

50% UNDERGROUND BY 2040

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We set goals for renewables, net zero energy and carbon free energy. These resource related goals will require a 21st Century distribution grid that is reliable, resilient and still affordable. Will it be our grandfather's distribution grid? No.



There is much work to do.

The electric distribution grid of the future will be a modern, integrated grid that accommodates distributed energy resources like rooftop solar, fuel cells, storage, and vehicle to grid electric vehicles (EV). This increasingly complex grid that delivers the clean electricity that we need for

our future will be fundamentally transformed into a new and dynamic technological wonder. Underground electric distribution lines will be an important part of that transformation. Therefore, as we set ambitious goals for clean electricity, we need to do the same for the distribution grid that delivers that electricity. I submit that we need to achieve 50% underground by 2040.

Today, the electric distribution system in America is approximately 20% underground. Some public power utilities like Ft. Collins, Colorado Springs, and Anaheim have had underground ordinances for years. They have beautified their cities and improved the performance of their systems. Fort Collins is 99% underground and is 99.9% reliable. Colorado Springs started in the 1970's and today is 77% underground with 99.9% reliability. They estimate they can be all underground with another \$2.2 billion investment.



Colorado Springs overhead transmission line with underground distribution

Anaheim has been engaged in their Home Underground Program (HUG) since 1990 with excellent results. And, the phone and cable TV utilities in Anaheim paid to go underground as well.

Investor owned utilities (IOU's) have put new neighborhoods underground for years, and now, many large IOU's like PG&E, FP&L, WEC Energy Group and Dominion are engaged in multi-year, multi-billion dollar programs to "strategically" underground laterals and other key parts of their systems.

PG&E will spend \$15-30 billion to underground the first 10% of their system. They plan to have 3600 miles of line placed underground by 2026 and will then be one third of the way to their 10,000 mile goal. CEO Patti Poppe has said they are rebuilding PG&E from the “underground up.” PG&E has two major programs focused on undergrounding: system hardening and the Rule 20 Program.

System hardening is part of the PG&E wildfire mitigation efforts. It focuses on strengthening the electric system with stronger poles and covered power lines in addition to undergrounding in or near high fire-threat areas.

The **Rule 20 Program** undergrounds lines throughout the PG&E service area as part of an effort to make communities more scenic and beautiful.

According to the PG&E website, these wildfire safety and undergrounding efforts make the PG&E system safer and more resilient. This positions PG&E to better serve customers and respond to California’s evolving climate challenges. Building and expanding the PG&E electric system underground will:

- Help stop wildfires caused by equipment
- Reduce public safety outages
- Decrease the need for tree trimming
- Improve system reliability
- Beautify our hometowns



FPL contract crews at work hardening overhead lines

Florida Power & Light will ramp up in 2025 to a \$1 billion per year spend on converting overhead laterals to underground. Their 3 year Storm Secure pilot program was so successful in terms of system resiliency and customer acceptance that the Florida Public Service Commission is allowing Duke and TECO to implement similar undergrounding programs. “After the historic hurricane seasons of 2004-05, when seven hurricanes affected our customers, FPL began making significant investments to strengthen our electric system and make the grid more resilient to severe weather. When Hurricane Irma struck in 2017, our hardening efforts helped significantly reduce damage to the grid and speed restoration for our customers. Still, we saw that the number one cause of outages during Irma was debris blowing into and trees falling onto our power lines.”

WEC Energy Group’s Wisconsin Public Service has undergrounded 2000 miles of overhead lines in the last 8 years increasing their percent underground from 27% to 39% with very high customer satisfaction and customer willingness to pay for the underground. This success will carry-over to their other companies as part of their progressive Deliver the Future initiative.

Paul Gogan, Director of Electric Distribution Asset Management for WEC Energy Group said, “The Underground projects have been a game-changer for WEC Energy Group. They have exceeded expectations, improved reliability and increased customer satisfaction. The projects have resulted in more than a 97% reduction in electric outage minutes in those areas where overhead lines have been replaced with underground circuits.”

Dominion Energy started their “strategic undergrounding” program almost 10 years ago. Today, they have achieved better system resiliency supported by empirical data. Graciously, they share their lessons learned and best practices especially when it comes to customer involvement and satisfaction! Dominion’s promise to customers leads the industry... “Customers can expect consistent outreach during every phase of an strategic undergrounding project (SUP) project because Communication Coordinators and Project Managers are assigned to all projects and directly communicate with property owners. We have a robust communication strategy that includes updates via mail, door-hanger, phone, email, and more! We also partner with contractors who help keep our customers informed every step of the way.”

These municipal and IOU's are starting to understand the total value of underground over the life of the asset. The data supports it. Data on capital cost, data on reduced operations and maintenance (O&M) cost, time and safety exposure, data on customer satisfaction, data on reliability measured in minutes, and data on resiliency measured by total time of line restoration (TLR).



There is much work to do, and ambitious goals need to be set not just for how we generate electricity, but how this Florida Keys distribution grid delivers it.

Resiliency is defined as the ability to withstand a High Impact, Low Probability (HILP) event with little or no customer outages. Like reliability, there is value in resiliency. Our planners and engineers must do the total cost of ownership analysis and quantify the value of resiliency when possible. It is their responsibility to make prudent system evaluations that support fundamental business decisions for our executives, our regulators and, ultimately, our customers. Increasingly, they are doing just that.

However, not everyone is an early adopter or fast follower. Tucson Electric Power, Hawaiian Electric Company and Puget Sound Energy want to build controversial overhead power lines in scenic communities with neighbors that do not want the large, ugly poles.

Citizens question TEP's cost estimates for undergrounding the line, citing examples that cost as little as half of TEP's \$13MM+ per-mile estimate. In addition, citizens question "TEP's assertion that maintenance costs of underground lines would be much higher than overhead lines." Property values are an issue as well with unsightly overhead lines. TEP admits that studies they reviewed indicate that "...though short term impacts to property values can occur, long-term property values are not greatly affected by transmission lines." But citizens said making only the affected property owners pay for the undergrounding through a special utility district just adds insult to injury. "That's asking people TEP is damaging to pay for TEP not damaging them," TEP anticipates that the line siting hearing to consider its application will be rescheduled for the first quarter of 2023.



The iconic Saguaro cactus is trimmed beneath a desert distribution line

Underground or overhead 46KV in a beautiful new master planned community in paradise? HECO said the cost to put the power lines overhead is \$6.7 million and that underground will cost \$25 million. But, that is their estimate of capital cost. What is total the cost of ownership of

these overhead lines compared to underground lines for the life of the asset? How much will vegetation management really cost 20 years from now? What is the cost utility and customer safety? What is the gross domestic product (GDP) cost of an outage for small business? Planners and engineers need to address these legitimate question (and others) as they decide to build more overhead or underground electric transmission and distribution (T&D) in Hawaii and across America. The Hawaiian neighbors have excellent points of concern and continue to meet with the developers and HECO.



HECO tree lined street along the tourist filled Kalanianaole Highway

Puget Sound Energy (PSE) issued the first project need report for the Energy East transmission upgrade project in February, 2012. Today, over 10 years later, PSE is one permit away from getting approval to build a 230kV line in place of the existing 115kV line. Is the need the same? Are there better alternatives 10 years later? Did anyone evaluate the lost goodwill and reputation of a utility that battles their customers for 10 years? Those customers started Citizens for Sane Eastside Energy.

Sadly, the PSE customers use words like “lies” and “fraud” in their year’s long opposition to the controversial PSE project. The website is a “public forum for citizens on the Eastside who oppose Puget Sound Energy’s proposed “Energize Eastside” project.”

There must be a better way to build electric infrastructure in our communities. What is the customer cost in lost local gross domestic product of an outage? What will the cost of tree trimming be 5-10 years from now? How can we reduce truck rolls and improve ESG? How can we improve worker and public safety? How can we beautify the streetscape and improve the quality of life for our customers? What can be a new and positive part of improved customer service? Electric utilities are asking these questions and, increasingly, the answer is underground.



Passersby are warned not to climb this neighborhood distribution pole in southern California.

As demonstrated, some utilities are leading the industry like public power underground advocates Anaheim, Ft. Collins, and Colorado Springs, or investor owned utilities like PG&E, Dominion, WE Energy and FPL that lead the nation with customer focused, progressive ideas for planning, design and construction of large underground programs. Some utilities choose not to lead, but their time will come.

So, is 50% underground by 2040 an unreasonable goal? Of course not, in fact it might be low. Are the goals for renewables, net zero and carbon free energy unreasonable? Again, no, but the nation will need a state-of-the art electric T&D grid to support our ambitious clean resource goals of the future.



21st Century undergrounding has come of age

Will an underground grid with better [equipment](#), cables, splices and terminations be enough? Will the new underground line sensing technology married with artificial intelligence deliver as promised? Will we drive real cost out of O&M? Will 50% be transformational or do we really need more like 75% underground to achieve our reliability and resiliency goals and significantly impact shareholder and customer value?

We will address these issues in the year to come. Our industry needs to have a debate. Will 50% underground by 2040 be transformational to support the resource goals that we are pledged to achieve? Will our stakeholders agree? Time will tell.

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