It's All About POWER

A Look Into Missouri's Regulated Electric Generation

By Debbie Bernsen and Lisa Kremer

Approximately two million residential, commercial and industrial customers rely upon electricity that is provided by the four investor-owned electric companies (Kansas City Power & Light Company, KCP&L Greater Missouri Operations Company, Ameren Missouri and The Empire District Electric Company) regulated by the Missouri Public Service Commission.

Regulated electric companies in Missouri sold approximately 61million megawatt-hours of electricity in 2010. On average, a megawatt provides power to about 1,000 homes at a given point in time. In December 2010, Missouri residential customers paid an average of 8.11 cents per kWh (kilowatt-hour) — or the sixth lowest in the nation, according to the U.S. Energy Information Administration. This average price includes Missouri-state regulated and non-regulated utilities, such as municipal power suppliers and electric cooperatives.

Ameren Missouri photo

Ameren Missouri's Labadie Plant was first placed into operation in 1970. When all four of its units are operating at full load, the plant burns more than 1,200 tons of coal to produce 16 million pounds of steam per hour.

Coal, a fossil fuel, is the dominant fuel for all state regulated electric generation in Missouri and supplies approximately 80 percent of the entire state's electricity market, according to the U.S. Energy Information Administration.

Renewable energy is a term that consumers hear a lot about these days. While there may be different interpretations of the specific application of the term, renewable energy is generally classified as energy generated from natural resources that are replenished such as wind, solar, biomass and water.

Utilities are facing an increasingly complex set of environmental regulations regarding power plant emissions. Environmental concerns have encouraged utility companies to pursue power generation technologies that limit the detrimental effects from emissions on the environment. As a result, renewable sources of energy have become an important part of utility energy portfolios.

As with all sources of power, there are advantages and disadvantages with renewable sources. While providing a relatively free and

Coal - The Largest Fossil Fuel Used by Missouri's Regulated Electric Companies

The Iatan coal-fired plant near Weston, Mo. is operated by Kansas City Power & Light Company.

non-polluting source of fuel, the production of the energy itself can be very costly, and these resources do not always provide a consistent source of energy; the wind does not always blow and the sun does not always shine. Renewable power also requires the development and installation of additional transmission lines to carry the energy, often from remote locations, to its customers for distribution.

TYPES OF GENERATING PLANTS

Coal-Fired

Coal-fired generation has played a significant role in electrical production since the first power plants were built in the United States in the 1880's. Electricity generated by coal includes the crushing and pulverizing of the coal into powder so that it can burn and heat water that is contained in tubes in a boiler. The heat converts the water into steam which is used to spin the turbine shaft generating electricity. The generated electricity flows through wires to transformers where the electrical voltage is increased to enable the electricity to flow more efficiently and ultimately get to its final destinations.

All of Missouri's regulated utility companies use significant amounts of coal to generate power. Some of the largest coal-fired power plants owned and or operated by Missouri-regulated utilities include Labadie, an Ameren Missouri plant, which generates approximately 2,400 megawatts of power and the Iatan I and II power plants, primarily owned by Kansas City Power & Light Company. Iatan I and II together generate over 1,500 megawatts of electricity.

One potential advantage of coal generation is that it is typically a low-cost production type of plant. Many coal plants have been in existence for decades and the original investment of such facilities may have already been substantially paid. Coal as a fuel, while being subject to federal environmental regulations when burned in power plants, is readily available in the United States. Potential drawbacks to coal-fired generation include the time it takes to build this type of plant and emission issues.

Combustion Turbines and Combined Cycle Generation

Combustion turbines (CT's) have become widely used by utilities to produce power and function much like a jet engine. Air entering the unit is mixed with natural gas or oil and is ignited. Hot gas from the fire is used to turn a generator and produce electricity.

One of the attractive features of combustion turbines is that they can reach full power in a very short amount of time – literally in a matter of minutes. Their lead-time placement and construction is far shorter than other types of generation, such as coal-fired and nuclear, however, their production capacity is smaller.

Natural gas combined cycle turbines at the South Harper Facility in Cass County.

CT's are frequently used as power "peaking" devices when electricity demand periods are highest. A potential downside to combustion turbines is their use of traditionally more costly fuel, such as natural gas or oil.

These turbines can be operated using natural gas or fuel oil. The units can transition between single and double turbine operation and can shift from natural gas to fuel oil without having to shut down.

Combined cycle generation is considered to be an efficient method to generate electricity because in addition to the use of gas turbines to produce electricity, waste heat coming from the exhaust of the combustion turbines is utilized to produce steam and generate additional electricity without additional natural gas. Emissions are also minimized in this type of technology. The Empire District Electric Company and Kansas City Power & Light are the only regulated utilities within the state of Missouri that own combined cycle plants.

Nuclear Plants – Powered by Uranium

Nuclear power plants make electricity similar to coal-fired plants; both make steam which turns a turbine. Instead of using coal, nuclear plants use nuclear fission or "atom splitting" to generate steam which is used to turn the turbines. Uranium, which is a common element in the earth, is the heating fuel of nuclear power plants. Uranium undergoes fission, and energy produced by it at nuclear power plants has to be carefully controlled.

The process of preparing uranium as a fuel source involves a number of steps. Uranium is formed into pellets that are placed into rods which are organized into bundles. The bundles are then placed into a pressurized container with water. The water is important as it acts as a coolant. Without it, the uranium would gradually overheat and eventually melt. Control rods, which absorb neutrons and reduce the number of fissions, are inserted into the bundles, and are constructed in such a manner that they may be raised or lowered. When a nuclear plant needs to be shut-down, the control rods can be completely inserted into the uranium bundle.

One of the primary differences between power generated by nuclear plants and the power generated by other types of plants, are safety issues surrounding radiation. Radiation results from fission producing the power. Construction precautions include concrete and steel liners to house reactors and prevent leakage of radioactive material. Transporting used fuel from those same sites to a repository can also pose risks.

There is one nuclear powered facility in Missouri. The Callaway Nuclear Power Plant was completed and licensed to operate by the Nuclear Regulatory Commission (NRC) in 1984. Callaway produces approximately 1,200 megawatts of power. According to Ameren Missouri, the electricity generated by the Callaway Plant is enough to meet the needs of 780,000 average households every year.

Kansas City Power & Light Company is a part owner of the Wolf Creek Generating Station, a nuclear plant located near Burlington, Kan. That plant came on line in June of 1985.

Ameren Missouri photo

The Callaway Plant is operated by Ameren Missouri and is located 25 miles northeast of Jefferson City.

Up In The Air

Kansas City Power & Light Company owns the Spearville Wind Energy Facility located in Ford County, Kansas. This facility has 99 towers and can generate 148.5 MW, enough intermittent power to serve over 33,000 homes.

RENEWABLE POWER

Wind

The force of the wind has been used for hundreds of years to assist in everything from pumping water to grinding grain. In the past, windmills captured the energy of the wind. Today, wind turbines are used to harness the wind's power to generate electricity. Wind turbines, like windmills, are mounted on tall (260 to 430 foot) towers to capture the faster and less turbulent wind that occurs at higher levels. The blades act much like an airplane wing, causing lift and drag. This combination makes the rotor spin and the shaft then spins a generator to make electricity. For utility companies that use wind turbines to be connected to the power grid, a large number of wind turbines may be built close together to form a wind plant or farm.

The wind is an important renewable energy source because it can generate electricity without producing harmful emissions that may pollute the environment. However, wind farms must be sited in locations that have strong, steady winds in order to be economical. The wind is not always predictable and their effect on flying wildlife and noise are frequently brought up as issues. The appearance of multiple wind turbines can alter the landscape and can be seen as spoiling the natural view.

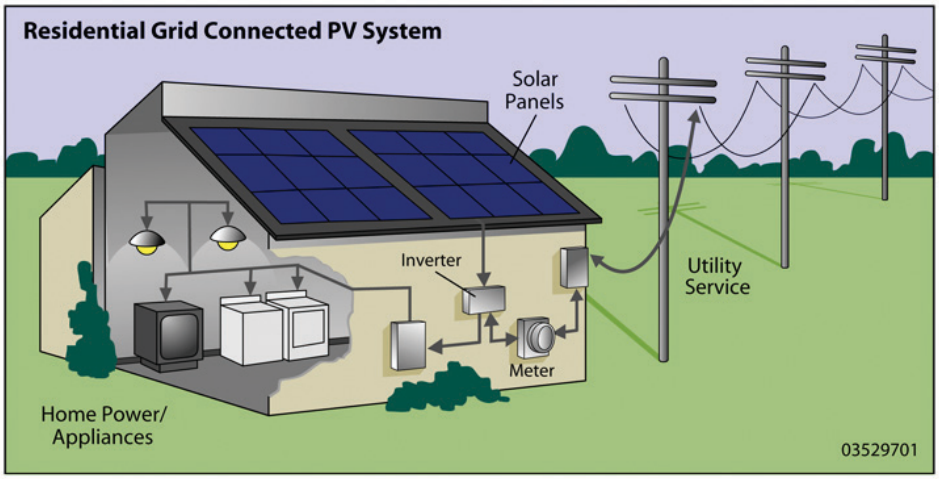
Kansas City Power & Light Company owns the Spearville Wind Energy Facility located in Ford County, Kansas. This facility has 99 towers and can generate 148.5 MW, enough intermittent power to serve over 33,000 homes.

In addition, KCP&L Greater Missouri Operations Company purchases 60 MW from NextEra Energy Resources at a wind farm in Gray County, Kansas. Ameren Missouri purchases 102 MW of wind energy from the Horizon Wind Energy's Pioneer Prairie Wind Farm (located in Iowa) to serve 26,000 homes. The Empire District Electric Company purchases a total of 255 MW from the Elk River and Meridian Way wind farms. Both of these facilities are in Kansas.

Solar Power

While the sun does not always shine, when it does, it offers a tremendous source of energy. A variety of technologies convert solar energy into usable energy for buildings. The most commonly used solar technologies for homes and businesses are solar water heating, passive solar design for space heating and cooling, and solar photovoltaics for electricity.

The sun's energy can be gathered through special panels. Solar photovoltaic panels contain sunlight-absorbing semiconductors, such as silicon. These panels can be installed on rooftops that are identified as being able



U.S. Department of Energy graphic

Solar electric systems, also known as photovoltaic (PV) systems, convert sunlight into electricity.

to gather the sun's rays for part of the day. The sun's energy is absorbed into the cell and converted into electrons, which then flow as direct current (DC) electricity. An inverter then transforms the DC electricity into alternating current (AC) electricity.

Solar energy provides a free fuel source that does not produce any emissions. The facilities themselves are long lasting, create no noise, and require little maintenance. Although the sun does not shine all of the time, solar power is usually available during the peak time of electricity usage. Solar energy can be somewhat unreliable depending upon the placement and location of the solar cells. However, the cost of installing solar power has been a major issue in the past. Ameren Missouri recently installed five solar power systems at its downtown St. Louis headquarters to allow customers to view these systems. The installation will also provide a classroom setting to illustrate how much energy the units are generating, how solar technology works, and a program to calculate costs versus benefits associated with solar installations.

The "fuels" for solar and wind facilities are free, however that does not necessarily mean that the energy produced is inexpensive. The cost to construct and operate (operations, maintenance, taxes, leases, etc.) wind and solar facilities must be recovered through the energy produced sales. Since neither of these technologies produces energy constantly, and installation and operating costs may be significant, the cost per kilowatt-hour may be higher than the cost of producing electrical energy at conventional power plants.

Hydropower

Hydropower, or hydroelectric power, is the most common source of renewable energy in the United States today. The U.S. Energy Information Administration states that more than six percent of the country's electricity came from hydropower resources in 2008.

Hydropower technology uses flowing water to produce energy that can be captured and turned into electricity. Moving water spins the turbines which drive generators that produce the electricity. The use of water to produce energy offers specific advantages over other energy sources, but also carries unique environmental issues associated with it.

Hydropower is a clean energy source that does not produce emissions like power plants that burn fossil fuels. The disadvantages of hydropower include the cost to the surrounding

The Powersite Dam area near Forsyth, MO is part of the Ozark Beach Hydroelectric Plant located in Taney County. It is owned and operated by The Empire District Electric Company.

DID YOU KNOW?

Every three years, regulated electric utilities in Missouri complete an analysis of the options that are available to meet consumer energy needs. They are required by Commission rule to file their analysis, known as an Integrated Resource Plan (IRP), with the Public Service Commission.

The IRP looks at the next 20 years and provides a description of the company's projections for future generation to meet the needs of consumers, as well as to maintain system reliability. Other factors such as environmental regulations, energy efficiency and affordable costs are all considered in making decisions on how best to plan to meet these needs.

While the Commission does not approve or reject IRPs, the Commission does determine if regulated electric companies are utilizing an adequate planning process.

environment as land is drained or flooded to accommodate the construction of a dam. This can have a significant impact on rivers and wildlife. Hydropower depends on an available water supply, and dams can be both time consuming and expensive to build. Permitting can also be difficult to obtain.

Ameren Missouri owns and operates three hydroelectric plants: the Keokuk plant in Keokuk, Iowa, the Osage plant in Lakeside, Missouri and the Taum Sauk plant (which is a pumped storage plant) in Reynolds County, Missouri. These plants represent four percent of the company's total generation.

The Empire District Electric Company owns and operates the Ozark Beach Hydroelectric Plant located in Taney County. This facility supplies Empire with 16 MW of power. The Ozark Beach Dam, completed in 1913, forms Lake Taneycomo, which provides a recreational area to the surrounding counties.

Biopower

Biopower is the use of biomass to generate electricity. Biomass can be defined as any plant or animal matter. Examples of substances that can be used for biomass power are wood, crop wastes, energy crops and the components of municipal solid waste systems. Biomass sources can be burned directly to produce energy. In some instances, organic material is allowed to ferment and decompose, producing materials such as methane gas, ethanol, or methanol.

Methane gas produced at landfills is now being identified as a potential source to generate electric power. Emerging technologies such as gas-fired micro turbines may help make generating power on-site from landfill gas an economic choice. Landfill gas has also been sent off-site to be directly connected to a recovery system to heat buildings.

In 2009, Ameren Missouri announced an agreement with Fred Weber, Inc., a construction company based in St. Louis, to generate electricity from solid waste landfill gas. Combustion turbines will be installed at the Fred Weber landfill in Maryland Heights and these turbines will be fueled by methane gas from the landfill. Pattonville High School in North St. Louis County will receive landfill gas and the system is anticipated to generate enough electricity to meet the needs of approximately 10,000 homes. This system is expected to be fully operational in 2012.

KCP&L Greater Missouri Operations Company has also partnered with the City of St. Joseph to investigate building a methane gas

Kansas City Power & Light's Montrose Power Station, a coal-fired plant located in LaDue, Mo.

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gathering system and power generation facility. The company will own and operate the plant and distribute the produced electricity through its power grid.

Ameresco, a private company that develops energy facilities, has installed a facility in Jefferson City that uses methane from the Allied Waste landfill to provide power to the City of Columbia. In addition, waste heat from the facilities' engines is being provided to Missouri Department of Corrections facilities nearby.

-- Debbie Bernsen and Lisa Kremer work in the PSC's Engineering and Management Services Department. Other members of that department and the Energy Department contributed to this article.

How To Read Residential Electric Meters

The basic unit of measure of electric power is the watt. One thousand watts are called a kilowatt. If you use one thousand watts of power in one hour you have used a kilowatt-hour (kWh). Your electric utility bills you by the kWh.

The standard electric power meter is a clock-like device driven by the electricity moving through it. As the home draws current from the power lines, a set of small gears inside the meter move. The number of revolutions is recorded by the dials that you can see on the face of the meter. The speed of the revolutions depends on the amount of current drawn; the more power consumed at any one instant, the faster the gears will rotate.

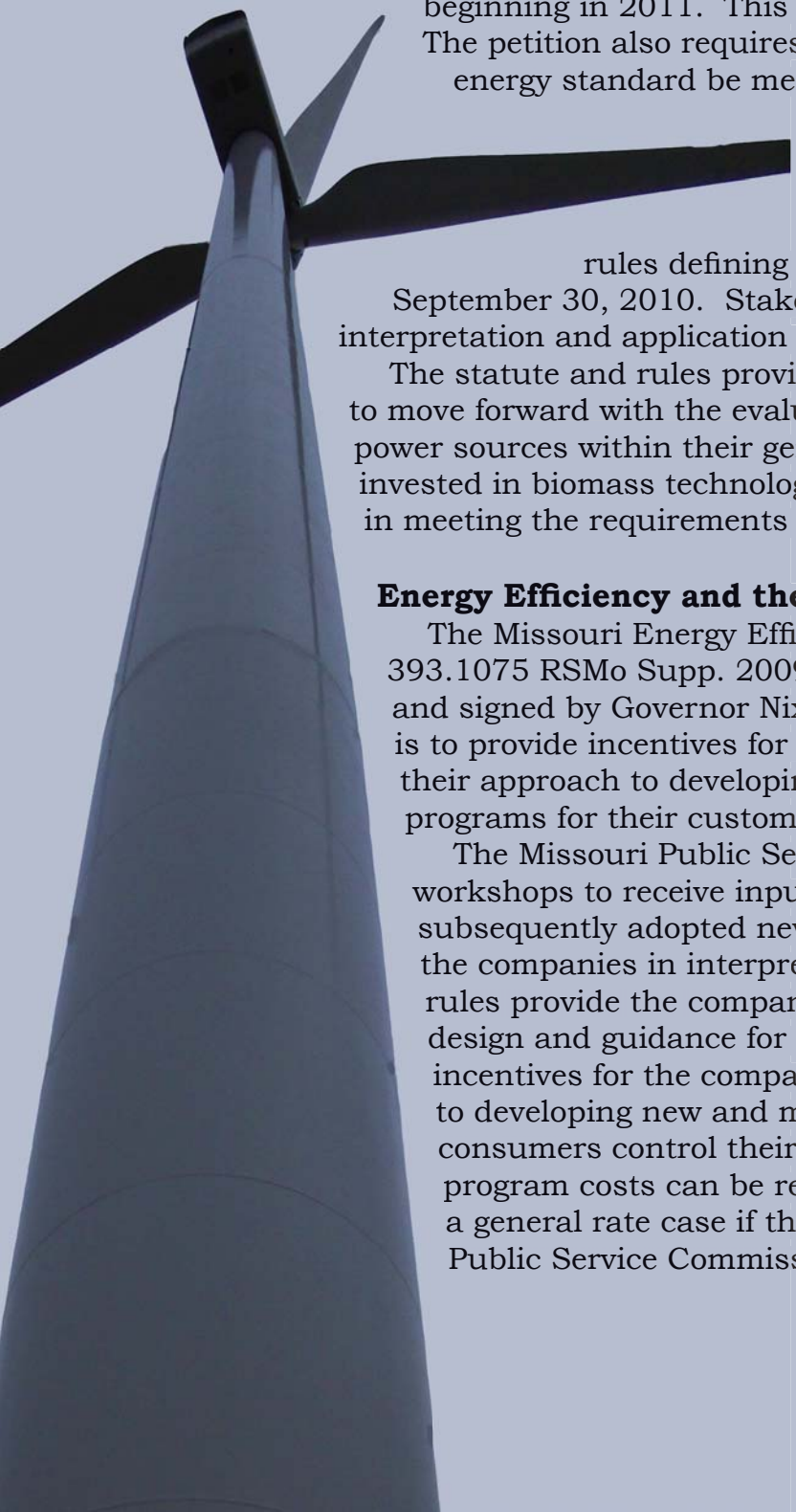
When reading an electric meter, read and write down the numbers as shown on the dials from *right to left*. When the pointer is directly on a number, look at the dial to the right. If it has passed zero, use the next higher number. If the dial has not passed zero, use the lower number. Record the numbers shown by writing down the value of the dial to your extreme right first and the rest as you come to them. Should the hand of a dial fall between two numbers, use the smaller of the two numbers.

Note that some newer electric meters use digital displays instead of dials. The difference between one month's reading and the next is the amount of energy units that have been used for that billing period.

For more information about reading your electric meter, please contact your utility provider.

-- U.S. Department of Energy

Recent Missouri Legislation Designed To Increase The Use Of Renewable Energy



Proposition C (Renewable Energy Standards)

While there currently is no federal policy designed to increase the types of renewable electrical generation, a number of states, including Missouri, have developed their own standards. In the fall of 2008, Missouri voters passed a ballot initiative requiring the state's four investor owned utilities to buy or generate two percent of their electricity from renewable fuels beginning in 2011. This will increase to 15 percent by 2021. The petition also requires that two percent of the renewable energy standard be met with solar power and requires the utilities to provide a $2/watt rebate for customers that install solar generation effective January 1, 2010. Missouri Public Service Commission rules defining the procedures became effective September 30, 2010. Stakeholders continue to discuss the interpretation and application of the rules.

The statute and rules provide encouragement to electric utilities to move forward with the evaluation of how to include renewable power sources within their generation mix. Missouri utilities recently invested in biomass technology, solar panels and wind farms to assist in meeting the requirements of Proposition C.

Energy Efficiency and the Missouri Efficiency Investment Act

The Missouri Energy Efficiency Investment Act (MEEIA) 393.1075 RSMo Supp. 2009 was passed by the Missouri legislature and signed by Governor Nixon in 2009. The purpose of the MEEIA is to provide incentives for electric companies to be innovative in their approach to developing new and additional energy efficiency programs for their customers.

The Missouri Public Service Commission held a series of workshops to receive input from various stakeholders and subsequently adopted new rules in February 2011 to assist the companies in interpreting these rules. The Commission rules provide the companies with flexibility in their program design and guidance for cost recovery. The rules will provide incentives for the companies to be innovative in their approach to developing new and more energy efficient programs to help consumers control their energy use. Under these rules, prudent program costs can be recovered by electric companies outside of a general rate case if the programs have been approved by the Public Service Commission.