



## 1. EXECUTIVE SUMMARY

The age of “Strategic” undergrounding, as a source of the lowest cost life-cycle cost and tool to achieve resiliency and reliability targets, is here. Whether driven by low-cost performance pursuit, aesthetic desires, maintenance efficiency, vegetation management reduction, reliability targets, resiliency speed improvement, or customer satisfaction intentions, for critical line segments, “Strategic” undergrounding is aligned with the “regulatory compact” where the utility provides reliable, nondiscriminatory (available to everyone) power at the lowest long-term cost.

In the following pages of the [Utility Undergrounding Life-Cycle Cost Guide](#) (Guide), a series of 10 industry myths are debunked, and a logical and structured approach to capture the lowest life-cycle cost and achieve resiliency and reliability targets from critical segments is described in the following areas.

### **The Current State of Undergrounding**

Highlighting the multiple Investor-Owned Utilities (IOU), Cooperatives (Co-Op), and municipal system operators embracing “Strategic” undergrounding, in every part of North America, for every reason. IOU examples include Dominion’s Strategic Undergrounding Program (SUP), Florida Power & Light Company’s (FPL) two programs including Storm Secure Underground Program (SSUP) and Municipality/community-initiated underground conversions, Georgia Power’s Grid Investment Program (GIP), San Diego Gas & Electric’s (SDG&E) Strategic Undergrounding Program, PEPCO’s DC PLUG (District of Columbia Powerline Undergrounding Initiative), and WEC Energy Group among others.

### **Emerging Undergrounding Materials, Practices, Techniques, and Costs**

“True Lifetime Costs” definition, performance, and implication demonstrate that “Strategic” undergrounding is the lowest long-term cost for selected segments. Driver examples include the potential for 100+ year cable life, 3-7x maintenance reduction, longer pulling length technology, and upfront cost differential of only 2-3x, **not the 10-15x industry myth.**

### **True Cost of Undergrounding...Taking the Long View**

Which “quantitative” and “qualitative” factors are driving superior cost performance of “Strategic” undergrounding on selected segments? Avoided costs or risks associated with “Strategic” undergrounding include among others: Lost local Gross Domestic Product (GDP) from an outage; Annual tree trimming; and Outage truck rolls. Captured gains and benefits associated with “Strategic” undergrounding include among others: Improved Environmental, Social, and Governance (ESG) performance; Utility staff and public safety risk exposure reduction; Streetscape beautification; Improved quality of life for utility customers; and Improved customer service perspectives.

### **Generating Boardroom and Regulatory Support for Undergrounding**

How to position and obtain approval of boards, councils, legislators, and regulators for “Strategic Undergrounding” efforts? “Strategic” undergrounding is a path to achieve low-cost performance, aesthetic desires, maintenance efficiency, vegetation management reduction, reliability targets, resiliency speed improvement, or superior customer satisfaction on critical line segments...which of these benefits is the driver for your governing body?

The reader can use this Guide to inform and educate their consideration of applying “Strategic” undergrounding, as a tool to achieve the lowest cost life-cycle cost and achievement of resiliency and reliability targets.

PDi² trusts you will find the Guide a useful tool as you explore the development and implementation of “Strategic” undergrounding programs that deliver superior cost, reliability, and resiliency performance on selected line segments.



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### 1.A. MYTH-BUSTING

#### Exhibit 1.1

#### Myth-Busting

Remove misconceptions of the nature, performance, and cost of “Strategic” undergrounding

Myth	Myth-Busted
1. Undergrounding is 10-15x the cost of overhead installation. <sup>51, 560</sup>	The real cost differential in upfront cost is 2-3x for “Strategic” undergrounding efforts where the intention is to capture the lowest cost life-cycle cost and achieve resiliency and reliability targets for critical line segments. Multiple successful and PUC-approved “Strategic” underground programs, including Dominion, are coming in at the 2-3x benchmark. Dominion’s Phase II SUP completed 249 miles undergrounded at an average cost of \$422,496 per mile – significantly below the legislatively required maximum of \$750,000. <sup>251</sup> Nearly every utility system will have line segments that exhibit similar cost/benefit.
2. Underground maintenance cost far exceeds overhead maintenance cost.	The cost of underground distribution maintenance per mile is 3 to 7 times <b>lower</b> than overhead distribution maintenance. <sup>559, 603</sup> This reduction in maintenance is also a direct reduction in “truck rolls” yielding both a safer environment and a focus on critical/emergency needs addressed by first or second responders.
3. Underground cable fails at a faster rate than overhead cable. <sup>531</sup>	Innovation and problem-solving where 100-year+ cable life, submerged and directly buried, is now possible. <sup>255, 602</sup> Specifically, materials, manufacturing, and factory comparable quality control (QC) field testing are greatly improved allowing cable systems to live 2 to 3 times longer than wood pole-supported assets. <sup>615</sup> In one study, underground assets exhibit 12x fewer System Average Interruption Duration Index (SAIDI) outage minutes than overhead assets. <sup>610</sup>
4. Overhead to underground conversion programs are cost-prohibitive. <sup>51</sup>	Undergrounding transformations are driving costs down and performance up via materials science; construction techniques; maintenance practices; regulatory policy; and financial engineering. What is truly cost-prohibitive is the lost GDP incurred by a weather-impacted region or state while overhead line segments are down a day or days longer than necessary – Hurricane Irma estimates of \$1 billion per day lost <sup>612</sup> in regions impacted are consistent with FL’s daily GDP of \$3.8 billion and by comparison, VA’s daily GDP of \$1.7 billion. <sup>611</sup>
5. Boards, councils, legislators, and regulators will not support “Strategic” undergrounding.	Approximately 90% of new subdivisions are undergrounded <sup>549,591</sup> ; “Strategic” undergrounding programs are underway in multiple states (AL, CA, DC, FL, GA, PA, WI, and VA among others) with implementation approval from boards, councils, legislators, and regulators. An “...increase in % share of T&D lines that are underground has a statistically significant correlation with improved reliability...” <sup>501</sup> WEC Energy is on track to achieve a 16% improvement in customer minutes interrupted (CMI) attributed to strategic undergrounding. <sup>533</sup>
6. “Strategic” undergrounding is not for Investor-Owned Utilities (IOUs).	“Strategic” undergrounding programs are underway by multiple IOUs (Alabama Power, Dominion, Georgia Power, PECO, PEPCO, PG&E, SDG&E, and WEC Energy Group as examples) with approvals achieved from boards, councils, legislators, and regulators.
7. Underground faults are hard to find, expensive to repair, and take longer to resolve. <sup>107</sup>	The quality, performance, and field testing of modern materials are allowing cable systems to live 2 to 3 times longer than overhead assets and reducing the number of faults below that of overhead lines <sup>610, 615</sup> This high-quality performance married with technology to accurately and rapidly locate faults, <sup>608</sup> when they do occur, and specialized keyhole or vacuum excavation technology dramatically speeds up and lowers the cost of finding and repairing any fault.



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<b>Myth</b>	<b>Myth-Busted</b>
8. “Strategic” undergrounding is not for municipal or Co-Op utilities.	“Strategic” undergrounding programs are underway by multiple municipalities (Anaheim, Austin, Ft. Collins, Salt River Project, and Seattle among others) and Co-Op <sup>501, 581</sup> (Cordova Electric Cooperative, Dakota Energy Cooperative, and Lane Electric Cooperative) utilities with approvals achieved from boards and councils.
9. Undergrounding offers very limited intangible benefits.	Municipalities, developers, communities, and homeowners demand that new distribution and service lines be placed underground where nationwide, approximately 90% of new subdivisions are undergrounded. <sup>549, 591</sup> Other, non-monetary benefits include raptor protection, public safety, customer satisfaction, reduced traffic incidents, and community and customer satisfaction ratings, etc. “Fewer than 15% of selected underground projects have been canceled due to the inability to secure easements.” <sup>601</sup>
10. The present value of underground vs. overhead cost to install, maintain, and repair is <b>not</b> compelling.	Dramatically reduce outage duration both modeled and achieved. <ul style="list-style-type: none"> <li>• “Strategic” undergrounding modeling, the Total Length of Restoration (TLR) will be reduced by up to 40-50% and this accomplishment is achieved despite spending less than 3% of the cost of more extensive undergrounding described in the VA SCC report on undergrounding post-Hurricane Isabel.<sup>252</sup></li> <li>• “...underground line would have paid for itself in just two damaging weather events. If the overhead line had been in place and damaged during all of the weather events after 1996, the cumulative cost of replacing it after each storm would have been far greater than the cost of burying it once.”<sup>581</sup></li> </ul>