The electric industry has seen its fair share of changes since its inception in the early 1900s. Central Electric Cooperative, like many other cooperatives across the nation, is working on updating its infrastructure.

**History**
Standards for different utilities and trades have changed through the years. In the early 1970s, when Central Electric started installing underground cable, the industry standard was to bury power lines directly in the ground.

Today’s standards, adopted in the early 1990s, call for buried power lines or cable to be housed in conduit. Why the change? Industry leaders learned the life of the protected cable is significantly longer than direct-buried line. These standards also lower the costs of future upgrades or replacement projects by greatly reducing the amount of excavation required.

“A vault and duct system improves reliability for members,” says Brad Wilson, CEC director of operations and engineering. “When something is direct-buried with rocks nearby, the earth will move and there will be compression. Over time, it will wear the cable down and allow penetration to occur. Conduit protects the cable from those forces.”

Brad points out not all areas on CEC’s underground system were direct buried. There were several instances when conduit was used, even prior to the 1990s, due to the nature of the project and the location of the cable.

At the same time the use of conduit became the new standard CEC launched a project injecting silicone into the direct-buried underground lines to extend the lifespan of the cable. Those sections of cable are now nearing the end of that lifespan, and the co-op has undertaken a program to replace that cable with sections housed in conduit.

**The Line**
Think about the underground cable system like those systems you see above ground. A traditional system has power poles with transformers connected by lines strung between them.

The mechanics are essentially the same in the underground system. The line runs through the conduit and is strung between vaults. Vaults are big concrete boxes placed at least 4 feet deep in the ground. The box leaves a void where conduits can be connected and excess cable can be stored. The transformer and junction boxes sit above ground on the vault lids.

“It’s not like a water, gas or sewer line where they
can tap off a mainline to serve that house,” says Brad. “We can’t do that with electrical. We need points of termination or ends where we can bring the cable up and terminate the high voltage and transform the voltage service voltage levels. There is a lot of planning involved.”

The cable CEC uses today is called EPR. It has a sponge-like insulation so it is more flexible and has a tighter bending radius than previous cable designs. Power cables with silicone or plastic insulation are very rigid, prone to breaking and temperature sensitive. Brad points out this is not a good fit for Central Oregon where there are big temperature fluctuations.

“With the EPR cable, manufacturers state it has a lifespan of 75 to 100 years,” he says.

The Project

The project CEC faces now is replacing almost 1,400 miles of direct-buried underground distribution line. With better technology and maps, the cooperative can track and monitor faults in the system.

CEC installed automated metering infrastructure technology in the early 2010s. This greatly improved the ability to record outage locations, and the co-op started converting hand-drawn maps into digital maps and catalogs. “We now have a catalog of our faults—overhead and underground—and we are integrating that information with our mapping system,” says Brad. “We have a very good system to track and monitor where faults are occurring, giving us valuable insight into planning and preparing.”

CEC now must take a significant portion of its

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existing underground electric system and replace it.

“It’s not a simple process,” Brad says. “We have to find room to set the new duct and vault systems, and terminate the conduit while continuing service to existing members. That puts constraints on the space we have in established neighborhoods with landscaping and trees.”

Many members might not realize it, but there may be public utility easements or rights of way on their property, which are generally located farther off the center of the roadway. This often includes the sidewalk-side of the curb inside a homeowner’s property. This is where the underground system typically is located.

“When we start our projects, we send out surveyors to find property lines, public utility easements or other existing easements,” Brad says. “What we commonly find is people have built fences, put in landscaping, or planted trees in places that we need to get to. This means we have to remove them to be able to get our work done.”

Members need to be cognizant of any utility coming in to do work on underground systems. Brad suggests people use soft materials such as bark and grass near curbs and electrical equipment.

“When we complete our work, we typically try to put everything back in place, but if it’s a structure or vegetation in the middle of the right of way, it may have to be removed,” he says. “We are trying to provide reliable electric service in the space we have available. In these areas, our options are limited, but we always try to come to a reasonable solution.”

The cooperative is working to update its existing equipment while still meeting the needs of members. The co-op also must work around water, phone, cable, sewer lines, etc., as well as different specifications from different cities, which can be challenging. The replacement of existing equipment takes a lot of planning. Members whose section of the system is being upgraded could face multiple planned outages.

“We have to complete the excavation, set the vaults and ducts, get the new wire installed, energize the new equipment, and then transfer the load to the new system,” Brad says. “This is a multi-step process and can sometimes take several weeks to complete.”

So how are project areas selected? The cooperative currently is focused on spots with the most faults.

Underground Power Lines
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Underground power cable has a conductor, surrounded by insulation and wrapped with ground wires on the outer surface. A fault is a weak spot or failure in the cable insulation that allows electricity to exit the cable and cause a short circuit.

Over a new set of conduit protected cables, crews work to place a platform to support a new transformer.

“There is a reliability index we work to meet, but we cannot make the faults go away immediately,” says Brad. “However, we can keep the numbers of outages down to an acceptable level.”

Above all, the message to members is, be patient. The upgrade project will take several years, and the cooperative needs members’ help to complete it in a timely fashion. Members affected by improvement projects in their neighborhood will receive written notification from the co-op beforehand.