine wave: A waveform corresponding to a single-frequency periodic oscillation that can be mathematically represented as a function of amplitude versus angle in which the value of the curve at any point is equal to the sine of that angle. ***OR,*** The type of alternative current generated by alternating current generators, rotary inverters, and solid-state inverters.

Single Glaze Or Pane: One layer of glass in a window frame. It has very little insulating value (R-1) and provides only a thin barrier to the outside and can account for considerable heat loss and gain.

Single-Crystal Material: In reference to solar photovoltaic devices, a material that is composed of a single crystal or a few large crystals.

Single-crystal silicon: Material with a single crystalline formation. Many photovoltaic cells are made from single-crystal silicon.

Single-Package System: A year 'round heating and air conditioning system that has all the components completely encased in one unit outside the home. Proper matching of components can mean more energy-efficient operation compared to components purchased separately.

Single-Phase: A generator with a single armature coil, which may have many turns and the alternating current output consists of a succession of cycles.

Single Point Mooring (SPM): A Single buoy mooring (**SBM**) (also known as single-point mooring or SPM) is a loading buoy anchored offshore, that serves as a mooring point and interconnect for tankers loading or offloading gas or liquid products. SPMs are the link between geostatic subsea manifold connections and weathervaning tankers.

Single-stage controller: A charge controller that redirects all charging current as the battery nears full state-of-charge.

Sizing: The process of designing a solar system to meet a specified load given the solar resource and the nominal or rated energy output of the solar energy collection or conversion device.

Skylight: A window located on the roof of a structure to provide interior building spaces with natural daylight, warmth, and ventilation.

Slab On Grade: A slab floor that sits directly on top of the surrounding

ground.

Slab: A concrete pad that sits on gravel or crushed rock, well-compacted soil either level with the ground or above the ground.

Slinky™ Ground Loop: In this type of closed-loop, horizontal geothermal heat pump installation, the fluid-filled plastic heat exchanger pipes are coiled like a Slinky™ to allow more pipe in a shorter trench. This type of installation cuts down on installation costs and makes horizontal installation possible in areas it would not be with conventional horizontal applications. Also see **closed-loop geothermal heat pump systems**.

Smart grid: An intelligent electric power system that regulates the two-way flow of electricity and information between power plants and consumers to control grid activity.

Smart Window: A term used to describe a technologically advanced window system that contains glazing that can change or switch its optical qualities when a low voltage electrical signal is applied to it, or in response to changes in heat or light.

Social Life Cycle Analysis (S-LCA): A methodology for assessing internalities and externalities of the production of goods and services based on social and socioeconomic indicators.

Sodium Lights: A type of high intensity discharge light that has the most lumens per watt of any light source.

Soffit: A panel which covers the underside of an roof overhang, cantilever, or mansard.

Soft costs: Non-hardware costs related to PV systems, such as financing, permitting, installation, interconnection, and inspection.

Solar Access Or Rights: The legal issues related to protecting or ensuring access to sunlight to operate a solar energy system, or use solar energy for heating and cooling.

Solar Air Heater: A type of solar thermal system where air is heated in a collector and either transferred directly to the interior space or to a storage medium, such as a rock bin.

Solar Altitude Angle: The angle between a line from a point on the earth's surface to the center of the solar disc, and a line extending horizontally from the point.

Solar Array: A group of solar collectors or solar modules connected together.

Solar Azimuth: The angle between the sun's apparent position in the sky and true south, as measured on a horizontal plane.

Solar cell: A solar photovoltaic device with a specified area. See photovoltaic (PV) cell.

Solar Collector: A device used to collect, absorb, and transfer solar energy to a working fluid. Flat plate collectors are the most common type of collectors used for solar water or pool heating systems. In the case of a photovoltaics system, the solar collector could be crystalline silicon panels or thin-film roof shingles, for example.

Solar constant: The average amount of solar radiation that reaches the earth's upper atmosphere on a surface perpendicular to the sun's rays; equal to 1353 watts per square meter or 492 Btu per square foot.

Solar Cooling: The use of solar thermal energy or solar electricity to power a cooling appliance. There are five basic types of solar cooling technologies: absorption cooling, which can use solar thermal energy to vaporize the refrigerant; desiccant cooling, which can use solar thermal energy to regenerate (dry) the desiccant; vapor compression cooling, which can use solar thermal energy to operate a Rankine-cycle heat engine; and evaporative coolers ("swamp" coolers), and heat-pumps and air conditioners that can by powered by solar photovoltaic systems.

Solar Declination: The apparent angle of the sun north or south of the earth's equatorial plane. The earth's rotation on its axis causes a daily change in the declination.

Solar Distillation: The process of distilling (purifying) water using solar energy. Water can be placed in an air tight solar collector with a sloped glazing material, and as it heats and evaporates, distilled water condenses on the collector glazing, and runs down where it can be collected in a tray.

Solar energy: Electromagnetic energy transmitted from the sun (solar radiation). The amount that reaches the earth is equal to one billionth of total solar energy generated, or the equivalent of about 420 trillion kilowatt-hours.

Solar Energy Collector: See **solar collector**.

Solar Energy Industries Association (**SEIA**): A national trade association

of solar energy equipment manufacturers, retailers, suppliers, installers, and consultants.

Solar Energy Research Institute (**SERI**): A federally funded institute, created by the Solar Energy Research, Development and Demonstration Act of 1974, that conducted research and development of solar energy technologies. Became the National Renewable Energy Laboratory (**NREL**) in 1991.

Solar Film: A window glazing coating, usually tinted bronze or gray, used to reduce building cooling loads, glare, and fabric fading.

Solar Fraction: The percentage of a building's seasonal energy requirements that can be met by a solar energy device(s) or system(s).

Solar Furnace: A device that achieves very high temperatures by the use of reflectors to focus and concentrate sunlight onto a small receiver.

Solar Gain: The amount of energy that a building absorbs due to solar energy striking its exterior and conducting to the interior or passing through windows and being absorbed by materials in the building.

Solar insolation: See insolation.

Solar Irradiation: The amount of solar radiation, both direct and diffuse, received at any location. See irradiance.

Solar Mass: A term used for materials used to absorb and store solar energy.

Solar Module (Panel): A solar photovoltaic device that produces a specified power output under defined test conditions, usually composed of groups of solar cells connected in series, in parallel, or in series-parallel combinations.

Solar noon: The time of the day, at a specific location, when the sun reaches its highest, apparent point in the sky. ***OR,*** Equal to true or due, geographic south.

Solar One: A solar thermal electric central receiver power plant ("power tower") located in Barstow, California, and completed in 1981. The Solar One had a design capacity of 10,000 peak kilowatts, and was composed of a receiver located on the top of a tower surrounded by a field of reflectors. The concentrated sunlight created steam to drive a steam turbine and electric generator located on the ground.

Solar panel: See photovoltaic (PV) panel. See **Photovoltaic Module**

Solar Pond: A body of water that contains brackish (highly saline) water that forms layers of differing salinity (stratifies) that absorb and trap solar energy. Solar ponds can be used to provide heat for industrial or agricultural processes, building heating and cooling, and to generate electricity.

Solar Power Satellite: A solar power station investigated by NASA that entailed a satellite in geosynchronous orbit that would consist of a very large array of solar photovoltaic modules that would convert solar generated electricity to microwaves and beam them to a fixed point on the earth.

Solar Radiation: A general term for the visible and near visible (ultraviolet and near-infrared) electromagnetic radiation that is emitted by the sun. It has a spectral, or wavelength, distribution that corresponds to different energy levels; short wavelength radiation has a higher energy than long-wavelength radiation.

Solar resource: The amount of solar insolation a site receives, usually measured in kWh/m2/day, which is equivalent to the number of peak sun hours.

Solar Simulator: An apparatus that replicates the solar spectrum, and used for testing solar energy conversion devices.

Solar Space Heater: A solar energy system designed to provide heat to individual rooms in a building.

Solar Spectrum: The total distribution of electromagnetic radiation emanating from the sun. The different regions of the solar spectrum are described by their wavelength range. The visible region extends from about 390 to 780 nanometers (a nanometer is one billionth of one meter). About 99 percent of solar radiation is contained in a wavelength region from 300 nm (ultraviolet) to 3,000 nm (near-infrared). The combined radiation in the wavelength region from 280 nm to 4,000 nm is called the broadband, or total, solar radiation.

Solar thermal electric systems: Solar energy conversion technologies that convert solar energy to electricity, by heating a working fluid to power a turbine that drives a generator. Examples of these systems include central receiver systems, parabolic dish, and solar trough.

Solar Thermal Parabolic Dishes: A solar thermal technology that uses a modular mirror system that approximates a parabola and incorporates two-axis tracking to focus the sunlight onto receivers

located at the focal point of each dish. The mirror system typically is made from a number of mirror facets, either glass or polymer mirror, or can consist of a single stretched membrane using a polymer mirror. The concentrated sunlight may be used directly by a Stirling, Rankine, or Brayton cycle heat engine at the focal point of the receiver or to heat a working fluid that is piped to a central engine. The primary applications include remote electrification, water pumping, and grid-connected generation.

Solar Thermal Systems: Solar energy systems that collect or absorb solar energy for useful purposes. Can be used to generate high temperature heat (for electricity production and/or process heat), medium temperature heat (for process and space/water heating and electricity generation), and low temperature heat (for water and space heating and cooling).

Solar Time: The period marked by successive crossing of the earth's meridian by the sun; the hour angle of the sun at a point of observance (apparent time) is corrected to true (solar) time by taking into account the variation in the earth's orbit and rate of rotation. Solar time and local standard time are usually different for any specific location.

Solar Transmittance: The amount of solar energy that passes through a glazing material, expressed as a percentage.

Solar Trough Systems (*see also* **Parabolic Trough):** A type of solar thermal system where sunlight is concentrated by a curved reflector onto a pipe containing a working fluid that can be used for process heat or to produce electricity. The world's largest solar thermal electric power plants use solar trough technology. They are located in California, and have a combined electricity generating capacity of 240,000 kilowatts.

Solar Two: Solar Two is a retrofit of the Solar One project (see above). It is demonstrating the technical feasibility and power potential of a solar power tower using advanced molten-salt technology to store energy. Solar Two retains several of the main components of Solar One, including the receiver tower, turbine, generator, and the 1,818 heliostats.

Solar-grade silicon: Intermediate-grade silicon used in the manufacture of solar cells. Less expensive than electronic-grade silicon.

Solarium: A glazed structure, such as greenhouse or "sunspace."

Solenoid Valve: An automatic valve that is opened or closed by an electromagnet.

Solenoid: An electromechanical device composed of a coil of wire wound around a cylinder containing a bar or plunger, that when a current is applied to the coil, the electromotive force causes the plunger to move; a series of coils or wires used to produce a magnetic field.

Solid Fuels: Any fuel that is in solid form, such as wood, peat, lignite, coal, and manufactured fuels such as pulverized coal, coke, charcoal, briquettes, pellets, etc.

Solidity: In reference to a wind energy conversion device, the ratio of rotor blade surface area to the frontal, swept area that the rotor passes through.

Solstice: The two times of the year when the sun is apparently farthest north and south of the earth's equator; usually occurring on or around June 21 (summer solstice in northern hemisphere, winter solstice for southern hemisphere) and December 21 (winter solstice in northern hemisphere, summer solstice for the southern hemisphere).

Sound Blanket - A sound blanket or a wall sometimes erected in order to reduce the noise emitted from a drilling rig.

Sour gas: natural gas that contains significant amounts of hydrogen sulphide (H_2S) (usually greater than 16 ppm) and possibly other objectionable sulphur compounds (mercaptans, carbonyl sulphide). Also called *acid gas*.

Space charge: See cell barrier.

Space Heater: A movable or fixed heater used to heat individual rooms.

Spacer (Window): Strips of material used to separate multiple panes of glass within the windows.

Spacing - The distance between wells allowed by a regulatory body. Spacing is based on what is deemed to be the amount of acreage that can be efficiently and economically drained by a well. ***OR,*** the distance between wells producing from the same reservoir. Spacing is often expressed in terms of acres (e.g. 80-acre spacing) and is often established by regulatory agencies.

Specific gravity: The ratio of the weight of the solution to the weight of an equal volume of water at a specified temperature. Used as an indicator

of battery state-of-charge. ***OR,*** specified physical conditions. As applied to gas, air is the reference substance: the ratio of the density of a substance to the density of a reference substance, both at and the physical conditions are a specified temperature and atmospheric pressure.

Specific Heat Capacity: The quantity of heat required to change the temperature of one unit weight of a material by one degree.

Specific Heat: The amount of heat required to raise a unit mass of a substance through one degree, expressed as a ratio of the amount of heat required to raise an equal mass of water through the same range.

Specific Humidity: The weight of water vapor, per unit weight of dry air.

Specific Volume: The volume of a unit weight of a substance at a specific temperature and pressure.

Spectral Energy Distribution: A curve illustrating the variation or spectral irradiance with wavelength.

Spectral Irradiance: The monochromatic irradiance of a surface per unit bandwidth at a particular wavelength, usually expressed in Watts per square meter-nanometer bandwidth.

Spectral Reflectance: The ratio of energy reflected from a surface in a given waveband to the energy incident in that waveband.

Spectrally Selective Coatings: A type of window glazing films used to block the infrared (heat) portion of the solar spectrum but admit a higher portion of visible light.

Spectrum: see Solar Spectrum above.

Spillway: A passage for surplus water to flow over or around a dam.

Spinning reserve: Electric power plant or utility capacity on-line and running at low power in excess of actual load.

Split Spectrum Photovoltaic Cell: A photovoltaic device where incident sunlight is split into different spectral regions, with an optical apparatus, that are directed to individual photovoltaic cells that are optimized for converting that spectrum to electricity.

Split System Air Conditioner: An air conditioning system that comes in two to five pieces: one piece contains the compressor, condenser, and a fan; the others have an evaporator and a fan. The condenser, installed outside the house, connects to several evaporators, one in each room to be cooled, mounted inside the house. Each evaporator is individually controlled, allowing different rooms or zones to be cooled to varying degrees.

Split-spectrum cell: A compound photovoltaic device in which sunlight is first divided into spectral regions by optical means. Each region is then directed to a different photovoltaic cell optimized for converting that portion of the spectrum into electricity. Such a device achieves significantly greater overall conversion of incident sunlight into electricity. See also mulitjunction device.

Spot gas market: short-term buying and selling of natural gas.

Spot gas: natural gas that is available and purchased on a short-term basis and is furnished to customers on an as-available basis.

Spot voyage: a charter for a particular vessel to move a single cargo between specified loading port(s) and discharge port(s) in the immediate future.

Spray Pyrolysis: A deposition process whereby heat is used to break molecules into elemental sources that are then spray deposited on a substrate.

Spreader Stocker: A type of furnace in which fuel is spread, automatically or mechanically, across the furnace grate.

Spud - The commencement of drilling operations.

Sputtering: A process used to apply photovoltaic semi-conductor material to a substrate by a physical vapor deposition process where high-energy ions are used to bombard elemental sources of semiconductor material, which eject vapors of atoms that are then deposited in thin layers on a substrate.

Square wave inverter: A type of inverter that produces square wave output. It consists of a direct current source, four switches, and the load. The switches are power semiconductors that can carry a large current and withstand a high voltage rating. The switches are turned on and off at a correct sequence, at a certain frequency. *OR,* The square wave inverter is the simplest and the least expensive to purchase, but it produces the lowest quality of power.

Square wave: A waveform that has only two states, (i.e., positive or negative). A square wave contains a large number of harmonics.

Squirrel Cage Motor: This is another name for an induction motor. The motors consist of a rotor inside a stator. The rotor has laminated, thin

flat steel discs, stacked with channels along the length. If the casting composed of bars and attached end rings were viewed without the laminations the casting would appear similar to a squirrel cage.

Stack (Heat) Loss: Sensible and latent heat contained in combustion gases and vapor emitted to the atmosphere.

Stack: A smokestack or flue for exhausting the products of combustion from a combustion appliance.

Staebler-Wronski effect: The tendency of the sunlight to electricity conversion efficiency of amorphous silicon photovoltaic devices to degrade (drop) upon initial exposure to light.

Stagnation Temperature: A condition that can occur in a solar collector if the working fluid does not circulate when sun is shining on the collector.

Stall: In reference to a wind turbine, a condition when the rotor stops turning.

Stand-Alone Generator: A power source/generator that operates independently of or is not connected to an electric transmission and distribution network; used to meet a load(s) physically close to the generator.

Stand-Alone Inverter: An inverter that operates independent of or is not connected to an electric transmission and distribution network.

Stand-alone system: An autonomous or hybrid photovoltaic system not connected to a grid. May or may not have storage, but most stand-alone systems require batteries or some other form of storage. *OR,* A system that operates independent of or is not connected to an electric transmission and distribution network.

Standard Air: Air with a weight of 0.075 pounds per cubic foot with an equivalent density of dry air at a temperature of 86 degrees Fahrenheit and standard barometric pressure of 29.92 inches of mercury.

Standard Conditions: In refrigeration, an evaporating temperature of 5 degrees Fahrenheit (F), a condensing temperature of 86 degrees F., liquid temperature before expansion of 77 degrees F., and suction temperature of 12 degrees F.

Standard Cubic Foot: A column of gas at standard conditions of temperature and pressure (32 degrees Fahrenheit and one atmosphere).

Standard Industrial Classification (SIC) Code: Standardized codes used to classify businesses by type of activity they engage in.

Standard metering: base standard conditions, plus agreed corrections, to which all natural gas volumes are corrected for purposes of comparison and payment.

Standard reporting conditions (SRC): A fixed set of conditions (including meteorological) to which the electrical performance data of a photovoltaic module are translated from the set of actual test conditions.

Standard test conditions (STC): Conditions under which a module is typically tested in a laboratory.

Standby current: This is the amount of current (power) used by the inverter when no load is active (lost power). The efficiency of the inverter is lowest when the load demand is low.

Stand-By Heat Loses: A term used to describe heat energy lost from a water heater tank.

Stand-By Power: For the consumer, this is the electricity that is used by your TVs, stereos, and other electronic devices that use remote controls. When you press "off" to turn off your device, minimal power (dormant mode) is still being used to maintain the internal electronics in a ready, quick-response mode. This way, your device can be turned on with your remote control and be immediately ready to operate.

Stand-off mounting: Technique for mounting a photovoltaic array on a sloped roof, which involves mounting the modules a short distance above the pitched roof and tilting them to the optimum angle.

Starting Surge: Power, often above an appliance's rated wattage, required to bring any appliance with a motor up to operating speed.

Starting Torque: The torque at the bottom of a speed (rpm) versus torque curve. The torque developed by the motor is a percentage of the full-load or rated torque. At this torque the speed, the rotational speed of the motor as a percentage of synchronous speed is zero. This torque is what is available to initially get the load moving and begin its acceleration.

Starved electrolyte cell: A battery containing little or no free fluid electrolyte.

State-of-charge (SOC): The available capacity remaining in the battery, expressed as a percentage of the rated capacity.

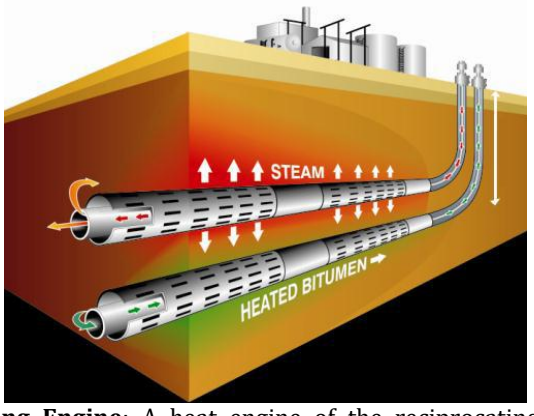
Static Pressure: The force per unit area acting on the surface of a solid boundary parallel to the flow.

Steam Boiler: A type of furnace in which fuel is burned and the heat is used to produce steam.

Steam Turbine: A device that converts high-pressure steam, produced in a boiler, into mechanical energy that can then be used to produce electricity by forcing blades in a cylinder to rotate and turn a generator shaft.

Steam: Water in vapor form; used as the working fluid in steam turbines and heating systems.

Steam-assisted gravity drainage (SAGD): A process used to recover bitumen that is too deep to mine. A pair of horizontal wells is drilled from a central well pad. In a plant nearby, steam generators heat water and transform it into steam. The steam then travels through above-ground pipelines to the wells. It enters the ground via the steam injection well and heats the bitumen to a temperature at which it can flow by gravity into the producing well. The resulting bitumen and condensed steam emulsion is then piped from the producing well to the plant, where it is separated and treated. The water is recycled for generating new steam.



Stirling Engine: A heat engine of the reciprocating (piston) where the working gas and a heat source are independent. The working gas is compressed in one region of the engine and transferred to another region where it is expanded. The expanded gas is then returned to the first region for recompression. The working gas thus moves back and forth in a closed cycle.

Stoichiometric Ratio: The ratio of chemical substances necessary for a reaction to occur completely.

Stoichiometry: Chemical reactions, typically associated with combustion processes; the balancing of chemical reactions by providing the exact proportions of reactant compounds to ensure a complete reaction; all the reactants are used up to produce a single set of products.

Storage Additions/Injections: Volumes of gas injected or otherwise added to underground natural gas reservoirs or liquefied natural gas storage.

Storage battery: A device capable of transforming energy from electric to chemical form and vice versa. The reactions are almost completely reversible. During discharge, chemical energy is converted to electric energy and is consumed in an external circuit or apparatus.

Storage Capacity: The amount of energy an energy storage device or system can store.

Storage Hydropower: A hydropower facility that stores water in a reservoir during high-inflow periods to augment water during low-inflow periods. Storage projects allow the flow releases and power production to be more flexible and dependable. Many hydropower project operations use a combination of approaches.

Storage Tank: The tank of a water heater.

Storage Water Heater: A water heater that releases hot water from the top of the tank when a hot water tap is opened. To replace that hot water, cold water enters the bottom of the tank to ensure a full tank.

Storage Withdrawals: Total volume of gas withdrawn from underground storage or from liquefied natural gas storage over a specified amount of time.

Storage: a means of maintaining a reserve of natural gas supplies to meet seasonal demands.

Storm Door: An exterior door that protects the primary door.

Storm Windows: Glass, plastic panels, or plastic sheets that reduce air

infiltration and some heat loss when attached to either the interior or exterior of existing windows.

Straddle plant: a gas-processing plant constructed near a transmission pipeline downstream from the fields where the natural gas in the pipeline has been produced.

Stranded gas: Gas that is not near a market and that does not have an economic basis for development and production. *OR,* Gas field located in area where there are no transportation services or markets within any economically reasonable distance. See *Remote gas*

Stranded Investment (Costs and Benefits): An investment in a power plant or demand side management measures or programs that become uneconomical due to increased competition in the electric power market. For example, an electric power plant may produce power that is more costly than what the market rate for electricity is, and the power plant owner may have to close the plant, even though the capital and financing costs of building the plant have not been recovered through prior sales of electricity from the plant. This is considered a Stranded Cost. Stranded Benefits are those power provider investments in measures or programs considered to benefit consumers by reducing energy consumption and/or providing environmental benefits that have to be curtailed due to increased competition and lower profit margins.

Stratification: A condition that occurs when the acid concentration varies from top to bottom in the battery electrolyte. Periodic, controlled charging at voltages that produce gassing will mix the electrolyte. See also equalization.

String: A number of photovoltaic modules or panels interconnected electrically in series to produce the operating voltage required by the load.

Stud: A popular term used for a length of wood or steel used in or for wall framing.

Sub-hourly energy markets: Electricity markets that operate on time steps of 5 minutes. Approximately 60% of all electricity in the United States is currently traded in sub-hourly markets, running at 5-minute intervals so that maximum flexibility can be obtained from the generation fleet.

Substation: An electrical installation containing power conversion (and sometimes generation) equipment, such as transformers, compensators, and circuit breakers.

Substrate: The physical material upon which a photovoltaic cell is applied.

Subsystem: Any one of several components in a photovoltaic system (i.e., array, controller, batteries, inverter, load).

Sulfation: A condition that afflicts unused and discharged batteries; large crystals of lead sulfate grow on the plate, instead of the usual tiny crystals, making the battery extremely difficult to recharge.

Sun Path Diagram: A circular projection of the sky vault onto a flat diagram used to determine solar positions and shading effects of landscape features on a solar energy system.

Sun Tempered Building: A building that is elongated in the east-west direction, with the majority of the windows on the south side. The area of the windows is generally limited to about 7% of the total floor area. A sun-tempered design has no added thermal mass beyond what is already in the framing, wall board, and so on. Insulation levels are generally high.

Sunspace: A room that faces south (in the northern hemisphere), or a small structure attached to the south side of a house.

Super Insulated Houses: A type of house that has massive amounts of insulation, airtight construction, and controlled ventilation without sacrificing comfort, health, or aesthetics.

Super Window: A popular term for highly insulating window with a heat loss so low it performs better than an insulated wall in winter, since the sunlight that it admits is greater than its heat loss over a 24 hour period.

Superconducting magnetic energy storage (SMES): SMES technology uses the superconducting characteristics of low-temperature materials to produce intense magnetic fields to store energy. It has been proposed as a storage option to support large-scale use of photovoltaics as a means to smooth out fluctuations in power generation.

Superconductivity: The abrupt and large increase in electrical conductivity exhibited by some metals as the temperature approaches absolute

zero.

Superstrate: The covering on the sunny side of a photovoltaic (PV) module, providing protection for the PV materials from impact and environmental degradation while allowing maximum transmission of the appropriate wavelengths of the solar spectrum.

Supplemental Gaseous Fuels Supplies: Synthetic natural gas, propane-air, coke oven gas, refinery gas, biomass gas, air injected for Btu stabilization, and manufactured gas commingled and distributed with natural gas.

Supplementary Heat: A heat source, such as a space heater, used to provide more heat than that provided by a primary heating source.

Supplier: a party that sells a commodity (for example, natural gas).

Supply Duct: The duct(s) of a forced air heating/cooling system through which heated or cooled air is supplied to rooms by the action of the fan of the central heating or cooling unit.

Supply Side: Technologies that pertain to the generation of electricity.

Surface Water Loop: In this type of closed-loop geothermal heat pump installation, the fluid-filled plastic heat exchanger pipes are coiled into circles and submerged at least eight feet below the surface of a body of surface water, such as a pond or lake. The coils should only be placed in a water source that meets minimum volume, depth, and quality criteria. Also see **closed-loop geothermal heat pump systems**.

Surge capacity: The maximum power, usually 3-5 times the rated power, which can be provided over a short time.

Suspended gas discovery: a gas field identified by a discovery well, but not being produced or developed.

Swamp Cooler: A popular term used for an evaporative cooling device.

Sweet gas: natural gas that contains such small amounts of hydrogen sulphide (and other sulphur compounds) and carbon dioxide that it can be transported or used without purifying, with no deleterious effect on piping and equipment.

Swept Area: In reference to a wind energy conversion device, the area through which the rotor blades spin, as seen when directly facing the center of the rotor blades.

Swing Gas: natural gas bought on short notice to meet unexpected daily demands not covered under long-term contracts.

Synchronous Generator: An electrical generator that runs at a constant speed and draws its excitation from a power source external or independent of the load or transmission network it is supplying.

Synchronous Inverter: An electrical inverter that inverts direct current electricity to alternating current electricity, and that uses another alternating current source, such as an electric power transmission and distribution network (grid), for voltage and frequency reference to provide power in phase and at the same frequency as the external power source.

Synchronous Motor: A type of motor designed to operate precisely at the synchronous speed with no slip in the full-load speeds (rpm).

Synthetic Natural Gas (SNG): (Also referred to as substitute natural gas) A manufactured product, chemically similar in most respects to natural gas, resulting from the conversion or reforming of hydrocarbons that may easily be substituted for or interchanged with pipeline-quality natural gas. ***OR,*** Methane obtained from sources other than naturally occurring reservoirs of natural gas, such as by crushing and gasifying coal at high temperature, refining heavier hydrocarbons, or processing rubbish or other organic materials. Gases other than natural gas or liquid or solid hydrocarbons converted to a gaseous fuel of heat content, compatibility and quality equivalent in performance to that of natural gas.

System Availability: The percentage of time (usually expressed in hours per year) when a photovoltaic system will be able to fully meet the load demand.

System Capacity: the physical limitation of a gas pipeline or storage system to flow gas to end-users. Also called normal system capacity.

System Mix: The proportion of electricity distributed by a power provider that is generated from available sources such as coal, natural gas, petroleum, nuclear, hydropower, wind, or geothermal.

System Operating Voltage: The photovoltaic array output voltage under load. The system operating voltage is dependent on the load or batteries connected to the output terminals.

System Storage: See battery capacity.

System Supply: natural gas supplies purchased, owned and sold by the supplier.

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Tail gas: the exhaust gas from any processing unit that is at a low pressure and is usually vented, treated for contaminant removal or combusted.

Take-or-pay (TOP) clause: contract clause in a sales and purchase agreement (SPA) requiring a minimum quantity of natural gas to be paid for, whether or not delivery is accepted by the purchaser.

Tank Battery - Tank batteries are part of the production equipment installed after a well is completed. They store the salt water that is returned from a producing well.

Tankless Water Heater: A water heater that heats water before it is directly distributed for end use as required; a demand water heater.

Taps: Trans-Alaska Pipeline System, the line from Prudhoe Bay, on the North Slope, to the terminal port of Valdez, on the south coast of Alaska.

Tare Loss: Loss caused by a charge controller. One minus tare loss, expressed as a percentage, is equal to the controller efficiency.

Tariff Gas: additional natural gas sold to a customer if the total amount of natural gas needed exceeds their original estimate.

Task Lighting: Any light source designed specifically to direct light a task or work performed by a person or machine.

tcf (trillion cubic feet): volume measurement of natural gas approximately equivalent to one Quad. See *Btu*, *bcf*, and *mcf*

Temperature Coefficient (of a Solar Photovoltaic Cell): The amount that the voltage, current, and/or power output of a solar cell changes due to a change in the cell temperature.

Temperature Compensation: A circuit that adjusts the charge controller activation points depending on battery temperature. This feature is recommended if the battery temperature is expected to vary more than ±5°C from ambient temperature.

Temperature Factors: It is common for three elements in photovoltaic system sizing to have distinct temperature corrections: a factor used to decrease battery capacity at cold temperatures; a factor used to decrease PV module voltage at high temperatures; and a factor used to decrease the current carrying capability of wire at high temperatures.

Temperature Humidity Index: An index that combines sensible temperature and air humidity to arrive at a number that closely responds to the effective temperature; used to relate temperature and humidity to levels of comfort.

Temperature Zones: Individual rooms or zones in a building where temperature is controlled separately from other rooms or zones.

Temperature/Pressure Relief Valve: A component of a water heating system that opens at a designated temperature or pressure to prevent a possible tank, radiator, or delivery pipe rupture.

Tempering Valve: A valve used to mix heated water with cold in a heating system to provide a desired water temperature for end use.

Tennessee Valley Authority (TVA): A federal agency established in 1933 to develop the Tennessee river valley region of the southeastern U.S., and which is now nation's largest power producer.

Termite Shield: A construction element that inhibits termites from entering building foundations and walls.

Therm: a unit of heating value equal to 100,000 Btu, in common use in the UK; about 56 therms are derived by setting fire to a barrel of crude oil; one therm has around the same heat content as 100 cf of natural gas.

Thermal Balance Point: The point or outdoor temperature where the heating capacity of a heat pump matches the heating requirements of a building.

Thermal Capacitance: The ability of a material to absorb and store heat for use later.

Thermal Efficiency: A measure of the efficiency of converting a fuel to energy and useful work; useful work and energy output divided by higher heating value of input fuel times 100 (for percent).

Thermal Energy Storage: The storage of heat energy during power provider off-peak times at night, for use during the next day without incurring daytime peak electric rates.

Thermal Energy: The energy developed through the use of heat energy.

Thermal Envelope Houses: An architectural design (also known as the double envelope house), sometimes called a "house-within-a-house," that employs a double envelope with a continuous airspace of at least

6 to 12 inches on the north wall, south wall, roof, and floor, achieved by building inner and outer walls, a crawl space or sub-basement below the floor, and a shallow attic space below the weather roof. The east and west walls are single, conventional walls. A buffer zone of solar-heated, circulating air warms the inner envelope of the house. The south-facing airspace may double as a sunspace or greenhouse.

Thermal Mass: Materials that store heat.

Thermal Resistance (R-Value): This designates the resistance of a material to heat conduction. The greater the R-value the larger the number.

Thermal Storage Walls (Masonry or Water): A thermal storage wall is a south-facing wall that is glazed on the outside. Solar heat strikes the glazing and is absorbed into the wall, which conducts the heat into the room over time. The walls are at least 8 in thick. Generally, the thicker the wall, the less the indoor temperature fluctuates.

Thermocouple: A device consisting of two dissimilar conductors with their ends connected together. When the two junctions are at different temperatures, a small voltage is generated.

Thermodynamic Cycle: An idealized process in which a working fluid (water, air, ammonia, etc.) successively changes its state (from a liquid to a gas and back to a liquid) for the purpose of producing useful work or energy, or transferring energy.

Thermodynamics: A study of the transformation of energy from one form to another, and its practical application. (see Law(s) of Thermodynamics above).

Thermoelectric Conversion: The conversion of heat into electricity by the use of thermocouples.

Thermography: A building energy auditing technique for locating areas of low insulation in a building envelope by means of a thermographic scanner.

Thermophotovoltaic Cell (**TPV**): A device where sunlight concentrated onto an absorber heats it to a high temperature, and the thermal radiation emitted by the absorber is used as the energy source for a photovoltaic cell that is designed to maximize conversion efficiency at the wavelength of the thermal radiation.

Thermopile: A large number of thermocouples connected in series.

Thermosiphon System: This passive solar hot water system consists relies on warm water rising, a phenomenon known as natural convection, to circulate water through the collectors and to the tank. In this type of installation, the tank must be above the collector. As water in the collector heats, it becomes lighter and rises naturally into the tank above. Meanwhile, cooler water in the tank flows down pipes to the bottom of the collector, causing circulation throughout the system. The storage tank is attached to the top of the collector so that thermosiphoning can occur.

Thermosiphon: The natural, convective movement of air or water due to differences in temperature. In solar passive design a thermosyphon collector can be constructed and attached to a house to deliver heat to the home by the continuous pattern of the convective loop (or, thermosyphon).

Thermostat: A device used to control temperatures; used to control the operation of heating and cooling devices by turning the device on or off when a specified temperature is reached.

Thick-crystalline materials: Semiconductor material, typically measuring from 200-400 microns thick, that is cut from ingots or ribbons.

Thin film photovoltaic module: A photovoltaic module constructed with sequential layers of thin film semiconductor materials. See also amorphous silicon.

Thin film: A layer of semiconductor material, such as copper indium diselenide or gallium arsenide, a few microns or less in thickness, used to make photovoltaic cells.

Third-Party Access (**TPA**): obliges companies operating gas-transmission or -distribution networks to offer terms for the carriage of gas on their systems by other gas distribution companies or particular customers, subject to capacity availability. See *Open access*

Three-Phase Current: Alternating current in which three separate pulses are present, identical in frequency and voltage, but separated 120 degrees in phase.

Throughput (**pipeline**): the volume of gas flowing (or transported) through a pipeline over a period of time.

Throughput (processing): average amount of raw material that is processed in a given period by a facility, such as a natural gas

processing plant, a crude oil refinery or a petrochemicals facility.

Tidal Power: The power available from the rise and fall of ocean tides. A tidal power plant works on the principal of a dam or barrage that captures water in a basin at the peak of a tidal flow, then directs the water through a hydroelectric turbine as the tide ebbs.

Tight gas: Natural gas produced from relatively impermeable rock. Getting tight gas out usually requires enhanced technology applications like hydraulic fracturing. The term is generally used for reservoirs other than shale.

Tilt Angle (of a Solar Collector or Module): The angle at which a photovoltaic array or a solar collector or module is set to face the sun relative to a horizontal position. The tilt angle can be set or adjusted to maximize seasonal or annual energy collection.

Time charter: a form of charter party issued when an LNG vessel is chartered for an agreed period of time. A time charter party is the contract between owner and charterer, and identifies the salient characteristics of the ship and the obligations of the ship-owner; specifically the ship-owner provides a ship capable of the specified performance and operates the ship according to that performance standard set by the charterer. The charterer pays the owner for the hire of the vessel at an agreed rate.

Time-of-Use (**TOU**) **Rates**: The pricing of electricity based on the estimated cost of electricity during a particular time block. Time-of-use rates are usually divided into three or four time blocks per twenty-four hour period (on-peak, mid-peak, off-peak and sometimes super off-peak) and by seasons of the year (summer and winter). Real-time pricing differs from TOU rates in that it is based on actual (as opposed to forecasted) prices which may fluctuate many times a day and are weather-sensitive, rather than varying with a fixed schedule.

Timer (Water Heater): This device can automatically turn the heater off at night and on in the morning.

Timer: A device that can be set to automatically turn appliances (lights) off and on at set times.

Tin oxide: A wide band-gap semiconductor similar to indium oxide; used in heterojunction solar cells or to make a transparent conductive film, called NESA glass when deposited on glass.

Tip Speed Ratio: In reference to a wind energy conversion device's blades, the difference between the rotational speed of the tip of the blade and the actual velocity of the wind.

Tolling agreement: an agreement whereby one party owns (and bears the risks on) the inputs to and outputs from a process, as well as the rights to a portion of the process capacity (the tollee). Another party agrees to operate the process or facility and charges a tolling fee per unit of input that is transformed, or per unit of capacity to which rights are granted (the toller). Under an LNG liquefaction tolling agreement, one company sends a volume of feed gas to a liquefaction facility, wherein the gas is liquefied in return for a pre-established tolling charge.

Ton (of Air Conditioning): A unit of air cooling capacity; 12,000 Btu per hour.

Ton, long (LT): a long ton is 2,240 pounds. Typically used as the unit measure for sulphur sales.

Ton, short (ST): a short ton is 2,000 pounds.

Tonnage: a shipping term referring to the total number of tonnes registered or carried or the ship's carrying capacity.

Tonne mile: a measurement used in the economics of transportation to designate 1 tonne being moved 1 mile; useful to the shipper because it includes the distance to move a commodity in the calculation.

Tonne, metric: a metric tonne equals 1,000 kilograms or 2,204.6 pounds. The capacity of an LNG baseload plant is typically expressed in tonnes and the unit capital costs for producing LNG are expressed as $/tonne.

Topping-Cycle: A means to increase the thermal efficiency of a steam electric generating system by increasing temperatures and interposing a device, such as a gas turbine, between the heat source and the conventional steam-turbine generator to convert some of the additional heat energy into electricity.

Torque (Motor): The turning or twisting force generated by an electrical motor in order for it to operate.

Total AC load demand: The sum of the alternating current loads. This value is important when selecting an inverter.

Total harmonic distortion: The measure of closeness in shape between a

waveform and its fundamental component.

Total Heat: The sum of the sensible and latent heat in a substance or fluid above a base point, usually 32 degrees Fahrenheit.

Total Incident Radiation: The total radiation incident on a specific surface area over a time interval.

Total internal reflection: The trapping of light by refraction and reflection at critical angles inside a semiconductor device so that it cannot escape the device and must be eventually absorbed by the semiconductor.

Total Recordable Rate (TRR): The total recordable rate is a measure of the rate of recordable cases, normalized per 100 workers per year. The factor is derived by multiplying the number of recordable injuries in a calendar year by 200,000 (100 employees working 2,000 hours per year) and dividing this value by the total man hours actually worked in the year.

Total Shareholder Return (TSR): Represents share price appreciation and dividends returned to shareholders over a period. It is calculated as follows: [(stock price at the end of the period) – (stock price at the start of the period) + (dividends paid during the calculation period) ÷ (stock price at the start of the period)].

Total Storage Field Capacity: The maximum volume of base and working gas that can be stored in an underground storage facility in accordance with its design, which comprises the physical characteristics of the reservoir, installed equipment, and operating procedures particular to the site.

Tracking array: A photovoltaic (PV) array that follows the path of the sun to maximize the solar radiation incident on the PV surface. The two most common orientations are (1) one axis where the array tracks the sun east to west and (2) two-axis tracking where the array points directly at the sun at all times. Tracking arrays use both the direct and diffuse sunlight. Two-axis tracking arrays capture the maximum possible daily energy.

Trader: gas merchant who purchases natural gas from a producer, supplier or another trader and resells it to a pipeline, utility or end-user, usually taking title and assisting in arranging transportation. See *marketer*

Trailing Edge: The part of a wind energy conversion device blade, or airfoil, which is the last to contact the wind.

Train (liquefaction): an independent unit for gas liquefaction. An LNG plant may comprise one or more trains.

Transfer pricing: a transfer price is the amount of money that one unit of an organisation charges for goods and services to another unit of an organisation. Perhaps the most important aspect in this area is the Arm's Length Principle regularly challenged by fiscal authorities, a common principle in International Accounting Standards to see that a transfer price has been calculated and agreed according to normal, fair, equitable, business principles.

Transformer: An electromagnetic device that changes the voltage of alternating current electricity. It consists of an induction coil having a primary and secondary winding and a closed iron core.

Transmission (of Natural Gas): Gas physically transferred and delivered from a source or sources of supply to one or more delivery points.

Transmission And Distribution Losses: The losses that result from inherent resistance in electrical conductors and transformation inefficiencies in distribution transformers in a transmission and distribution network.

Transmission Company: company that obtains the major portion of its operating revenues from the operation of a natural gas transmission system and/or from mainline sales to industrial customers.

Transmission line: Transmit high-voltage electricity from the transformer to the electric distribution system. ***OR,*** Pipeline transporting natural gas from principal supply areas to distribution centres, large-volume customers or other transmission lines.

Transmission: The process of sending or moving electricity from one point to another; usually defines that part of an electric power provider's electric power lines from the power plant buss to the last transformer before the customer's connection. ***OR,*** the transport of large quantities of natural gas at high pressures, often through national or regional transmission systems.

Transparent conducting oxide (TCO): A doped metal oxide used to coat and improve the performance of optoelectronic devices such as photovoltaics and flat panel displays. Most TCO films are fabricated

with polycrystalline or amorphous microstructures and are deposited on glass. The current industry-standard TCO is indium tin oxide. Indium is relatively rare and expensive, so research is ongoing to develop improved TCOs based on alternative materials.

Transportation contract: contract setting forth the terms and conditions applicable to natural gas or electricity transportation services.

Transportation: the movement of natural gas for third parties through pipeline facilities for a fee.

Transported Gas: Natural gas physically delivered to a building by a local utility, but not purchased from that utility. A separate transaction is made to purchase the volume of gas, and the utility is paid for the use of its pipeline to deliver the gas.

Transporter: Pipeline Company that transports natural gas for a shipper.

Transport-or-pay contract: a contract between a natural gas producer and a pipeline company that requires the pipeline company to pay for a set amount of natural gas whether or not the buyer takes delivery of the full amount.

Traveling Grate: A furnace grate that moves fuel through the combustion chamber.

Tray cable (TC) - may be used for interconnecting balance-of-systems.

Treating plant: facility that treats raw natural gas to remove undesirable impurities such as carbon dioxide, hydrogen sulphide and water vapour.

Trellis: An architectural feature used to shade exterior walls; usually made of a lattice of metal or wood; often covered by vines to provide additional summertime shading.

Trickle (Solar) Collector: A type of solar thermal collector in which a heat transfer fluid drips out of header pipe at the top of the collector, runs down the collector absorber and into a tray at the bottom where it drains to a storage tank.

Trickle charge: A charge at a low rate, balancing through self-discharge losses, to maintain a

Triple Pane (Window): This represents three layers of glazing in a window with an airspace between the middle glass and the exterior and interior panes.

Trombe Wall: A wall with high thermal mass used to store solar energy passively in a solar home. The wall absorbs solar energy and transfers it to the space behind the wall by means of radiation and by convection currents moving through spaces under, in front of, and on top of the wall.

True Power: The actual power rating that is developed by a motor before losses occur.

True South: The direction, at any point on the earth that is geographically in the northern hemisphere, facing toward the South Pole of the earth. Essentially a line extending from the point on the horizon to the highest point that the sun reaches on any day (solar noon) in the sky.

Tube (Fluorescent Light): A fluorescent lamp that has a tubular shape.

Tube-In-Plate-Absorber: A type of solar thermal collector where the heat transfer fluid flows through tubes formed in the absorber plate.

Tube-Type Collector: A type of solar thermal collector that has tubes (pipes) that the heat transfer fluid flows through that are connected to a flat absorber plate.

Tungsten Halogen Lamp: A type of incandescent lamp that contains a halogen gas in the bulb, which reduces the filament evaporation rate increasing the lamp life. The high operating temperature and need for special fixtures limits their use to commercial applications and for use in projector lamps and spotlights.

Tunneling: Quantum mechanical concept whereby an electron is found on the opposite side of an insulating barrier without having passed through or around the barrier.

Turbine: A device for converting the flow of a fluid (air, steam, water, or hot gases) into mechanical motion.

Turn Down Ratio: The ratio of a boiler's or gasifier's maximum output to its minimum output.

Turnaround: a period of brisk activity at a plant or receiving terminal when processing units, or portions of them, are shut down either for scheduled maintenance or for the installation of new equipment and systems.

Turnback of capacity: a situation that occurs when shipper contracts expire, without renewal or re-contracting. Shippers turn back all or part of their firm contracted capacity to the pipeline company.

Two-axis tracking: A photovoltaic array tracking system capable of

rotating independently about two axes (e.g., vertical and horizontal).

Two-Tank Solar System: A solar thermal system that has one tank for storing solar heated water to preheat the water in a conventional water heater.

u

Ultimate Analysis: A procedure for determining the primary elements in a substance (carbon, hydrogen, oxygen, nitrogen, sulfur, and ash).

Ultimate customer: customer that purchases energy for consumption and not for resale. See *End-user*

Ultraviolet: Electromagnetic radiation in the wavelength range of 4 to 400 nanometers.

Unaccounted For (Natural Gas): Represents the difference between the sum of the components of natural gas supply and the sum of components of natural gas disposition, as reported by survey respondents. These differences may be due to quantities lost or to the effects of differences in company accounting systems in terms of scope and definition. A positive "unaccounted for" volume means that supply exceeds disposition by that amount. A negative "unaccounted for" volume means that supply is less than disposition. See also "Balancing Item."

Unconventional gas: natural gas that cannot be produced using existing technologies.

Unconventional reservoirs: Reservoirs with permeability so low (generally less than 0.1 millidarcy) that horizontal hydraulically fractured stimulated wells or other advanced completion techniques must be utilized to extract hydrocarbons at commercial rates. Shale reservoirs such as the Eagle Ford and Barnett, as well as tight reservoirs like the Bakken and Three Forks, both are examples of unconventional reservoirs.

Unconventional Resource: Any area (shales, tight sands, fractured carbonates) where natural gas cannot be drilled and extracted vertically.

Underground feeder (UF): May be used for photovoltaic array wiring if sunlight resistant coating is specified; can be used for interconnecting balance-of-system components but not recommended for use within battery enclosures.

Underground Gas Storage: The use of sub-surface facilities for storing gas that has been transferred from its original location. The facilities are usually hollowed-out salt domes, natural geological reservoirs (depleted oil or gas fields) or water-bearing sands topped by an impermeable cap rock (aquifer).

Underground Home: A house built into the ground or slope of a hill, or which has most or all exterior surfaces covered with earth.

Underground service entrance (USE): May be used within battery enclosures and for interconnecting balance-of-systems.

Undeveloped acreage: Acreage on which wells have not been drilled or completed to a point that would permit the production of commercial quantities of oil and gas regardless of whether or not the acreage contains proved reserves.

Unglazed Solar Collector: A solar thermal collector that has an absorber that does not have a glazed covering. Solar swimming pool heater systems usually use unglazed collectors because they circulate relatively large volumes of water through the collector and capture nearly 80 percent of the solar energy available.

Uninterruptible power supply (UPS): The designation of a power supply providing continuous uninterruptible service. The UPS will contain batteries.

Unit Value, Consumption: Total price per specified unit, including all taxes, at the point of consumption.

Unit: The joining of interests in a reservoir or field to provide for development and operations without regard to separate property interests. Also, the area covered by a unitization agreement.

Unitary Air Conditioner: An air conditioner consisting of one or more assemblies that move, clean, cool, and dehumidify air.

Unvented Heater: A combustion heating appliance that vents the combustion by-products directly into the heated space. The latest models have oxygen-sensors that shut off the unit when the oxygen level in the room falls below a safe level.

USAC: tanker market term for US Atlantic coast.

Useful Heat: Heat stored above room temperature (in a solar heating

system).

USG: tanker market term for US Gulf, more properly known as the Gulf of Mexico.

Utilisation factor: a ratio of the maximum demand of a system or part of a system to its rated capacity.

Utility: A regulated entity which exhibits the characteristics of a natural monopoly (also referred to as a power provider). For the purposes of electric industry restructuring, "utility" refers to the regulated, vertically-integrated electric company. "Transmission utility" refers to the regulated owner/operator of the transmission system only. "Distribution utility" refers to the regulated owner/operator of the distribution system which serves retail customers.

Utility-interactive inverter: An inverter that can function only when tied to the utility grid, and uses the prevailing line-voltage frequency on the utility line as a control parameter to ensure that the photovoltaic system's output is fully synchronized with the utility power.

U-Value: The reciprocal of R-Value. The lower the number, the greater the heat transfer resistance (insulating) characteristics of the material. See *Coefficient of Heat Transmission*

V

Vacuum Evaporation: The deposition of thin films of semiconductor material by the evaporation of elemental sources in a vacuum.

Vacuum zero: The energy of an electron at rest in empty space; used as a reference level in energy band diagrams.

Valence Band: The highest energy band in a semiconductor that can be filled with electrons.

Valence level energy/valence state: Energy content of an electron in orbit about an atomic nucleus. Also called bound state.

Vapor Retarder: A material that retards the movement of water vapor through a building element (walls, ceilings) and prevents insulation and structural wood from becoming damp and metals from corroding. Often applied to insulation batts or separately in the form of treated papers, plastic sheets, and metallic foils.

Vapour displacement: release of vapours that had previously occupied space above liquid fuels stored in tanks. These releases occur when tanks are emptied and filled.

Vapour pressure: the pressure exerted by a vapour that is in equilibrium with a liquid.

Variable price: a contracted price that can change by the hour, day, month, etc.

Variable-Speed Wind Turbines: Turbines in which the rotor speed increases and decreases with changing wind speed, producing electricity with a variable frequency.

Varistor: A voltage-dependent variable resistor. Normally used to protect sensitive equipment from power spikes or lightning strikes by shunting the energy to ground.

Vehicle Fuel Consumption: Natural gas (compressed or liquefied) used as vehicle fuel.

Vent Damper: A device mounted in the vent connector that closes the vent when the heating unit is not firing. This traps heat inside the heating system and house rather than letting it draft up and out the vent system.

Vent Pipe: A tube in which combustion gases from a combustion appliance are vented out of the appliance to the outdoors.

Vent: A component of a heating or ventilation appliance used to conduct fresh air into, or waste air or combustion gases out of, an appliance or interior space.

Vented cell: A battery designed with a vent mechanism to expel gases generated during charging.

Vented Gas: Gas released into the air on the production site or at processing plants.

Vented Heater: A type of combustion heating appliance in which the combustion gases are vented to the outside, either with a fan (forced) or by natural convection.

Ventilation Air: That portion of supply air that is drawn from outside, plus any recirculated air that has been treated to maintain a desired air quality.

Ventilation: The process of moving air (changing) into and out of an interior space either by natural or mechanically induced (forced) means.

Vertical Ground Loop: In this type of closed-loop geothermal heat pump installation, the fluid-filled plastic heat exchanger pipes are laid out in a plane perpendicular to the ground surface. For a vertical system, holes (approximately four inches in diameter) are drilled about 20 feet apart and 100 to 400 feet deep. Into these holes go two pipes that are connected at the bottom with a U-bend to form a loop. The vertical loops are connected with horizontal pipe (i.e., manifold), placed in trenches, and connected to the heat pump in the building. Large commercial buildings and schools often use vertical systems because the land area required for horizontal ground loops would be prohibitive. Vertical loops are also used where the soil is too shallow for trenching, or for existing buildings, as they minimize the disturbance to landscaping. Also see closed-loop geothermal heat pump systems.

Vertical multijunction (VMJ) cell: A compound cell made of different semiconductor materials in layers, one above the other. Sunlight entering the top passes through successive cell barriers, each of which converts a separate portion of the spectrum into electricity, thus achieving greater total conversion efficiency of the incident light. Also called a multiple junction cell. See also multijunction device and split-spectrum cell.

Vertical-Axis Wind Turbine (**VAWT**): A type of wind turbine in which the axis of rotation is perpendicular to the wind stream and the ground.

Visible Light Transmittance: The amount of visible light that passes through the glazing material of a window, expressed as a percentage.

Visible Radiation: The visible portion of the electromagnetic spectrum with wavelengths from 0.4 to 0.76 microns

Volt (V): A unit of electrical force equal to that amount of electromotive force that will cause a steady current of one ampere to flow through a resistance of one ohm.

Voltage at maximum power (Vmp): The voltage at which maximum power is available from a photovoltaic module.

Voltage protection: Many inverters have sensing circuits that will disconnect the unit from the battery if input voltage limits are exceeded.

Voltage regulation: This indicates the variability in the output voltage. Some loads will not tolerate voltage variations greater than a few percent.

Voltage: The amount of electromotive force, measured in volts that exists between two points.

Volt-Ampere: A unit of electrical measurement equal to the product of a volt and an ampere.

Volume flexibility: provides a contractual option to buy or sell a non-financial item in a purchase and sales contract that can be settled net in cash or through another financial instrument. Such a contract, under International Financial Reporting Standards, can generally not apply the own use exemption to applying fair-value accounting to contracts. See *Own use exemption*.

W

Wafer: A thin sheet of semiconductor (photovoltaic material) made by cutting it from a single crystal or ingot.

Wall Orientation: The geographical direction that the primary or largest exterior wall of a building faces.

Wall: A vertical structural element that holds up a roof, encloses part or all of a room, or stands by itself to hold back soil.

Water Jacket: A heat exchanger element enclosed in a boiler. Water is circulated with a pump through the jacket where it picks up heat from the combustion chamber after which the heated water circulates to heat distribution devices. A water jacket is also an enclosed water-filled chamber in a tankless coiled water heater. When a faucet is turned on water flows into the water heater heat exchanger. The water in the chamber is heated and transfers heat to the cooler water in the heat exchanger and is sent through the hot water outlet to the appropriate faucet.

Water Source Heat Pump: A type of (geothermal) heat pump that uses well (ground) or surface water as a heat source. Water has a more stable seasonal temperature than air thus making for a more efficient heat source.

Water Turbine: A turbine that uses water pressure to rotate its blades; the primary types are the Pelton wheel, for high heads (pressure); the

Francis turbine, for low to medium heads; and the Kaplan for a wide range of heads. Primarily used to power an electric generator.

Water Wall: An interior wall made of water filled containers for absorbing and storing solar energy.

Water Wheel: A wheel that is designed to use the weight and/or force of moving water to turn it, primarily to operate machinery or grind grain.

Waterflood: An improved oil recovery technique that involves injecting water into a producing reservoir to enhance movement of oil to producing wells.

Watt: The rate of energy transfer equivalent to one ampere under an electrical pressure of one volt. One watt equals 1/746 horsepower, or one joule per second. It is the product of voltage and current (amperage).

Watt-Hour: A unit of electricity consumption of one Watt over the period of one hour.

Wattmeter: A device for measuring power consumption.

Wave form: The shape of the phase power at a certain frequency and amplitude.

Wave Power: The concept of capturing and converting the energy available in the motion of ocean waves to energy.

Wavelength: The distance between similar points on successive waves.

Weatherization: Caulking and weather stripping to reduce air infiltration and exfiltration into/out of a building.

Weather-stripping: A material used to seal gaps around windows and exterior doors.

Wellbore: The hole drilled by a drilling rig to explore for or develop oil and/or natural gas. Also referred to as a well or borehole.

Wellhead: the equipment installed at the surface of the wellbore. A wellhead includes such equipment as the casing-head, tubing hanger, and various valves to control flow from the well. ***OR,*** The control equipment fitted to the top of the well, consisting of outlets, valves, blowout-prevention equipment, etc.

Wet gas: Produced gas that contains natural gas liquids. ***OR,*** a gas containing condensable hydrocarbons or other liquids. The term is subject to varying legal definitions as specified by applicable statutes. Natural gasoline, butane, pentane and other light hydrocarbons can be removed by chilling and pressure or extraction. Usually maximum allowable is 7 pounds/mmcf for water content and 0.02 gallons/mmcf for natural gasoline. Also known as associated gas.

Wet Natural Gas: A mixture of hydrocarbon compounds and small quantities of various nonhydrocarbons existing in the gaseous phase or in solution with crude oil in porous rock formations at reservoir conditions. The principal hydrocarbons normally contained in the mixture are methane, ethane, propane, butane, and pentane. Typical nonhydrocarbon gases that may be present in reservoir natural gas are water vapor, carbon dioxide, hydrogen

Wet shelf life: The period of time that a charged battery, when filled with electrolyte, can remain unused before dropping below a specified level of performance.

Wheeling: The process of transmitting electricity over one or more separately owned electric transmission and distribution systems. (See Wholesale and Retail Wheeling.)

Whole House Fan: A mechanical/electrical device used to pull air out of an interior space; usually located in the highest location of a building, in the ceiling, and venting to the attic or directly to the outside.

Wholesale Wheeling: The wheeling of electric power in amounts and at prices that generally have been negotiated in long term contracts between the power provider and a distributor or very large power customer.

Wind Energy Conversion System (WECS) or Device: An apparatus for converting the energy available in the wind to mechanical energy that can be used to power machinery (grain mills, water pumps) and to operate an electrical generator.

Wind Energy: Energy available from the movement of the wind across a landscape caused by the heating of the atmosphere, earth, and oceans by the sun.

Wind Generator: A WECS designed to produce electricity.

Wind Power Plant: A group of wind turbines interconnected to a common power provider system through a system of transformers, distribution lines, and (usually) one substation. Operation, control, and maintenance functions are often centralized through a network of computerized monitoring systems, supplemented by visual inspection.

This is a term commonly used in the United States. In Europe, it is called a generating station.

Wind Resource Assessment: The process of characterizing the wind resource, and its energy potential, for a specific site or geographical area.

Wind Rose: A diagram that indicates the average percentage of time that the wind blows from different directions, on a monthly or annual basis.

Wind Speed Duration Curve: A graph that indicates the distribution of wind speeds as a function of the cumulative number of hours that the wind speed exceeds a given wind speed in a year.

Wind Speed Frequency Curve: A curve that indicates the number of hours per year that specific wind speeds occur.

Wind Speed Profile: A profile of how the wind speed changes with height above the surface of the ground or water.

Wind Speed: The rate of flow of the wind undisturbed by obstacles.

Wind Turbine Rated Capacity: The amount of power a wind turbine can produce at its rated wind speed, e.g., 100 kW at 20 mph. The rated wind speed generally corresponds to the point at which the conversion efficiency is near its maximum. Because of the variability of the wind, the amount of energy a wind turbine actually produces is a function of the capacity factor (e.g., a wind turbine produces 20% to 35% of its rated capacity over a year).

Wind Turbine: A term used for a wind energy conversion device that produces electricity; typically having one, two, or three blades.

Wind Velocity: The wind speed and direction in an undisturbed flow.

Windmill: A WECS that is used to grind grain, and that typically has a high-solidity rotor; commonly used to refer to all types of WECS.

Window: A wide band gap material chosen for its transparency to light. Generally used as the top layer of a photovoltaic device, the window allows almost all of the light to reach the semiconductor layers beneath. ***OR,*** A generic term for a glazed opening that allows daylight to enter into a building and can be opened for ventilation.

Windpower Curve: A graph representing the relationship between the power available from the wind and the wind speed. The power from the wind increases proportionally with the cube of the wind speed.

Windpower Profile: The change in the power available in the wind due to changes in the wind speed or velocity profile; the windpower profile is proportional to the cube of the wind speed profile.

Wingwall: A building structural element that is built onto a building's exterior along the inner edges of all the windows, and extending from the ground to the eaves. Wingwalls help ventilate rooms that have only one exterior wall which leads to poor cross ventilation. Wingwalls cause fluctuations in the natural wind direction to create moderate pressure differences across the windows. They are only effective on the windward side of the building.

Wire (Electrical): A generic term for an electrical conductor.

Wire types: See Article 300 of National Electric Code for more information.

Wobbe Index: it represents a measure of the heat released when a gas is burned at a constant pressure, and is defined as the gross calorific value divided by the square root of the density of the gas relative to the density of air.

Wood Stove: A wood-burning appliance for space and/or water heating and/or cooking.

Work function: The energy difference between the Fermi level and vacuum zero. The minimum amount of energy it takes to remove an electron from a substance into the vacuum.

Working Fluid: A fluid used to absorb and transfer heat energy.

Working Gas Capacity: The presently developed maximum capacity of gas in the reservoir that is in addition to the base gas

Working gas: volume of natural gas expected to be cycled from a gas-storage facility.

Working Interest - The right granted to the lessee of a property to explore for and to produce and own oil, gas or other minerals. The working interest owners bear the exploration, development and operating costs.

World-scale rates: a schedule of nominal freight rates against which tanker rates for all voyages, at all market levels, can be compared and readily judged.

Wound Rotor Motors: A type of motor that has a rotor with electrical windings connected through slip rings to the external power circuit. An external resistance controller in the rotor circuit allows the

performance of the motor to be tailored to the needs of the system and to be changed with relative ease to accommodate system changes or to vary the speed of the motor.

x y z

YAW: The rotation of a horizontal axis wind turbine around its tower or vertical axis.

YTD: Year-to-date.

Yurt: An octagonal shaped shelter that originated in Mongolia, and traditionally made from leather or canvas for easy transportation

Zenith angle: the angle between the direction of interest (of the sun, for example) and the zenith (directly overhead).

Zone: An area within the interior space of a building, such as an individual room(s), to be cooled, heated, or ventilated. A zone has its own thermostat to control the flow of conditioned air into the space.

Zoning: The combining of rooms in a structure according to similar heating and cooling patterns. Zoning requires using more than one thermostat to control heating, cooling, and ventilation equipment.

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