

“While the early experimenters chiefly directed their attention to the chemical effects of galvanic currents, other phenomena were not overlooked. It was soon found that, when passing through a conductor of any kind, the current evolved heat, the amount of which depended on the nature of the conductor. This thermal effect is now of great practical use in electric lighting, heating, etc.”

Sir William Cecil Dampier

The Public Utilities: The Basics

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Overview

The position that electric energy has come to occupy in our civilization is a result of its unique characteristics of ease in transportation and distribution, ease of application to the widest range of processes requiring energy, and its potential for application to almost all energy-using processes with the utmost flexibility, complete cleanliness, and safety, and with the largest and most sensitive susceptibility to control.¹

The engineers, accountants, lawyers, economists and regulators who run the electricity supply industry speak a jargon that baffles outsiders and obscures simple concepts behind a fog of specialized verbiage. Here are the basic concepts and vocabulary necessary to understand the industry, its operations, regulation, finance, ratio analysis and interaction with the capital markets.

¹ Philip Sporn, *The Social Organization of Electric Power Supply in Modern Societies* (Cambridge: The MIT Press, 1971), p.3.

Measurement

The industry uses a measuring system that combines Greek prefixes with units named after dead scientists.

The common prefixes are:

Kilo – thousand (1,000 or 10^3), from the Greek word for “thousand,” pronounced “kill-oh” or “kee-loh,” abbreviated “K”.

Mega – million (1,000,000 or 10^6), from the Greek word for “large,” pronounced “mehg-uh,” abbreviated “M”.

Giga – billion (1,000,000,000 or 10^9), from the Greek word for “giant,” pronounced “jig-uh” or pronounced with a hard g as in “giggle”), abbreviated “G”.

Tera – Trillion (1,000,000,000,000 or 10^{12}), from the Greek word for “monster,” pronounced “ter-uh,” abbreviated “T”.

The three commonest units (and their non-technical meanings) are volts (electrical pressure), watts (size of a generating station or even a light bulb), and kilowatt-hours (thousands of units of output in an hour). Notice the ability to combine: a thousand volts equals one kilovolt (kV), a power station of one million watts size is rated at one megawatt (MW), and because the watt-hour is too small a unit, we commonly measure in thousands of watt-hours, or kilowatt hours (kWh). The letters and the combinations are capitalized in various ways, depending on the source and the country. Do not worry. A kWh is a KWH is a kwh is a Kw.h.

Operations

Electricity producers measure the size (capacity) of a generating station in *kilowatts* (thousands of watts), abbreviated kW, or *megawatts* (millions of watts), abbreviated MW. Those measures are equivalent to saying that a factory has 10 machines, or that a hamburger stand has 10 grills. Capacity figures tell how big a plant is, but not how much it actually produces. The unit of electrical production is the *kilowatt-hour* (kWh) – the amount of electricity produced by running a generator that is one kilowatt in size for one hour. Sales of electricity are measured in kilowatt-hours. The *revenues* of an electric company are its sales in kilowatt-hours multiplied by the price per kilowatt-hour. *Voltage* is the pressure at which electricity is pushed through power lines. Long distance *transmission* lines carry electricity at high voltages. Local *distribution* lines carry it at low voltages. The time at which demand for electricity is highest is the *peak*. A utility must have a *reserve* – spare capacity available should a power station break down during the peak period. The *reserve margin* is the reserve measured as a percentage of the peak load.

Regulation

An electric utility is supposed to be a *natural monopoly*, meaning that one producer can serve customers more efficiently than can many competing producers. In addition to obvious inconvenience of having five or six utility companies dig up the streets, the natural monopoly provides *economies of scale* – that is, one large utility can produce and sell electricity more cheaply than could a number of small producers. Because a utility has a monopoly, a *regulatory agency* in each state assures that the utilities do not take advantage of their customers. The agencies set service standards and prices. The price (rate) is set to permit the utility to collect enough money to cover all operating expenses, including taxes, and to have *enough operating income* left to provide a fair *rate of return* on the money invested in the business. Investors supply the money used to build the plant and to buy the equipment that serves the customers (the *rate base*). The rate of return is determined for the utility's *cost of capital*. For example, suppose that a utility has invested \$1,000 in facilities to serve its customers. The company borrowed \$500 on which it is paying 8% interest (\$40 a year). Holders of the utility's common stock furnished another \$500. The regulators note that the loan costs 8%. After a lengthy hearing, the regulators decide the common stockholders are entitled to a return of 12% on their investment (\$60 a year). Thus, the cost of capital, as calculated below, is 10%, the rate of return that the utility is allowed to earn.

Type of Capital	Amount of Capital		Cost of Capital		Dollar Return	
Debt	\$500	x	8%	=	\$40	
Stock	500	x	12%	=	60	
Total	\$1,000				\$100	And: \$100/\$1,000 = 10%

Regulatory agencies rarely set rates more often than annually. Certain major expenses, however, can move up or down rapidly in the course of a year. A utility might earn too little when these expenses rise, or too much when they fall. To avoid having frequent rate hearings to adjust price for these sudden shifts in expenses, most agencies allow the use of *automatic adjustment clauses* that pass on to customers changes in certain expenses. Fuel expenses that eat up 30-40% of revenues are volatile. Thus, the most common automatic adjustment is for fuel costs.

With the advent of competition, regulators have to deal with additional issues. They have to work out *transition* plans that allow existing utilities to rearrange services and new competitors to establish themselves. In the *bulk power* (wholesale generation) sector, many markets are now fully competitive, that is unregulated as to price or terms of sale. Many states want to establish *retail* (sale to the individual customer) competition as well. Probably the biggest problem is how to devise payment arrangements that allow the utilities to recover *stranded costs* (cost incurred under regulation that the utility will have difficulty collecting from customers once those customers can start to buy service from new suppliers that do not have those costs).

The old regulatory framework, however, has begun to fall apart. Technological developments have facilitated competition in the generation of electricity, and many retail electricity customers can now choose their provider of electricity (but not the company over whose lines the electricity is delivered). Old style regulation now controls less of the business than before, and reformers want to change what remains in order to provide utilities with incentives to operate more efficiently and customers to use electricity more efficiently.

Types of Business

Electric utilities have begun to reorganize by line of business. Some utilities have chosen to specialize in certain lines, selling off those in which they choose not to participate. *Generation*, the actual production of electricity, has become an unregulated business in many parts of the country, carried on by independent companies rather than by utilities. Federal regulation requires that utilities operate their *transmission* lines, which carry power over long distances, separately from their generation activities, a ruling that has caused many utilities to transfer control of transmission to *regional transmission organizations* (RTOs). The *local distribution* system, carrying electricity from the high voltage transmission line to the customer's premises, remains a regulated entity under the jurisdiction of the state. In many states, however, energy *retailers* procure electricity at wholesale and then sell it at retail to consumers, using the lines of the local distribution company to make the delivery. In addition, *power marketers* buy and sell electricity in large volumes, which helps retailers and consumers that want to purchase electricity on certain terms in large volumes, and also aids generators that know how to produce electricity but not necessarily where to sell it.

Ownership

Investor-owned companies control the electric utilities that deliver around three-quarters of the nation's electricity. They own almost all the independent (non-utility) generators of electricity and the power-marketing firms, too. *Public power* utilities, which supply the balance, are government agencies, divisions of local governments, or are owned by their customers. The Federal government owns power agencies that specialize in generation and transmission. A number of states run power agencies that specialize in generation and transmission, as well. Many cities and other governmental subdivisions operate utilities that may have generation, transmission and distribution functions, or, often, only distribution. The trade often refers to these state and city agencies as *municipals* or *munis*, because they issue securities in the tax-exempt or "municipal" bond markets. Customer-owned *rural electric cooperatives* provide electricity in much of America's countryside.

Financing

The electricity business is *capital intensive*, meaning that the electricity supplier has to lay out a lot of money up front, to put in place the plant and equipment that serves the

customer. Rarely can the electricity firm collect enough money from customers in a particular year to pay for the next big investment that will serve customers for many years. Thus, to pay for those large investments, the companies have to borrow money and sell more shares in the market (*external financing*). Public power agencies, which do not issue shares of stock, will borrow the money. When, however, the construction (also called *capital expenditure*) program is low, funds accumulated from the year's operations (*internal funds*) should cover the costs of investment in new plant.

The terms of financing make a difference. For instance, if the interest cost of the new borrowing exceeds the profit that the utility earns on the new piece of equipment, the utility ends up worse off than before, financially. When selling new shares to finance the investment, management knows that the profit earned from the new business has to be added to the profit from the old business. They do not want to sell so many shares to finance the new business that the shares in existence after the financing now earn less per share than before the financing. That is the phenomenon of *dilution*, meaning that so many shares had to be sold to finance the expansion that earnings per share are lower than they would have been had no expansion and financing taken place. Bond owners and other creditors do not worry about earnings per share, but they do place limitations on the entity's ability to borrow, because they do not want it to take on an unsafe burden of debt.

Ratio Analysis

The financial reports of investor-owned corporations and of public power agencies have three key parts. The *income statement* shows revenues and expenses for the year, and the net income, which is what is left over after expenses are paid. The *balance sheet* provides a statement of assets (what is owned), money owed, and money put in by the owners or accumulated from net income retained in the business. The *statement of cash flows* tells how the company raises and disposes of cash in a particular period.

Allowance for funds used during construction (AFUDC) is unique to utility accounting. The utility has to raise money to pay for large projects, but the incomplete plant (*construction work in progress* or CWIP) earns no profit for the utility until completed, although the utility has to pay interest and dividends on the money that it raised to build the facility. Accountants hold that the current year's earnings should not be reduced by the charges for a plant that will serve customers in future years, and regulators hold that utilities are entitled to earn a return on all costs, including the cost of financing a facility before it goes into service. Therefore, the utility adds this cost of capital, the AFUDC, back into income, and then adds it to the cost of the new plant. Unfortunately, some utilities have managed to calculate AFUDC at a level that has exceeded what the utility managed to earn when it finally put the plant into service. AFUDC, remember, is bookkeeping – not cash – income, so investors have to be wary of firms that produce a high level of income from AFUDC.

With little construction underway, one would think that utility financial statements would become like those of other business. Regulated utilities, however, do not yet adhere to generally accepted accounting principles (GAAP). Furthermore, the addition of unregulated business ventures, investments abroad, and the development of new types of financing makes it more important than ever for investors to analyze the accounts carefully.

Competition

The advent of competition will force electricity suppliers to operate and finance in a different manner, cause regulators to change their procedures, and convince investors to differentiate the companies on the basis of varying risk levels. But the physical and financial measures will remain the same.

Operations

Introduction

More than a century after it began, the electricity supply industry still generates most of its output in the same way: burning a fuel to heat water to turn a blade on a wheel that turns a magnet that induces an electric current into the grid. The industry transmits the electricity, in bulk, from the generating station to the place where it is used, and then distributes the electricity safely to the individual consumers, just as before. It invests in huge fixed assets that sit idle much of the time, but must be ready to respond to customers' needs almost instantaneously.

Terminology: Watts, Volts and Ohms

Electricity is the flow of tiny, charged atomic particles (electrons). Its flow through a wire is like the flow of water through a pipe. Its speed, pressure, quantity, and the resistance of obstacles to the flow all must be measured in order to properly describe the flow. The quantity of the charge (akin to gallons or liters for water) is measured by the *coulomb* (C), the charge produced by a total of 6×10^{18} (six followed by eighteen zeroes) electrons. (Charles Augustin de Coulomb was a French military engineer who experimented with electrical and magnetic forces in the 1780s. He found that electric force was proportional to both charge and distance.)

The flow of water in a pipe is measured in terms of how many liters or gallons pass a point per unit of time, e.g., gallons per second. An ampere (A) is the flow of one coulomb per second, under certain conditions of pressure and resistance. (Andre Marie Ampere, a French physicist, showed, early in the nineteenth century, that electrical forces acted on magnets and that electric currents produced forces that acted on other electric currents.)

Water may not flow through the pipe unless it is pushed, i.e., under pressure, possibly from a pump. The *volt* (V) is the unit of electromotive force, or pressure. High voltage is measured in thousands of volts called *kilovolts* (kV). Alessandro Volta was the Italian scientist who, in 1800, built the first electric battery.

Clogged screens or garbage could impede (resist) the steady flow of water through the pipe. Some materials conduct electricity more easily than others. That is, they show less resistance to the flow of electrons than others. That is, they show less resistance to the flow of electrons. In addition, resistance usually rises as a metal conductor is heated. The ohm (Ω) is the unit of electrical resistance. It allows one volt to maintain a current of one ampere in the conductor. (Georg Simon Ohm, a German scientist, early in the nineteenth century discovered the relationship between current, voltage, and resistance, known as Ohm's Law.) Current is proportional to voltage and resistance:

$$\text{Current (in amperes)} = \frac{\text{Voltage (in volts)}}{\text{Resistance (in ohms)}}$$

In other words, if you increase the voltage while the resistance remains the same, you will push more current through. If you raise the resistance, but do not raise the voltage, less current gets through. All of which seems intuitively correct, and gets back to the water analogy.

Work and Power

Work is “the product of the force which acts on the body and the distance through which the body moves while force is acting upon it.”² Power is “the work done divided by the time during which the work is done.”³ The *joule* (J), for all practical purposes, is the energy required to lift 98 grams (about 3.5 ounces) up one meter. (James Prescott Joule was a British scientist who, in the middle of the nineteenth century, demonstrated that heat and work were equivalent.) In our society, though, we are not impressed by the amount of work accomplished if it is done too slowly. The rate of work done is measured in joules per second, or by the *watt* (W), which is one joule per second. (The watt, of course, was named after James Watt, the Scottish inventor who developed the steam engine in the middle of the eighteenth century. For the automotive minded, one horsepower equals 746 watts.) Thus:

$$\text{Work} = \text{Force} \times \text{Distance}$$

$$\text{Power} = \frac{\text{Force} \times \text{Distance}}{\text{Time}}$$

$$= \frac{\text{Work}}{\text{Time}}$$

2

Henry Semat, *The Fundamentals of Physics* (New York: Rinehart, 1957), p. 104.

3

Semat, *op. Cit.*, p. 110.

$$\text{Work} = \text{Power} \times \text{Time}$$

Capacity vs Output

The watt rating attached to an electrical generating station tells us that the plant can produce so many joules per second of power, but that does not tell us what the output actually was in a period, because the plant might have been running for a fraction of the time period, or not up to its fullest ability, or not at all. It is as if we said that a fast food restaurant has 12 stoves, each of which can produce one hamburger every five minutes. That does not tell us how many hamburgers were cooked in an hour, only how many could be cooked (12 per hour per stove or a total of 144). Electric utilities sell their output on the basis of thousands of watts (kilowatts) per hour. That is, if the generating station has the ability to produce at a one kilowatt rate, and does so for an hour, the plant produced one kilowatt-hour (kWh), which is the standard measure of electricity output.

Capacity, Capability and Output

Confusion exists between the output of the generating plant (measured in kilowatt-hours) and the *capacity* or *capability* of the plant, measured by the kilowatt (kW) or megawatt (MW). Capacity is the ability to produce a given output of electricity at an instant in time, and output is the amount of electricity produced in a period of time. (Technically, capacity is a rating given to the generator by the manufacturer or the utility. Capability, on the other hand, refers to the load the unit can handle without exceeding limits set to prevent operating problems.) I.e., an electrical station that has the capability of producing 1,000 kilowatts at one time will have an output of 1,000 kilowatt-hours if it runs at maximum capacity for one hour.

In a sense, the consumer of electricity makes two different calls on the electric system, one for capacity (measured in kilowatts) and one for output (measured in kilowatt-hours). If a customer owns a machine that requires 1,000 kilowatt-hours of electricity each hour to run, the utility must set aside 1,000 kilowatts of capacity to serve that machine. The customer demands 1,000 kilowatts of capacity, and that amount is fixed. The customer, however, could run the machine any amount of time up to 24 hours a day (requiring an output of 24,000 kilowatt-hours). The output taken by the customer varies. That situation is one of the major problems of the electric utility industry, which must have the capacity available for the customer and must support that fixed plant, while realizing that the customer's need for power may vary greatly.

AC and DC

Electric currents come in two kinds: *alternating* current (AC) and *direct* current (DC). Of the two, DC is the simpler. The current flows in one direction. Batteries produce DC, which flows from one pole, through the electrical circuit, to the other pole. AC, on the other hand, changes its direction on a regular basis. Each complete trip, before reversing direction, is called a *cycle*. The frequency of the alternation is measured in cycles per

second, or in *hertz* (hz). That is, 30 hertz means 30 cycles per second. (Heinrich Hertz was a German scientist who in the 1880s discovered electro-magnetic waves in space, which led to the wireless radio, and television.

Although electricity suppliers started out furnishing DC, they found that it was uneconomical to transmit DC for long distances. Now, companies generate AC for most customers, although they do transmit DC on certain routes. Because all the generators that feed power into the electricity network are interconnected, which means that the currents from the various systems are mixed, it is vital that they synchronize the alternations of the current, making sure that each utility reverses the current the same number of times per second in unison. Electrical appliances and equipment, moreover, have to be built for a particular number of cycles per second. In the USA, the standard is 60 hertz. In some other countries, it is 50 hertz. That lack of uniformity is why electric appliances may not work outside their native countries.

Power Factor

Electric motors work by means of an electro-magnetic field. The electricity that magnetizes the equipment does no work, and does not even turn the ordinary electric meter that measures the electricity the customer takes. That component of alternating current, the magnetizing current, is called reactive power. It is measured in volts multiplied by amperes (of the reactive portion of the current) – the volt-ampere reactive, or VAR. The portion of the current that does work (and turns the meter) is real power, measured in watts. The total output, real and reactive, is known as apparent power, and is measured by the volt-ampere (VA), which is volts time amperes.

The power factor measures the proportion of output represented by real power, i.e.,

$$\begin{aligned} \text{Power factor} &= \frac{\text{Real power}}{\text{Real power} + \text{reactive power}} \\ &= \frac{\text{Real power}}{\text{Apparent power}} \end{aligned}$$

The electrical system must produce VARs both for its customers and to maintain the operation of the system itself, components of which absorb VARs. Obviously, the utility prefers to have a high power factor, in order to get paid for services rendered. In the case of residential customers, the utility may add a fixed percentage to the bill to cover the costs. Some industrial customers must pay for VARs on a metered basis because they require so much reactive power for operation.

Summary

The key technical points to remember are that electric current operates under a pressure (voltage), and that it may be direct or alternating, and if the latter, it alternates at a standard frequency per second. The size of a generating station is measured in units of kilowatts, and the units of output by which the quantity of electric supply is measured are kilowatt-hours.

Generation

The building and equipment of the station and its distribution system required large outlays of capital, whereas the demand for light was confined to a relatively small portion of the running time. . . .⁴

Operationally, the electricity supply industry, like Gaul, is divided into three parts. *Generation* is the production of electricity, usually at a power station. The generating operation connects to the utility system through a device called a busbar. (Busbar cost is the cost of generated electricity before it enters the system, and that is the traditional measure for the total cost of generating the electricity.) Right outside the generation station, there is a substation at which a step-up transformer increases the voltage of the electricity for *transmission* at high voltages to the load centers where customers are located. At the load center, the electricity has to be stepped down to the lower voltages at which it will be taken by the customers. Industrial and transit users need higher voltages than commercial and residential customers, so the utility may have several different transformers that step electricity down to different voltages. The *distribution* system carries the electricity from where the transmission line ends to the customer.

Generation is, by far, the biggest sector of the electricity business, accounting for over half of assets as well as of the cost of producing and delivering electricity. Most electricity is generated by burning a fossil fuel (coal, oil or natural gas), or from the burn-up of nuclear fuel, or from the force of water (hydro-electricity). The principle of production is similar for all three sources.

A magnet is surrounded by magnetic lines of force that travel from one end of the magnet (pole) to the other. The lines of force also travel from the pole of one magnet to the opposite pole of another magnet (i.e., from the north pole of the first to the south pole of the second magnet). Those opposite poles attract each other. Lines of force will not travel from like pole to like pole (i.e., from the south pole to south pole of two different magnets). The like poles repel each other. Back in 1819, Hans Oersted, the Danish physicist, noticed that a wire carrying an electric current would deflect a magnet. In 1831, Michael Faraday, the British experimenter, discovered that if he moved a wire through the lines of force of a magnetic field, the field created (induced) an electric current in the wire. That discovery is the basis for almost all electric generation today.

Transmission and Distribution

⁴ Abbott Payson Usher, *A History of Mechanical Invention* (Boston: Beacon Press, 1959), p. 403

The high voltage transmission system carries the electricity from generating stations – often located far from the load center at sites that offer proximity to water and fuel – to the load centers. In the process, transmission losses reduce the electricity available for customers, and those losses may make it uneconomical to transmit electricity for excessively long distances. (Ironically, new high voltage DC transmission is acting as a long distance carrier, but the lines need expensive equipment at both ends to integrate them into the AC network.)

The low voltage distribution system that delivers the electricity to the customer requires many smaller wires, and numerous substations that take the higher voltage and step it down to low levels for neighborhood use. Although high voltage lines are invariably above ground, due to the immense cost of burying them and trying to dissipate the heat that would build up underground, distribution lines often are underground, especially in urban areas. At the end of the distribution line, right on the customer's premises, the meter is located, measuring how much electricity (in kWh) the customer takes. Until recently the meter was the only device on the customer's premises: prosaic, reliable, and unchanged for many years. Now, with the revolution in microelectronics, utilities can read more than quantity of kWh consumed, and they can install devices that control what appliance goes on, and even send automatic meter readings to a central point.

Public Utility – The Evolving Electric Industry

The electricity industry in the United States is evolving rapidly in the direction of increased competition. This trend is the product of the interaction of a number of developments. Prices for natural gas have fallen dramatically. And the technology of gas-fired electricity generation has been advanced to the degree that new combined-cycle gas power plants are relatively low-cost, flexible resources. These changes have broken down the financial barriers that once blocked entry into the electricity generation business.

These forces have been amplified by important policy changes at federal and state levels. Federal policies encouraging competition in generation began with the Public Utilities Regulatory Policy Act of 1978 (PURPA) and have been advanced by both the Natural Gas Act of 1980 and the National Energy Policy Act of 1992. The Federal Energy Regulatory Commission is in the process of adopting new rules to ensure competitive wholesale power markets. Progress toward competition at the retail level has been left to the states to determine and shape. In many states, the prospect of lower-cost power is driving consumers of large amounts of electricity to seek access to the competitive market or at least to market prices.

The pressure for retail competition is evident. For example, the Bonneville Power Administration, which markets electricity from the federal power system in the Northwest region of the United States, is a power wholesaler and, as such, is already fully exposed to competition. Bonneville's size and importance in this regional power system mean that wholesale competition will have dramatic effects in the Pacific Northwest regardless of actions at the retail level.

Capturing the Benefits of Competition

Competition in the electricity industry has been promoted because it is considered to be more effective than regulation in fostering improved productivity, greater innovation, increased choice and lower costs to consumers. However, without a market structure that fosters effective competition, the industry could simply replace regulated monopolies with deregulated oligopolies -- where a few large companies have near-monopoly power.

There are generally recognized conditions that need to be met to foster effective competition. For example, an effective market requires an adequate number of sellers, and market access by buyers and sellers to ensure that no individual has the power to influence prices in the market. The Federal Energy Regulatory Commission (FERC) is pursuing policies intended to satisfy these conditions at least partially, by expanding access to electricity markets through transmission systems.

An effective market also requires that sellers cannot subsidize their competitive position by shifting costs to customers in the monopoly part of their business. This condition could be met by separating companies into their competitive and monopoly components.

Even if effective competition is achieved in the utility industry, market imperfections and other barriers could keep the industry from functioning efficiently. For example, if environmental costs and benefits are not taken into account, the utility industry will fall short of environmental goals. Other market barriers can limit the amount of energy conservation that is secured. Consequently, continued attention to market imperfections may still be required even in competitive markets.

There are also some things that competitive markets simply can't do. In California, for example the utility system supports social goals, such as economic development in remote rural areas or promotion of irrigated agriculture, generally by offering lower rates for these purposes. In a competitive electricity market, it may be difficult to include the costs of providing low rates to some in the prices charged to others. If supporting such social goals is to continue, new avenues and sources for the support may need to be identified.

Finally, how the transition from the regulated utility industry to a more competitive market is structured is critical. The transition requires reconciling decisions and actions made in the regulated environment with the new realities of competition.

Stranded investment -- the inability to recover the full costs of past utility decisions at current market prices -- is the most contentious issue in this area. Where legitimate stranded costs exist, the allocation of those costs between utility stockholders and utility customers will need to be negotiated.

Resource Issues in Competitive Markets

The advent of competitive electricity markets raises new issues with respect to the development of conservation, renewable resources and the consideration of environmental costs and benefits.

Cost-Effective Conservation

An objective of most utilities in the United States has been "to achieve cost-effective energy conservation." Despite the success in these conservation efforts, significant cost-effective energy savings remain. Conservation can identify savings equivalent to the electricity generated by a number of typical combustion-turbine power plants, and on average, they cost about two-thirds as much.

If this conservation is developed, consumers would save billions of dollars on their future electricity bills. Consumers on their own will make some of the efficiency improvements. Regional utilities will secure more. Together, consumers and utilities will

probably capture about a third of the available and cost-effective savings over the next 20 years. But, unless the remaining two-thirds of the savings are secured, each region will pay billions more in power system costs and natural resource impacts than it needs to.

There are significant uncertainties inherent in any long-term look at the benefits of conservation. On the other hand, there is the risk that growing scientific evidence that global climate change is occurring could result in the imposition of measures to reduce emissions of carbon dioxide and other greenhouse gases thought to contribute to this climate change. If a carbon tax between \$10 and \$40 per ton of carbon dioxide were implemented in 2005, the value of the conservation would grow to between \$3.2 and \$6.1 billion.

In even extreme scenarios, the development of further cost-effective conservation is a positive long-term investment for a region. In the shorter term, however, conservation requires that the region incur somewhat higher costs today compared to buying electricity off the open market. For conservation to be successfully developed in the future, the near-term costs must be weighed against its longer-term benefits.

A region's utilities have been the dominant forces behind the success of conservation efforts in the past. However, their role is changing because competitive pressures are making some utilities reluctant to spend money on conservation programs when some of their competitors do not make such investments. As a result, utilities will be unable to secure all the remaining conservation that is cost-effective.

Consumers are expected to save some electricity on their own, but there are significant market barriers that will likely limit this activity. Most utility resource plans include significant amounts of conservation acquisitions over at least the next four years. As a result, each region has some time to think through potential actions that might be appropriate for the long run.

In light of the potential benefits that may be at risk, it is suggested that the states evaluate the costs and benefits of potential mechanisms to acquire conservation beyond what will naturally be developed in the market. The goal should be a competitive market that preserves as much of the conservation benefit as possible.

Some options include: waiting during this transition period to see what happens in the market; instituting a system benefits charge similar to the charge on phone bills that pays for the 911 emergency line; granting utilities distribution monopolies only if they offer conservation opportunities to their customers; or requiring that a certain amount of load growth be met by conservation. The last suggestion would result in efficiency trading, similar to emissions trading, which is already in practice in the electricity industry. Important qualifications for any mechanism are:

1. That it be competitively neutral and not interfere with the market pricing of electricity;
2. That it complement the emergence of competitive markets for energy-efficiency services;

3. That it provide some symmetry between who pays and who benefits;
4. That it be administratively efficient;
5. That it use competitive mechanisms to the greatest extent possible; and
6. That it incorporate mechanisms to ensure performance.

Renewable Resources

Renewable energy projects -- those powered by the sun, wind, biomass, water and geothermal energy sources -- are valued because they have generally favorable environmental characteristics, they offer diversity and flexibility, and they help ensure the long-term sustainability of the power system. Approximately 17 percent of all resources developed during the last eight years can be attributed to renewable energy -- primarily biomass and hydropower.

Declining wholesale electricity prices in the Western United States have resulted in near-cessation of the development of additional generating resources within this area. This is consistent with the surplus of generating capacity on the Western electrical system, but it raises the question as to what type and level of renewables activity, if any, is desirable in this environment.

Few renewable resources are cost-effective in the near term. Even over the long-term, the large inventory of undeveloped renewable resources available has little expected economic value. However, the potential value of these resources would increase substantially if mitigation of carbon dioxide production were required to control global climate change. Such controls could raise the cost of competing resources.

But, even if carbon dioxide controls were needed in the future, there appears to be little economic value in developing renewables in advance of need and cost-effectiveness. Such projects would require a substantial cost premium, they preclude the benefits of later technological development and are unlikely to produce significant economic benefit. This holds even with consideration of uncertain fuel prices, water conditions, demand growth and with adoption of relatively high carbon taxes.

Renewable resources are unlikely to be selected by utilities in a competitive market in the near term because they are not cost-competitive. However, key development and demonstration activities conducted now will help the utilities integrate such resources into the power system in the future.

Based on analysis conducted by a consortium of utilities in the northwest United States, a renewable resource strategy should focus on:

Ensuring that the restructured electric power industry provides equitable opportunities for the development of cost-effective renewable resource projects;

- Ensuring that the renewable resource potential is adequately defined and that prime undeveloped renewable resources remain available for future development. This will require completion of key demonstration projects and additional resource assessment activities that are already under way within the industry;
- Supporting research and development efforts to improve renewable technology;
- Offering green power purchase opportunities; and
- Monitoring fuel prices, the global climate change issue and other factors that might influence the value of renewable resources. More aggressive preparation for the development of renewables could be initiated if changes in these factors indicate that accelerated development of renewables is desirable.

Environmental Considerations

There is increasing scientific concern that global climate change may be caused by emissions of greenhouse gases, most notably carbon dioxide. Carbon dioxide is produced in large quantities by power plants (and other energy equipment) that burn fossil fuels. Global climate change is a particularly difficult issue to address in power planning for several reasons. First, while the uncertainty regarding global climate change is narrowing, there remain questions regarding the existence, causes and magnitude of that climate change. The consequences of global climate change are also not well understood.

Second, global climate change is largely "external" to a particular region. While each region would experience the effects of any climate change that occurs, actions taken unilaterally by the region could not, in and of themselves, significantly affect the degree of climate change experienced by the region. Third, in regions that have significant hydroelectric resources, the electric utility industry is not the most significant producer of greenhouse gases. Reductions in greenhouse gases might be accomplished at less expense in other sectors of the economy or in other parts of the world. Thus, while some areas in the US must be seriously concerned about their impact on the global climate, others have little impact. Each region must assess their efforts toward conservation.

Regardless, the possibility that emissions of greenhouse gases might someday need to be controlled poses a financial risk. For example, a carbon tax could significantly increase the cost of electricity from fossil fuel power plants. If the type, magnitude and timing of possible carbon dioxide regulations were better known, certain near-term resource choices or, alternatively, investing in carbon offsets (e.g., tree planting) might be good hedges against carbon regulation. However, because of the lack of sufficient information, strategic responses to global climate change cannot be evaluated with the level of sophistication that it can bring to, for example, gas price uncertainties or future electricity requirements of the region.

Until the uncertainty regarding climate change is resolved by scientific consensus, and national and international policies respond to that consensus, a region can reduce its exposure to risk by:

- Avoiding investments in generating resources that are heavy emitters of greenhouse gases;

- Securing cost-effective conservation;
- Gaining experience with measures to offset greenhouse gas emissions, such as reforestation; and
- Considering the carbon dioxide offset value of the region's operating nuclear plants.

Structuring the Competitive Marketplace

Deregulation without attention to how competition is structured will not secure the low-cost and reliable electricity that is the desire of the deregulation architects. Nor will competition necessarily secure the societal and environmental values that the utility client base has come to expect from its power system.

To achieve the full benefits of a competitive electricity market -- lower power costs, innovation in both services and technologies, more choices for consumers, and attention to societal and environmental values -- the industry will need to design its own structure for that market.

An example of this structural redesign is Energy Source Costing.

Competitive Market Effects on Production Cost Management & Pricing

The traditional utility market model in which a utility was government owned or a regulated investor owned company focused on cost recovery. This model rewarded utilities for keeping track of total costs that were used to calculate the rates that customers would pay. The intent was to recover the cost plus an allowed rate of return. While this model allowed the utility to recover its costs, it did not require the utility to be exacting in tracking individual plant costs. Instead the costs were tallied together and an average rate established to transfer the costs to rate base. This model worked well for many years.

In many areas of the world independent power producers and cogenerators have emerged. They have developed their own operating techniques and have in many cases found ways to produce energy at lower costs. This has given increased attention to Energy source costs.

As competition has been introduced, customers are becoming more price conscious in their selection of a utility service provider. This makes it necessary for a utility to know by source the cost of providing energy. This information is needed to provide prospective customers with the price that service will be provided. The energy provider needs to know the exact cost to make pricing and production decisions.

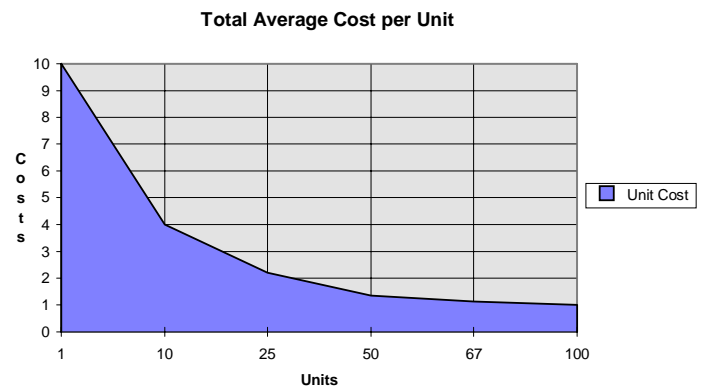
This trend is having an impact on customer billing. Some customers are requesting and getting cost based prices. Given that the largest consumers have the most to gain by cutting utility costs, they are the most likely to switch suppliers. This reality means that for a utility to retain these customers, they need to be able to find the lowest cost energy sources to serve these customers.

In order to supply these customers, the exact cost of energy by source must be known. Airlines have become very adapt at understanding the marginal costs of adding passengers on flights and have complex pricing and costing systems to maximize the yield or revenue from each flight. This has caused consumers to become very astute in the purchase of their airline tickets.

Just as an airline markets fares based on incremental costs the same principals can be applied to utility service. A utility providing electric service may have some nuclear generation, fossil fuels, such as coal or oil, and hydro resources that it owns and operates. Other sources may include independent power producers, co-generators and exchange agreements. Each of these by plant have costs associated with them.

There are fixed plant costs that reflect the cost of building the plant, operating costs stemming from the labor and materials to keep the plant operating and fuel costs. The fuel costs for a hydro plant may include opportunity costs given that the amount of water available to run through the turbines may not accommodate a full load -- full time operation.

The chart on the right illustrates this concept. As more units are produced, the cost per unit decreases. This fact of production cost can be exploited to provide valued high volume customers pricing that reflects their greater contribution to utilizing the full production capacity. Fixed and operating costs can be tallied together in time periods, such as a week and captured as spinning costs. The fuel costs are a variable cost that may vary by the hour. For example, a fossil fuel plant running at half capacity will be using more than 50% of the fuel it would consume running at full capacity. This represents an incremental cost opportunity to sell energy at a discounted price to special (a.k.a. large key) customers.



As the airlines moved into the competitive environment, they had to rebuild themselves and revamp even the most basic of their operating systems. Prior to deregulation, the operations department kept the passenger list in case the unthinkable occurred and families needed to be notified. Today, the flight attendants have a list with the names of the passengers and notes about which passengers are premium flyers. This required considerable change within the airline, not only in operations but in business process and practice.

Just as the airlines had to remake themselves, so must utilities to provide special treatment to that 5% of the customers who account for over half of the total revenue.

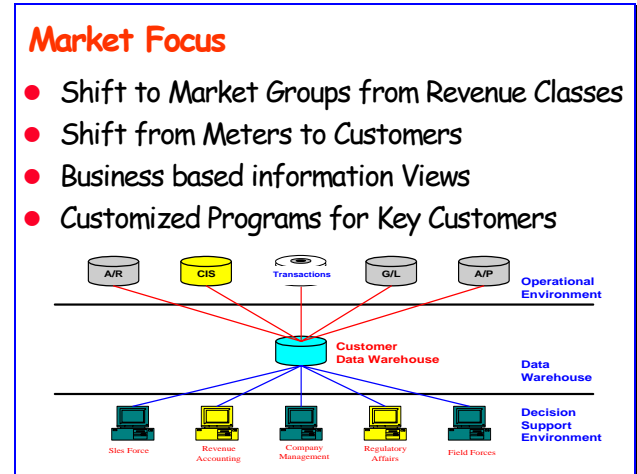
Many airlines failed to understand the need for or how to make the essential transformations to survive.

The following chart shows some of the business shifts that utilities will need to make to succeed. While deregulation is in its infancy in the utility industry, the organizations that are forward thinking and do projects based on a business vision rather than as tactical moves will be the ones who will be able to attract more of the large consumption customers and reap the benefits of a deregulated market place.

Flexibility is the key word in today's utility market place. Utility ERP systems must be flexible to handle multiple companies in a multinational, multi-currency environment. Billing systems must be customer centric rather than meter centric. All systems must be

structured to handle one-to-one transactions and marketing yet provide management with consolidated views of their business. Executive information delivery systems must have "real-time" access to the corporate data warehouse but present the information in individually customized views based on the particular executives preferences. Data Marts will be established for each business unit of the utility each accessing the common data warehouse for consistency. Management of the complex spot-market options for electric utilities must link between the vast supply network and the regional demand requirements in a seamless environment. This "real-time" network must be linked to the corporate data marts in order to complete the work flow for the corporation.

The electric industry is evolving. It is considerably different today from what it was only ten years ago. Competition, deregulation, mergers and acquisitions, globalization, disaggregation and changing products and services have had their effect. The next ten years will see even more changes. Those utilities that survive in this industry will be those companies that can prepare for the future. Decisions made today regarding information technology may well be the deciding factor for those that survive and those that don't. These decisions must be business based not technology based. They must anticipate the changing environment and position their respective companies to be flexible, adaptable and successful.



Public Utility – Conclusion

I was shipwrecked before I got aboard.⁵

---Seneca

Not a bad run: almost 80 years of steady growth, uninterrupted profits, declining prices, reliable service, satisfied customers. But, around 1965 this run ended, when economies of scale for generation reached a limit.⁶ The industry and its regulators had difficulty facing up to the new reality: that the next power plant would not reduce unit costs, that prices might rise rather than fall. Perhaps if they had faced reality, if they had set prices that represented the new cost structure, then the electric industry, and its customers might have fared better. But they did not – and probably could not – do so. The traditional regulatory process, alone, with its fixation on historic average costs would have constituted a formidable roadblock to reform, even if the industry had wanted it.

Thomas P. Hughes, historian of science and technology, warned that problem solvers had to distinguish between the technical and the technological. To Hughes, the technical involved “tools, machines, structures, and other devices” while the technological encompassed “technical . . . , economic, political, scientific, sociological, psychological, and ideological . . .”⁷ In other words, “technological” meant the tools and how they functioned and interacted with the environment. When the industry’s difficulties began, those in it focused on specific technical fixes, whether those fixes included new coal unloading facilities to reduce costs, or nuclear power to replace coal, or account-rate cases designed to deal with appearances rather than reality. They seem not to have realized that the fundamentals of the industry’s operations had altered radically, and with that change, its relationships with its customers.

Institutional Change

For decades, utilities handled all aspects of electricity supply: production, procurement of electricity from outside sources, delivery and billing. Some utilities went so far as to mine and transport the fuel they needed on one side, and sell electrical appliances on the other. What electricity they did not produce they purchased from other utilities, for resale to their customers. As the low cost, protected suppliers of a necessity to a fast growing market, utilities incurred minimal business risk. The customer took everything the utility could offer. The utility designed its financial policies with this protected position in mind, borrowing heavily, paying out high dividends, engaging in financial practices that normal companies would shun, confident that they could always raise money when needed. Regulators, admittedly, prevented the utility from earning excessive profits, but

5 Epistles of Seneca, 87, 1.

6 Richard f. Hirsh, *op.cit.*, takes this view.

7 Thomas P. Hughes, “Technological History and Technical Problems,” in Chauncey Starr and Philip C. Ritterbush, eds., *Science, Technology and the Human Prospect* (New York: Pergamon Press, 1980), p. 182

they also stood ready to shield the utilities from incipient competition and from the consequences of poor business decisions. The electricity industry operated in a self-contained world, insulated, so it seemed, from the turbulent, market-driven world that surrounded it – until the 1960s.

By the 1980s, the utility industry began to lose its absolute grip on the market. New generators started to take a small but fast growing share of the generating market. Ironically, those new generators financed their expansion by borrowing money on the strength of long-term power purchase contracts signed by the utilities. Within a decade, those utility-supported independent generators demonstrated that they could provide a viable alternative to utility-produced power.

In that same time period, bracketed roughly by the ascendancy of Margaret Thatcher and the fall of communism, prevailing attitudes about the efficacy of government ownership and regulation swung in the favor of private initiative and free market solutions for economic problems. In the United Kingdom, the Thatcher government began a decade-long process of selling off all government-owned utilities to the private sector, and instituting “light-handed” regulation, accompanied by the introduction of competition. By the time the government got to the electricity supply industry (the British term), it had concluded, from its experiences with telecommunications and natural gas privatization, that breaking up the industry in advance of privatization would lead to more competition faster than leaving the industry intact with the hope that formidable competitors would arise quickly. In the United States, the Carter Administration deregulated railroads, trucking and air transportation. The Reagan Administration partially deregulated natural gas pipelines and telecommunications. Those moves produced significant savings for consumers. Why not tackle the electricity sector next?

First, the Federal government removed restrictions on generation of electricity by non-utilities, permitted utilities to expand internationally, and opened up the transmission networks to use by all generators, whether owned by utilities or by others. Then the states began to examine how changes in regulation might reduce prices for consumers. At that point, all the stakeholders (formerly called “special interest groups”) jumped into the process in order to protect or advance their positions, having learned, presumably from past deregulations, that competition can hurt incumbents. As a result, a decade of electricity restructuring produced a confusing array of arrangements: state-by-state actions, partial deregulation, protection for incumbents against the inconveniences of immediate competition, mandated but limited price reductions, few usable price signals for consumers, corporate reorganizations, and internationalization.

The new Millennium

The electric company, the old utility, no longer produces the product from beginning to end. They may package the product for consumers, and as the regulated delivery vehicle with the known name, deep pockets and no way to escape, they will take the fall when something goes wrong, even when no longer responsible for the components that fail.

That brings up the need to build facilities to meet future demand, and the need to assure reliable service. As a start, the regulated utilities have cut back on their capital expenditures, over a multi-year period. They did not know what deregulation would bring, they did not know which functions they would perform, and they thought that they had better places to invest their money.

With generating reserve margins now at low levels, and some regions short on capacity, electricity suppliers will have to beef up their investments in generation, or consumers will have to begin a process of investment in distributed resources that serve them when the electricity industry cannot. Of course, proper pricing might reduce demand, but neither electric companies nor consumers have put in place the metering and controls needed to make price a key component of the market.

The transmission and distribution sector, similarly, will require additional investment in order to meet growing demand and maintain reliability. The cost of that needed investment probably did not enter into the negotiations for price freezes that characterized the transition deals, so the utilities may face expenditures for which they receive no compensation. As an alternative, consumers or energy service companies might have to install the equipment and institute the services needed, at the customer's level.

The regulatory system in most places consists of price freezes for multi-year periods or old-style rate of return regulation. Neither alternative fits with a competitive market in the sense of sending price signals, and neither alternative encourages the regulated entity to find better ways to meet the needs of the market players.

Organizationally, the old utilities have regrouped through mergers and divestitures, moving into many states and abroad. Small companies sell out, fearing that they cannot compete with the electric industry giants, which by the standards of the international energy business, are still small companies. Meanwhile, the public power agencies that do not have the same organizational flexibility as the investor-owned companies have to deal with many of the same competitive and service issues.

The supposed transition to competition has left the customer in an odd position. Presumably, policymakers designed their restructuring plans for the ultimate benefit of consumers, but the results initially produced a combination of small price reductions in some places, price volatility in others, and nationwide concern about the reliability of service. This restructuring has neither captured the imagination of the public nor attracted the mass marketing entrepreneurs in the same way as airline or telecommunications restructuring did. Could this be a different business? The incumbents made sure that they could cash out before the public would see any dramatic benefits, and the first years of restructuring have produced few benefits of consequence to the consumer.

The Future

While the existing utilities and generators continue to fixate on centrally determined solutions in both generation and transmission, and politicians and regulators continue to supervise the transition to whatever they think a competitive market should look like, the technology of producing, delivering and managing the product continues to move at a faster pace than those supervising the industry. The electricity system will have to show prices to customers, and at that point, the customers will get what they want, either through the network or via distributed resources, because new technologies will afford real choice to the consumer.

Of course, there is an alternative. Those disturbed by price fluctuations and uncertainties, by the fact that the semi-regulated, transitional, imperfect market (with all its price controls and fixing) has not lived up to the hype generated by advocates of free markets and disturbed by opportunistic politicians looking for a quick fix, might succeed in reintroducing regulation, possibly via price controls on everything. That would not solve the supply problem and would continue to exacerbate the demand problem by not sending price signals to customers. And price controls could hamper the development of non-grid alternatives, at least until the point at which consumers choose those alternatives, not on a price basis, but because the grid-based suppliers no longer provide reliable service. Put Humpty-Dumpty back together again? Is that a dream or a nightmare?

Summary

In the end, the consumers – not the regulators, incumbents or politicians – will call the shots. Inefficient suppliers will lose out. Market-driven companies will come out ahead. Unexpected entrants will push aside established players. Big energy firms cannot long leave such a market to small-sized local incumbents. Competition should, eventually, lower costs and lead to new products. A nineteenth century industry cannot serve a twenty-first century economy.

Public Utility – Afterword

“Consider your verdict,” the King said to the jury. “Not yet, not yet!” the rabbit hastily interrupted. “There’s a great deal to come before!”⁸

---Lewis Carroll

We considered our verdict. We wanted competition, the discipline of the market, as opposed to the discipline of the regulator. Well, not exactly. We really wanted lower prices and new products, what other deregulations achieved, but without hurting incumbents or disturbing established interests. We wanted all customers better off and no customers worse off. We wanted the play of supply and demand to go in one direction all the time, pushing down prices, but somehow still not discouraging new investment. No really trusting markets, we fixed some prices but not others, put new monopolists in place, and even prevented customers from exercising the choice of free exit from the system. We achieved consensually arrived-at restructuring imposed in a rush by those determined to show that they would do something. Remember the old joke about the cruise ship captain who announced: “I’ve good news and bad news. Let’s start with the bad news. We’re lost. Now for the good news. We’re 30 minutes ahead of schedule.

In the year 2000, almost everything that could go wrong did go wrong. On the East Coast, customers realized that they could game a system that offered a fixed regulated and fluctuating unregulated market price. They switched from the unregulated to regulated price whenever the unregulated market price was higher. This forced the providers of regulated service to operate at a loss because they had to provide the output at the fixed price while they had to procure it from others at the higher market price. (That, of course, brings up the old refrain, “We lose money on every sale, but we make up for it with volume.”) Whenever market price fell below the regulated price, customers returned to the unregulated provider, so the regulated provider never had a chance to recoup the losses. And, while that was going on, transmission organizations quarreled over the price of connection with generators who wanted to connect to the network.

But the eastern missteps paled in comparison to California’s fiasco. There, prices rose instead of falling. Long years of not building power plants, combined with high demand produced power shortages. Utilities could not shop around for cheaper power (assuming that it was there) or hedge against price hikes because the state mandated that they could shop in only one place, and that place did not provide what the utilities needed. The transmission organization stumbled from one near miss to another, although the lights did stay on most of the time. The utilities ran up billions of dollars in debts incurred buying the electricity (at market price) that they had to sell to customers at lower regulated prices. The state government decided to solve the power shortage by imposing price controls. Then the Federal Energy Regulatory Commission demanded wholesale

restructuring of the state's market and imposed its own price caps. As a result of the debacle in California, some policymakers decided to hold off restructuring in other states. The California experience gave deregulation a bad name even though what California had instituted was anything but deregulation. After a first act like that, would anyone stay for the second act?

Unfortunately, the restructured system, in return for a small price reduction, provides for little choice and little interplay between the forces of supply and demand. It does not provide incentives for improving reliability, and seems to contain within it perverse incentives that bring on the unintended consequences that have marred other industry reorganizations.⁹ Government policymakers and confused consumers might even attempt to halt the move toward deregulation, thanks to events brought about more by the absence of deregulation but seen as the fruits of deregulation.

The faults of the reorganization of the industry may derive more from the restrictions on market forces than from their operation. We are, still, nowhere close to the competitive goal. The dash to competition has barely begun.

9

Marija Ilic and Leonard Hyman, "Getting It Right the First Time: The Value of Transmission and High Technologies," *Electricity Journal*, November 1996, p. 8

Appendices

Appendix A: Chronology 1800-2000

Year	Technological	Institutional USA and Canada
1800	First electric battery	
1801	Principles of arc light – H. Davy (UK)	
1808	First effective arc lamp – H. Davy (UK)	
1816		Gas Light Co. of Baltimore founded by R. Peale – first energy utility in the USA, predecessor of Baltimore G&E
1820	Relationship of electricity and magnetism confirmed – H.C. Oersted (Denmark)	Congress gives City of Washington authority to regulate some prices.
1821	First electric motor – M. Faraday (UK)	
1826	Ohm’s Law – G.S. Ohm (Germany)	
1831	Principles of electromagnetism, induction, generation and transmission – M. Faraday (UK)	
1832	First dynamo – H. Pixii (France) Faraday publishes on induction (UK) J. Henry publishes on induction (USA)	
1837	First industrial electric motors – T. Davenport (USA)	
1839	First fuel cell – W. Grove (UK) Term “acid rain” coined – A. Smith (UK)	Rhode Island sets up regulatory commission
1860	Lead storage battery – G. Plante (France)	
1865	Mathematical theory of electromagnetic fields – J.C. Maxwell (UK)	
1870	First effective dynamo – Z.T. Gramme (Belgium)	
1872	Gas turbine patent – F. Stulze (Germany)	
1873		Outdoor arc lighting, Winnipeg
1876	Improved arc light, Jablohoff candle – P. Jablohoff (France)	Arc lights at Philadelphia exposition
1877		Munn v. Illinois – U.S. Supreme Court

Year	Technological	Institutional USA and Canada
		upholds regulation First commercial districting heating in USA -- Lockport, NY
1878	Efficient arc lamp and open coil dynamo – C.F. Brush (USA)	Edison Electric Light Co. (USA) and American Electric and Illuminating of Montreal are founded
1879	T.A. Edison (USA) and J. Swan (UK) independently invent practical incandescent lamp	First commercial power station opens in San Francisco, uses Brush generator and arc lights British Columbia Electric Railway
1880		First isolated power system, from Edison, for S. S. Columbia
1881	Electric streetcar – E. W. v. Siemens (Germany)	
1882		Edison's Pearl Street Station First hydroelectric station opens – Appleton, WI
1883	Transformer invented – L. Gaulard (France) and J. Gibbs (UK)	First electric lighting plant in Canada, Cornwall, Ont. First electric tramway in USA, Richmond, VA – Sprague design
1884	Steam turbine invented – C. Parsons (UK)	Edison takes control of Edison Lighting Co. Streetlights, Montreal and Toronto
1886	W. Stanley develops transformer and AC electric system (USA)	Westinghouse Electric is formed
1888	N. Tesla invents induction motor and polyphase AC system (USA) O. Shellenberger invents induction motor, first AC meter to measure consumption (USA)	
1889	Impulse turbine patent – L. Pelton (USA)	Edison General Electric is formed National Association of Regulatory Commissioners founded as association of railway commissioners
1890		First execution in electric chair

Year	Technological	Institutional USA and Canada
		The North American Co. is formed United Electric Securities organized by Thomson-Houston
1891	Westinghouse transmits hydro AC at 3.3 kV for 13 miles, Oregon C. Brown transmits at 3.0 kV for 110 miles (Germany)	
1892	T. Wilson develops electric furnace process to produce calcium carbide (Canada)	General Electric (GE) formed by merger of Thomson-Houston and Edison General Electric C. Steinmetz, theoretician of AC and mathematician joins GE, beginning corporate industrial research in USA
1893	Westinghouse displays AC system at Chicago World's Fair Folsom Powerhouse in California transmits at 11.0 kV 3 phase AC, 22 miles to Sacramento	AC chosen for Niagara Power
1895		Niagara station completed
1896	Niagara line, 11.0 kV, 3 phase AC, 20 miles Connection between CO ₂ and climate change – S. Arrhenius (Sweden)	Niagara transmission line (Niagara Falls to Buffalo) opened
1897	J. Thompson discovers electron (UK)	C. Yerkes proposes state regulation for streetcars and long franchises
1898		Smith v. Ames. Supreme Court decrees just compensation on fair value S. Insull proposes state regulation of utilities
1900	Highest voltage transmission line 60 kV	
1901	Westinghouse offers 3.5 MW turbine. 2.0 MW turbine, largest installed in USA	First power transmission line between USA and Canada – Niagara Falls
1902	5.0 MW turbine for Fisk St. Station, Chicago	

Year	Technological	Institutional USA and Canada
1903	First successful gas turbine (France)	World's first all turbine station, Chicago. Shawinigan Water & Power installs world's largest generator (5000W) and world's largest and highest voltage line – 136 Km and 50 kV (to Montreal).
1905		Work begins on Great Southern Grid (USA) that, by 1914, transmits in NC, SC, GA, and TN. Pacific G&E incorporated. Electric Bond and Share founded. Ontario Hydro founded.
1906		Associated G&E incorporated.
1907	Electric vacuum cleaner – J. Spangler (USA). Electric washing machine – A. Fisher (USA).	State utility regulation in MA, NY and WI.
1909	First pumped storage plant, 1500 kW, Schlaffhausen (Switzerland).	
1910	Neon lamps. Tungsten wire filament.	S. Insull electrifies rural communities.
1911	Air conditioning – W. Carrier (USA).	
1912	Largest generator 35 MW, highest transmission voltage, 150 kV	Insull starts holding company.
1913	Gas filled incandescent lamps. First air pollution control device – cinder catcher – T. Murray (USA). Electric refrigerator – A. Goss (USA).	
1914		Illinois forms regulatory agency.
1916		Federal government begins construction of Muscle Shoals, AL, dam to supply electricity to munitions complex. Origin of TVA.
1919	Atomic fission – E. Rutherford (Canada).	
1920	First station in USA to burn only	Federal Power Commission (FPC).

Year	Technological	Institutional USA and Canada
	pulverized coal.	
1922	175 MW largest generation station.	Associated Gas and Electric incorporated. Connecticut Valley Power Exchange (CONVEX) starts, pioneering interconnection between utilities.
1923	Television components – V. Zworykin (USA).	<i>Bluefield</i> decision calls for reproduction cost rate base.
1924		Cities Service Power & Light incorporated.
1926		A.B. Collins creates Reddy Kilowatt.
1927		First regional power pool, Pennsylvania-New Jersey Interconnection.
1928	Construction of Boulder Dam begins. F. Whittle publishes thesis proposing gas turbines for aircraft propulsion (UK).	Federal Trade Commission begins investigation of holding companies.
1929	GE produces 208 MW generating unit, largest in service through 1953.	Commonwealth & Southern and United Corp. organize. Stock market crashes.
1930	Transmission at 240 kV. Jet engine patented – F. Whittle (UK).	
1932	Sodium light.	Middle West Utilities, National Electric Power, Seaboard P.S. collapse – end of Insull empire.
1933		Tennessee Valley Authority (TVA) established.
1934	Nuclear chain reaction described – L. Szilard (UK).	
1935		Public Utility Holding Co. Act. Federal Power Act. Securities and Exchange Commission. Bonneville Power Administration. First night baseball game in major leagues (Cincinnati, OH).
1936	Highest steam temperature reaches 900 degrees Fahrenheit vs. 600 degrees	

Year	Technological	Institutional USA and Canada
	Fahrenheit in early 1920s. 287 kV line runs 266 miles to Boulder (Hoover) Dam. Boulder Dam completed.	
1938	Man-made fission of uranium – O. Hahn and F. Strassman (Germany).	Supreme Court affirms Holding Co. Act of 1935 in <i>Electric Board & Share v. SEC</i> .
1939	First jet flight – engine developed by H.P. von Ohain working with E. Heinkel (Germany)	
1940	Steam pressure in generation reaches 2400 pounds per square inch (psi) vs. 1100 psi in early 1920s.	Non-utility generation accounts for 21% of USA total.
1941	First flight with Whittle jet engine (UK).	
1942	Sustained nuclear reaction – E. Fermi (USA)	
1943		SEC orders divestments of Engineers P.S. subsidiaries, begins breakup of holding companies.
1944		Hydro-Quebec formed. <i>F.P.C. v. Hope Natural Gas</i> decision establishes new rules for regulation.
1945	Atomic bomb.	
1946		Atomic Energy Act, establishes Atomic Energy Commission (AEC).
1947	Transistor invented. Mercury vapor lamp. Highest steam temperature in generation reaches 1000 degrees Fahrenheit.	
1950		Non-utility generation accounts for 15% of USA total.
1953	First practical nuclear reactor – for submarines. First 345 kV transmission line – American Electric Power.	First nuclear power station ordered – Shippingport, PA. Atoms for Peace program announced by Eisenhower.
1954	First high voltage direct current (HVDC) line (20 MW/1900 kV, 96 Km)(Sweden).	Atomic Energy Act of 1954 allows private ownership of nuclear reactors.
1955	Nuclear submarine Nautilus	

Year	Technological	Institutional USA and Canada
	commissioned by U.S. Navy. Construction of Shippingport begins.	
1956		AEC issues first permits for commercial nuclear plants. GE begins “Live Better Electrically” campaign.
1957	Generator steam reaches 1150 degrees Fahrenheit and pressure 4500 psi at Philo station, first supercritical unit in USA. Shippingport goes operational.	Price Anderson Act promotes nuclear development. Washington Public Power Supply System formed.
1959		TVA Revenue Act restricts TVA boundaries.
1960		Non-utility generation accounts for 10% of USA total.
1961	SL-1 Excursion accident at Idaho AEC reactor kills three. Largest generating unit in Canada, 300 MW.	First gas turbines placed into service as stationary power sources by utilities in USA.
1962	First nuclear power in Canada, Rolphton station.	Rachel Carson’s <i>Silent Spring</i> published, beginning environmental movement.
1963		Clean Air Act. Columbia River Treaty ratified, opens way for international hydro developments.
1964	500 kV lines, USA – VA and TN	FPC conducts National Power Survey.
1965	First 765 kV transmission line (Canada).	Northeast Blackout.
1966	Accident at Fermi nuclear plant (USA – MI).	USA – Endangered Species Act. Hydro development on Nelson River, Manitoba begins.
1967	First commercial CANDU nuclear reactor (Canada)	P-J-M power interruption.
1968		National Electric Reliability Council formed.
1969		National Environmental Policy Act of 1969.
1970		National Power Survey by FPC. Environmental Protection Agency (EPA) formed.

Year	Technological	Institutional USA and Canada
		<p>Water and Environmental Quality Act.</p> <p>Clear Air Act of 1970.</p> <p>Earth Day – April 22.</p>
1972		<p>Electric Power Research Institute (EPRI).</p> <p>Clear Water Act of 1972.</p> <p>Power production begins at Churchill Falls (Canada).</p>
1973		<p>Arab oil embargo begins, price of oil quadruples.</p> <p>Endangered Species Act of 1973.</p> <p>Natural gas production peaks.</p>
1974	Number of nuclear plants on order or under construction reaches peak.	<p>First drop in sales since 1946.</p> <p>AEC splits up into Energy Research and Development Administration (ERDA) and Nuclear Regulatory Commission (NRC).</p> <p>Consolidated Edison omits dividend.</p> <p>Churchill Falls hydro plant completed (Canada).</p>
1975	Brown's Ferry nuclear accident.	Thirteen nuclear projects canceled.
1977		<p>New York City blackout.</p> <p>Department of Energy (DOE) formed.</p> <p>Carter energy plan.</p>
1978		U.S. Supreme Court affirms primacy of FERC ratesetting in Narragansett decision.
1979	<p>Three Mile Island nuclear accident.</p> <p>N. Wertheimer and E. Leeper publish studies linking EMF to cancer (USA).</p>	<p>Hydro-Quebec's James Bay project begins operation (Canada).</p> <p>Oil prices jump \$11 due to Iranian revolution.</p>
1980	<p>First U.S.A. windfarm (NH).</p> <p>Nuclear industry operates at 62.7%</p>	Pacific Northwest Electric Power Planning and Conservation Act establishes regional regulation and planning.

Year	Technological	Institutional USA and Canada
	capability factor.	
1981		PURPA ruled unconstitutional by Federal judge – Mississippi (decision overturned 1982).
1982	Shippingport retired from service. Record drop of 19 plants from list of nuclear plants in operation, under construction, or ordered.	Nuclear Waste Policy Act directs DOE to build geological repository for waste. U.S. Supreme Court upholds legality of PURPA in <i>FERC v. Mississippi</i> (456 US 742).
1983	First denial of operating license by NRC (Byron, #1, Illinois)	Washington Public Power Supply System defaults on \$2.25 billion of bonds due to inability to complete five nuclear reactors. P.S. of Indiana cancels Marble Hill nuclear plant, cuts dividend. Cincinnati G&E suspends Zimmer as nuclear project, announces conversion of Zimmer to coal. Production of electricity from non-utility sources hits lowest level since 1950.
1984	Annapolis, N.S., tidal power plant – first of its kind in North America (Canada).	
1985		Citizens Power, first power marketer, goes into business.
1986	Chernobyl nuclear accident (USSR).	
1987		Non-utility generation exceeds 5% of USA total for first time since 1974.
1988	NASA scientist J. Hansen tells congress that greenhouse effect is already taking place.	Public Service of New Hampshire files for bankruptcy due to nuclear project – first utility bankruptcy in more than 50 years. FERC approves merger of Pacific P&L and Utah P&L with conditions that require transmission access for other utilities – precursor of program to open transmission networks.
1989	Shippingport becomes first nuclear plant in world to be decommissioned to “greenfield” condition.	Long Island Lighting sells Shoreham nuclear plant to state: first completed and commissioned nuclear plant to be abandoned without commercial operation.

Year	Technological	Institutional USA and Canada
	Series on EMF by P. Brodeur begins in <i>New Yorker</i> (USA).	
1990	Nuclear industry operates at 71.7% capability factor.	Clean Air Act amendments mandate additional pollution controls. Non-utility generation reaches record level.
1992	Rio environmental summit.	National Energy Policy Act.
1993	Commercial production of variable speed wind turbine begins (USA).	TransAlta, largest investor-owned utility in Canada, files for unbundled rates that would allow retail wheeling if approved. Credit agencies tighten bond rating standards to reflect increasing competition and risk in electric utility business.
1994	USA nuclear plants attain 84.5% capability factor – highest ever.	California PUC launches inquiry into the structure of utilities, proposes retail wheeling as a possible outcome in a phased transition. Michigan launches multi-year retail wheeling experiment. FPL Group cuts dividend, possibly the first electric utility to reduce dividend as a matter of financial policy rather than from financial necessity.
1995	First commercial static compensator (USA).	FERC Mega NOPR to reform electric utility industry. Moody's estimates stranded cost at \$136 billion.
1996	National Research Council finds no proof that EMF harms human health.	California, Rhode Island, Massachusetts announce retail wheeling reform plans. First electricity futures trading (NYMEX). Macdonald committee calls for privatization of and competition with Ontario Hydro. FERC Rules 888 and 889 open the transmission network, set reforms in motion. Enron announces merger with Portland General.

Year	Technological	Institutional USA and Canada
		Duke Power announces merger with Pan Energy.
1997		<p>PECO proposes first securitization (\$3.6 billion).</p> <p>Long Island Power Authority plans purchase of Long Island Lighting (first major municipalization in decades).</p> <p>ISO New England begins operation (first ISO).</p> <p>New England Electric sells power plants (first major plant divestiture).</p>
1998	Nuclear industry operates at 87.0% capability factor.	<p>California opens market and ISO.</p> <p>Ontario to break up Ontario Hydro, sell some generation.</p> <p>FERC orders removal of Edwards dam, first time without approval of owner.</p> <p>Electric shortages and price spikes in Midwest.</p> <p>Scottish Power (UK) to buy Pacificorp, first foreign takeover of utility in USA. National (UK) Grid then announces purchase of New England Electric System.</p>
1999	<p>Secretary of Energy delays opening of Yucca Mountain nuclear waste site to 2010.</p> <p>Electricity marketed on internet.</p> <p>EPA sues 7 utilities for violation of clean air laws.</p>	<p>First nuclear plant sold (Boston Edison's Pilgrim).</p> <p>Legendary investor Warren Buffett buys an electric company, MidAmerican.</p> <p>Enron to sell Portland General.</p> <p>FERC issues Order 2000, promoting regional transmission.</p>

Year	Technological	Institutional USA and Canada
2000	Industry survives Y2K. ABB stops making large steam generators. GE announces H System, super efficient gas turbine (60% efficiency, 5685 Btu heat rate).	California restructuring turns into fiasco. Utilities respond to Order 2000 with regional plans.

Glossary

A

accounts payable. Amounts companies owe suppliers for goods and services. Listed in the current liabilities section on the statement of financial position.

accounts receivable. Amounts customers owe a company from sales of goods or services that the company expects to collect within one year. Listed in the current assets section on the statement of financial position.

annual report. A report a company publishes for its stockholders at the end of each fiscal year. The report includes required elements such as an auditors' report and the company's statement of earnings, statement of financial position, and statement of cash flows. The report also includes elements such as letters and articles by the company's executives, information on its financial condition, and significant events.

assets. Anything companies own. These things might be physical assets such as buildings, trucks, inventories of products, equipment, and cash. Or these things might be intangible assets such as goodwill, trademarks, and patents. Listed as a category on the statement of financial position. See also accounts receivable, current assets, fixed assets, noncurrent assets.

auditor. A firm of certified public accountants a company hires as an independent third party to review its financial information. The auditor's main purpose is to make sure the statement of earnings, statement of financial position, and statement of cash flows fairly present the company's financial condition, and that they comply with GAAP.

auditors' opinion. A summary of the findings of a firm of certified public accountants that audits, or examines, a company's financial statements. This report is included in the company's annual report. Also called auditors' report and report of independent accountants.

auditors' report. A summary of the findings of a firm of certified public accountants that audits, or examines, a company's financial statements. This report is included in the company's annual report. Also called auditors' opinion and report of independent accountants.

B

backlog. The amount of a company's unfilled orders at the end of the year. When the company fills the orders the following year, it records the revenue on the statement of earnings. Frequently, a company will give its perspective on backlog in the management discussion section in the annual report.

balance sheet. A financial statement that reports a company's assets and the claims against them — liabilities and stockholders' equity — at a set date noted on the statement. Also called statement of financial position.

bond. A form of debt security a government or corporation issues, promising payment of the original investment plus interest on specified future dates. See also marketable securities.

book value. The value of an asset, a liability, or a stockholders' equity account. For a fixed asset, it is typically the cost of the asset minus accumulated depreciation. As companies continue to use fixed assets to generate revenue, the book values lessen, and sometimes ultimately reach zero. See also depreciation.

C

cash. Currency and checks on hand and deposits in banks. Listed in the current assets section on the statement of financial position. See also cash equivalents.

cash equivalents. Short-term, temporary securities that can be quickly and easily converted to cash. Listed in the current assets section on the statement of financial position. See also cash.

consolidated statements. Financial statements of a company that presents the financial information of all its holdings as one company.

current assets. Assets a company can convert to cash within one year. Examples are accounts receivable and inventories of products to sell. Listed in the assets category on the statement of financial position. See also accounts receivable, assets, fixed assets.

current liabilities. Obligations a company has to others, such as creditors, suppliers, and tax authorities, payable within one year. Listed in the liabilities category on the statement of financial position. See also accounts payable, debt, income taxes.

D

debt. Money a company has borrowed and must repay, frequently with interest. Listed in the liabilities category on the statement of financial position.

depreciation. An allowance for wear or age made to the value of a fixed asset, allocating its cost over its estimated useful life. Listed in the assets category on the statement of financial position. See also book value.

dividends. Cash or stock payments from a company's profits distributed to stockholders, an equal amount for each share of stock owned. Listed as dividends on the statement of stockholders' equity.

E

earnings per share (EPS). The portion of a company's profit assigned to each share of stock. For example, if the profit is \$1 million and 500,000 shares are outstanding, the earnings per share would be \$2 ($\$1 \text{ million} \div 500,000 \text{ shares} = \2). Listed in the per share of common stock amounts category on the statement of earnings.

earnings report. A financial statement that reports the results of a company's business operations (revenue and expenses) for a set period, usually one year. Also called an income statement, statement of earnings, statement of operations, and statement of profit and loss.

equity. The part of a company's assets that belongs to the stockholders. In other words, the amount that would remain if a company sold all of its assets and paid off all of its liabilities. Listed as stockholders' equity on the statement of financial position and on the statement of stockholders' equity.

expenses. Costs such as salaries, rent, office supplies, advertising, and taxes. Listed in the operating expenses category on the statement of earnings.

F

Financial Accounting Standards Board (FASB). An association of accounting professionals that decides, maintains, and communicates generally accepted accounting principles (GAAP).

fixed assets. Anything companies use for more than one year to manufacture, display, store, and transport products. Often called "Property, plant, and equipment" because that's what fixed assets usually are. Listed after current assets in the assets category on the statement of financial position. See also assets, noncurrent assets.

footnotes. An annual report section that provides information essential to fully understanding the financial statements. Notes explain the financial statements' numbers and any significant events affecting them. Notes also provide additional detail and provide supplementary financial information. Also called notes.

Form 10-K. A financial report the SEC requires companies to submit yearly. This audited form contains more detailed information than the financial statements in the annual report.

Form 10-Q. A financial report the SEC requires companies to submit quarterly. This unaudited form includes briefer, less detailed financial statements than those in the annual report.

G

generally accepted accounting principles (GAAP). A set of rules and financial reporting guidelines companies must follow to prepare and present the financial information on the statements. See also Financial Accounting Standards Board (FASB).

goodwill. An intangible asset that adds value to the worth of a company; for example, the reputation of its products, services, or personnel. Listed in the assets category (sometimes as "Investments and sundry assets") on the statement of financial position.

See also asset, intangible assets, noncurrent assets.

gross income. The difference between a company's total sales and its cost of sales. Listed as a category on the statement of earnings. Also called gross profit.

gross profit. The difference between a company's total sales and its cost of sales. Listed as a category on the statement of earnings. Also called gross income.

I

income statement. A financial statement that reports the results of a company's business operations (revenue and expenses) for a set period, usually one year. Also called an earnings report, statement of earnings, statement of operations, and statement of profit and loss.

income taxes. Fees placed by federal, state, local, and foreign governments on a company's earnings. Listed on the statement of earnings.

intangible assets. Anything nonphysical, such as goodwill, trademarks, and patents, that have value for a company. Listed in the assets category (sometimes as "Investments and sundry assets") on the statement of financial position. See also asset, fixed assets, goodwill.

inventories. All goods and materials available for sale (in the case of wholesalers, retailers, and distributors) or raw materials and supplies, work in process, and finished goods (in the case of manufacturers). Listed in the current assets section on the statement of financial position.

investments. A company's equity ownership in unconsolidated subsidiaries and affiliates. Listed in the category of assets (for example, "Investments and sundry assets") on the statement of financial position.

investor relations. The division of a company that answers stockholders' questions and sends them regular updates about the company's performance.

L

leverage. A company's use of debt, instead of its equity, to support its assets and grow.

liabilities. A company's debts to a lender, a supplier of goods and services, a tax authority, a landlord, and others. Listed as a category on the statement of financial position.

liquid asset. An asset that can be quickly converted into cash. Examples include cash and marketable securities. See also cash equivalents.

long-term debt. Debt a company will repay after one year. Listed in the liabilities category on the statement of financial position.

M

market value. The amount two unrelated parties agree one of them will pay for

something the other has. Also, the value of a company determined by multiplying the total number of outstanding shares by the market price per share. For example, if a company has 4,000,000 shares of stock outstanding and the current price per share is \$50, the company's market value is 4,000,000 x \$50 or \$200 million.

marketable securities. Financial assets, such as stocks and bonds, that companies can convert to cash. Listed as assets on the statement of financial position.

N

net earnings. A company's total revenue less total expenses, showing what a company earned (or if lost, called net loss) for a set period, usually one year. Listed often literally as the "bottom line" on the statement of earnings. Also called net income and net profit.

net income. A company's total revenue less total expenses, showing what a company earned (or lost, called net loss) for a set period, usually one year. Listed often literally as the "bottom line" on the statement of earnings. Also called net earnings and net profit.

net profit. A company's total revenue less total expenses, showing what a company earned (or lost, called net loss) for a set period, usually one year. Listed often literally as the "bottom line" on the statement of earnings. Also called net earnings and net income.

net sales. A company's total sales less returned merchandise and discounts. Listed on the statement of earnings.

net worth. The amount of a company's stockholders' equity. Listed as total stockholders' equity on the statement of financial position.

noncurrent assets. Anything of long-term value to a company, including fixed assets and intangible assets. Listed in the assets category (after current assets) on the statement of financial position. See also fixed assets, goodwill, intangible assets.

notes. An annual report section that provides information essential to fully understanding the financial statements. Notes explain the financial statements' numbers and any significant events affecting them. Notes also provide additional detail and provide supplementary financial information. Also called footnotes.

O

operating expenses. Costs related to a company's operations. Examples are salaries, advertising, sales commissions, travel, and entertainment. Listed as a category on the statement of earnings.

operating income (or loss). The result of deducting the cost of all sales and operating expenses from a company's net sales. Listed on the statement of earnings.

P

price earnings ratio (P/E ratio). A ratio used to evaluate the relationship between a company's price per share and the earnings per share (EPS). For example, if a

company's stock is selling for \$12 per share and the earnings per share is \$2, the P/E ratio is 6 ($12 \div 2 = 6$).

R

ratio. A measure of the relative size of two numbers. Usually, financial ratios are expressed as a times multiple (x) or a percentage (%). Ratios provide a quick way to compare a company to its performance over time, to other companies in the same industry, and to the industry average.

report of independent accountants. A summary of the findings of a firm of independent certified public accountants that audits, or examines, a company's financial statements. This report is included in the company's annual report. Also called auditors' report and auditors' opinion.

retained earnings. The total amount of a company's net earnings since its inception, minus any payments made to stockholders. Retained earnings is actually part of stockholders' equity and represents the portion of a company's assets that are financed from profitable operations rather than from selling stock to investors or borrowing from external sources. Listed on the statement of financial position.

revenue. The total flow of funds into a company, mostly for sales of its goods or services. Listed as the first category on the statement of earnings.

S

SEC. Abbreviation for Securities and Exchange Commission. A U.S. government agency responsible for, among other things, ensuring publicly held companies report financial information to stockholders regularly.

SEC Form 10-K. A financial report the SEC requires companies to submit yearly. This audited form contains more detailed information than the financial statements in the annual report.

SEC Form 10-Q. A financial report the SEC requires companies to submit quarterly. This unaudited form includes briefer, less detailed financial statements than those in the annual report.

Securities and Exchange Commission (SEC). A U.S. government agency responsible for, among other things, ensuring publicly held companies report financial information to stockholders regularly.

securities. Investments, including stocks and bonds. Listed as assets on the statement of financial position.

share. A certificate of ownership in a company. Also called stock.

statement of cash flows. A financial statement that reports the flow of cash in and out of a company for a set period, usually one year. It reports the operating activities, investing activities and financing activities of the company.

statement of earnings. A financial statement that reports the results of a company's business operations (revenue and expenses) for a set period, usually one year. Also

called an earnings report, income statement, statement of operations, and statement of profit and loss.

statement of financial position. A financial statement that reports a company's assets and the claims against them — liabilities and stockholders' equity — at a set date noted on the statement. Also called the balance sheet.

statement of operations. A financial statement that reports the results of a company's business operations (revenue and expenses) for a set period, usually one year. Also called an earnings report, income statement, statement of earnings, and statement of profit and loss.

statement of owners' equity. A financial statement that reports the changes in the owners' interests (equity); for example, by detailing changes in net earnings or dividends paid to stockholders. This statement is usually separate but a company may prepare a statement of retained earnings instead. Also called statement of stockholders' equity.

statement of profit and loss. A financial statement that reports the results of a company's business operations (revenue and expenses) for a set period, usually one year. Also called an earnings report, income statement, statement of earnings, and statement of operations.

statement of stockholders' equity. A financial statement that reports the changes in the owners' interests (equity); for example, by detailing changes in net earnings or dividends paid to stockholders. This statement is usually separate but a company may prepare a statement of retained earnings instead. Also called statement of owners' equity.

stock. A certificate of ownership in a company. Also called share.

stockholder. An owner of part of a company. Also called a shareholder.

T

trend. A pattern in a company's financial performance over time. For example, if a company's sales have been increasing over many months or years, analysts would describe this pattern as a sales growth trend.