Chapter 8

Understanding Rural Electric Service

Rural versus urban electric service

Electric service is on the minds of rural folks much more than city folks. With homes and buildings spread out more, getting power to where you need it can be a concern, in both cost and effort.

Though not always so, service reliability may be an issue. Longer power line distances from utility distribution substations provide more opportunities for Mother Nature to find ways to interrupt electric service to your home. In the our Midwestern hardwood forest area, falling trees and limbs are common causes, though many of our power outages are from a situation described by local utility linemen as 'Squirrel Fricassee'.

Folks in cities are rarely concerned how power is delivered to their homes. An electrical contractor works with the local electric utility to connect the homes circuit breaker panel and meter to a utility owned distribution transformer. Most of this wiring is hidden from the homeowner.

A detailed knowledge of electric power distribution and wiring is not necessary even for rural folks. Understanding some of the basics of that subject is helpful if you require new electric service or any change to existing service is needed. Knowing what is involved with installing or modifying electric service will allow you to make better decisions when you are presented with choices.

Electric power basics

Most of us understand that electric power generated in power plants is delivered around the country via large transmission lines. Locally, those transmission lines connect to distribution substations. Local substations are so common a sight that we hardly notice them as we drive by.

A local distribution substation contains a collection of voltage dropping transformers, motorized circuit breakers, and large disconnect switches. A high fence usually surrounds it to keep people from contacting high voltage components.

The transformers in substations step the transmission line voltage down to a somewhat lower distribution voltage. Though lower than transmission voltage, distribution voltage is still high voltage. Rural distribution lines typically carry twelve thousand or seventy five hundred volts. That is high enough to set most anything it touches on fire.

Why send such dangerous voltages out on the power lines through neighborhoods and along rural roads? The problem with long power lines is voltage drop when current is drawn. The voltage drop from the sending end of a distribution power line to a load such as your air conditioner is proportional to the number of amps of current flowing on that line.

Higher voltages allow fewer amps to flow for the same amount of power drawn or watts delivered. One thousand watts, say for a small room heater, would require about eight amps at one hundred twenty volts but only about eight one hundredths of an amp at twelve thousand volts to produce the same heat. Higher voltages therefore allow power to be distributed with lower voltage drop, and incidentally, less power wasted.

Distribution voltage, though, is too high to use safely in our homes. Distribution transformers are used to reduce it to the one hundred twenty and two hundred forty volt service we are used to.

To minimize voltage drop from the higher current drawn at this lower voltage, very large conductors are used between the transformer and the household circuit breaker panel. The distance between the transformer and the panel is usually limited to less than two hundred feet.

So, the electric power service to your property consists of a distribution voltage power line running from a local substation, usually along the tops of power poles, a

transformer near your house, and heavy conductors connected to your circuit breaker panel.

The two hundred foot distance limit between a transformer and your breaker panel will generally require that distribution voltage lines be run onto your property. This will usually require that you provide an access easement to the electric utility. It will also involve the installation of power poles or trenching for underground service.

Getting service

The first step in obtaining new or modified electric service for your property is to visit the local electric utility office. There is a department or person you can talk to about construction issues. What you are interested in is a list of construction requirements and costs. While technical requirements are fairly consistent from utility to utility, costs are not. For example, when we bought our property, underground power service in California was priced at $7.50 per foot while it was only $0.75 here in our part of Missouri. The difference in price for overhead service was even greater, priced at only $0.35 per foot here.

For new construction you will have to decide whether you should have overhead or underground service. Overhead service, the kind with utility power lines strung along the tops of power poles across your property, is usually the less expensive choice. Most people assume this is the only practical choice, and in some cases that may be true. In many situations, running the utility power lines underground may be a good choice. We elected to have underground electric service.

Underground service has an advantage when power must be run through dense woods. Some trees will be lost because of the trenching but generally far fewer than for overhead service. Utilities typically require twenty foot clearance between trees and power lines. That may require trees be removed in a forty to sixty foot wide swath through your trees. After the power line is installed, trees along it will periodically have to be trimmed back. Once underground feed is installed, there is no further maintenance needed and the woods eventually fill back in, hiding the path of the power trench.

With either underground or overhead service, a utility distribution transformer will have to be located within about two hundred feet of your house. With overhead service, the transformer will be installed at the top of the closest power pole. Transformers for underground service are usually installed on low ground mounted pedestals.

Talk to the utility staff about installation procedures and requirements. Don't be afraid to ask questions. Make sure you understand everything they tell you. Utility personnel will work carefully with you to make sure everything is done correctly but they can detect mistakes only after you make them. Once you have made a mistake, it will probably take additional money to correct it.

Upgrading existing service

If electric service is already available on your property, you will have to determine if it is in the correct location and of adequate capacity. While requirements vary from utility to utility, remember that you will not want the wire run from a power line transformer to your house circuit breaker panel to be more than about two hundred feet, less being preferable. Longer wire runs produce greater voltage dips when your air conditioner or other large appliance kicks on.

Electric supply capacity is an issue with older homes. An older home may have been wired in a time when a refrigerator, a vacuum cleaner, a small well pump, and a few light bulbs were the expected maximum electric loads. New homes in the U.S. are typically wired for two hundred Amp service. This allows adequate capacity for air conditioning systems, microwave ovens, electric clothes dryers, and other large electric appliances commonly installed in modern homes.

Determining the electric load capacity of existing service is simple. You simply look at the label on the main power circuit breaker. If the main breaker is labeled for less than 100 Amps, you should have an electrician inspect your wiring before adding any large electrical appliance. If it turns out the electric panel uses screw-in fuses instead of circuit breakers, you can usually count on having to upgrade the wiring.

In some cases, the utility's power line transformer will have to be upgraded if you upgrade your house wiring. If your electric service connection to the utility's power lines must be moved, obviously that will require utility construction work.

Underground service

Underground service requires more work during installation than overhead service. A trench must be dug from the nearest utility power pole to your house site. There are specific requirements for electric trenches. Though specification vary, most utilities require underground service be run in electrical conduit at least three feet under ground.

You will probably be responsible for both digging and backfilling your electric power trench. You can usually find backhoe services listed in a local newspaper or phone book. This kind of trenching is not critical as long as the machine can dig to the depth specified by the utility construction department. Once the trench is dug, conduit and power cable can be laid in it. Once the utility construction crew finishes whatever work and inspections they must perform, you will have the backhoe come back and backfill the trench. Backhoe operators are familiar with the process.

In cases where burying the conduit at a depth of three feet is impractical, there are usually provisions for using shallower depths by covering the conduit with concrete. Even with concrete, burial depths of twelve to eighteen inches are commonly required.

You will likely have to procure conduit to run the power cable through. What size and kind is required for underground electrical service varies with different utilities but most commonly two-inch diameter gray PVC electrical conduit is specified for high voltage runs. The thick two hundred forty volt household drop wires will likely require larger.

You may also be required to procure the power cable. The utility company people can tell what kind of cable to buy and where it is available. Some utilities, though, prefer to supply their own high voltage cable. The cost is usually reasonable.

Above ground service

Above ground service is usually less trouble than underground service, provided your power line does not have to run through a stand of trees. In open country, a utility crew can dig holes for power poles, install them, string the wires, and install a transformer very quickly.

If trees are in the way of your power line path, you will be responsible for removing them. Also, limbs on remaining trees will have to be trimmed back so they will be no closer than some specified distance from where the power lines will be run. That distance is commonly twenty feet.

Ask the utility company for a recommendation about the most economical and timely way to remove and trim trees. New construction hookup is one of their primary jobs. They will have had considerable experience to draw on.

In most areas, the utility company supplies the power poles and high voltage electric wire. Prices for these materials are often below what you would be able to buy

them from other sources. In our part of Missouri, power pole price was $35 per pole and $0.35 per foot for wire installed.

Lightning protection

An obvious concern in areas that experience lightning storms is protecting your electrical equipment from voltage spikes caused by power line lightning strikes. By far, the greatest damage to household electric appliances and electronic equipment from lightning is power line voltage surges, not direct strikes.

Electric utility companies in areas of the country where lightning storms are common make available devices to suppress power line voltage surges. There are surge suppressors that mount at your electric meter and in your circuit breaker panels. Use both kinds if they are available.

Even with meter and circuit breaker panel suppressors installed, additional protection for critical and expensive items should be used. Items such as refrigerators, freezers, computers, and home entertainment equipment can be protected using suppressors that plug into wall outlets.

All surge suppressors do not necessarily provide the same level of protection for your electrical equipment. Some have little surge capacity. Read the labeling on the package before you buy one. Compare it with others for how much protection you can expect. Choose a unit with a surge capacity greater than about five hundred joules.

Water well pumps are especially vulnerable to lightning strike damage. They are usually made of metal and well grounded by virtue of being in water deep under ground. Lightning strike surge current flows through all possible ground paths, in proportion to how well grounded each is. Well pumps can receive a large portion of strike current. Surge suppressors should be installed at both the circuit breaker panel feeding the pump and at the power connection at the top of the well.

Power for house and outbuilding

The common rule is that only the main circuit breaker panels in your house and one outbuilding may be directly connected to your electric meter. All other buildings must be fed power through circuit breakers in either of those panels.

Each additional outbuilding should have its own circuit breaker panel. Since they will be fed from another circuit breaker panel, they are called sub-panels. Sub-panels may feed other sub-panels but remember that voltage drop increases with wire length.

Unless you are very familiar with electrical construction codes and practices, you should always consult an experienced electrician any time you are contemplating electrical work. Better yet, have the work done by a professional electrician. This is especially critical when installing or modifying a circuit breaker sub-panel is involved.