



Life-Cycle Cost Approach to Decision Making

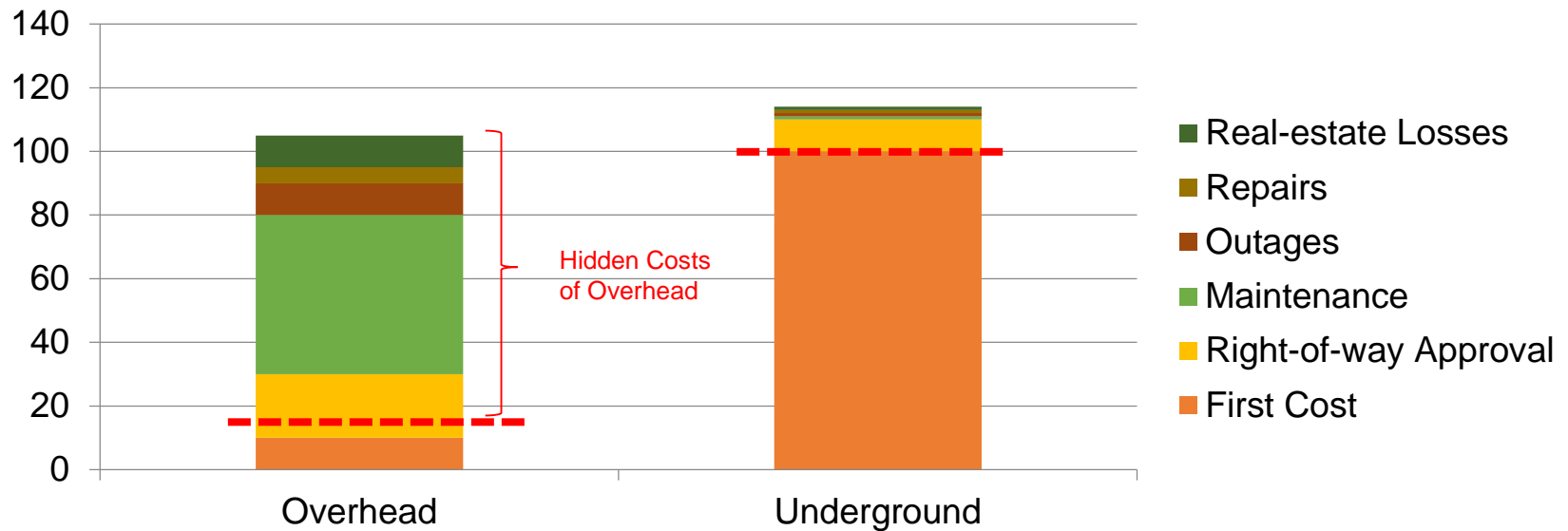
Power Delivery Intelligence Initiative



Power Delivery
Intelligence Initiative

What is Power Delivery Intelligence Initiative (PDI²)?

- PDI² is a working group whose aim is to collect and use data to provide an objective means to evaluate power infrastructure investments from the perspective of **life-cycle costs** to determine when and where it makes sense to install underground – instead of, or in conjunction with overhead lines.
- The group will use that data to educate stakeholders, communicate methodologies to utilities and help utilities justify investment decisions based on data-driven, life-cycle cost analysis. For example:



PDi²'s Scope

Geography priority is North America. Initial focus will be new infrastructure for HV transmission projects. Modeling projects will consider:

- Population density
- Areas prone to storms/repeated outages
- Land values
- Growing economic regions

The group proposes to underground cables in areas where overhead cables present limitations associated with:

- Reliability
- Availability of right-of-way
- Project timeline
- Aesthetics and real-estate value
- Physical security (theft/terrorism)

PDi² Current Members



Engineered to order. Built to last.



Undergrounding – an Underutilized Solution

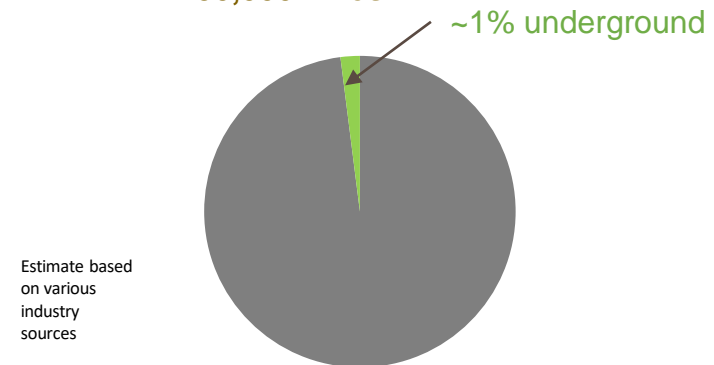
What is driving this trend?

- 1) Initial capital investment costs for underground are often higher than overhead
- 2) Addressing storm damage is easier than preventing future damage
- 3) Limited formal policies to help with cost-recovery for underground

Placing all facts on the table may shift this perception...

- Education and decisions based on full life-cycle cost comparisons
- Case-specific models which include:
 - Speed of implementation
 - First cost of systems
 - Cost of delaying the project
 - Cost of outages to the economy and tax revenues
 - Additional repair and maintenance costs

**Existing Transmission lines
in North America
450,000 miles**



Focus on Life-cycle Impact: Example - Outages

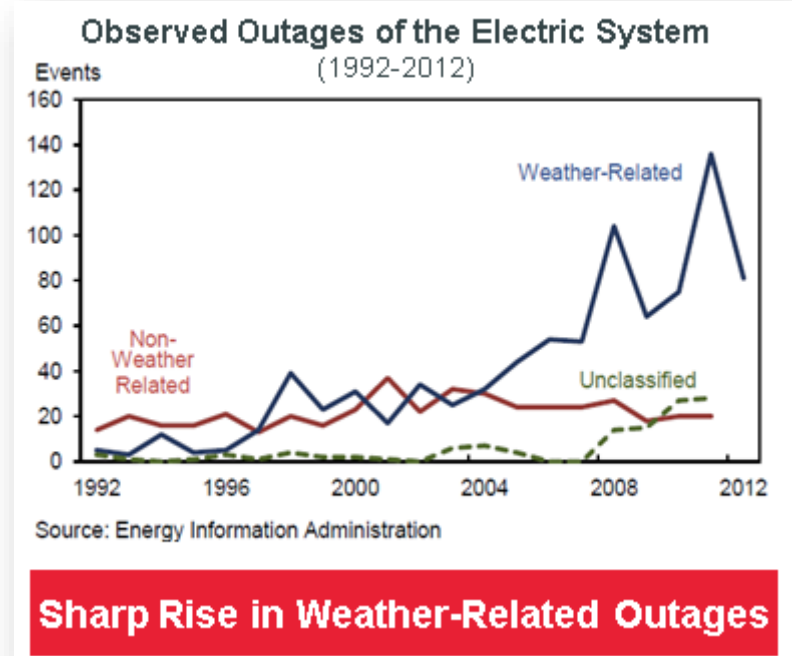
One outage can cost a utility up to \$14 million per day (1)

Power outages cost the economy between \$18 and \$33 billion every year (2)

Lawrence Berkley National Labs, published new preliminary findings in 2016 calculated much higher at nearly \$110B annually

More extreme weather patterns are causing an increase in weather related outages

- Super Storm Sandy
- Polar Vortices
- 2017 Hurricanes Harvey, Irma, Maria



(1) Study of Dominion Virginia Power

(2) Report from the White House on Aug 13 2013



Driving a Forward-looking Approach

- Drivers impacting transmission and undergrounding:
 - Aging infrastructure
 - Need for new paths for electricity flow
 - New sources of generation (e.g. renewables)
 - More volatile weather
 - Political interests
 - Physical security (e.g. terrorism)
- The environment is right for a change in philosophy



Value can be Realized with Coordinated Action

- **Help** utilities justify investment decisions based on data-driven life-cycle cost analysis
- **Educate** stakeholders on all technology and construction options to determine the most viable, reliable and cost-effective solution for the installation of transmission and distribution systems when evaluated via life-cycle cost analysis
- **Convey** qualitative and quantitative value of underground to all stakeholders
- **Develop** common methods by which cable systems can be evaluated from both a utility and public value perspective
- **Communicate** the methodology to utilities, individual state utility commissions and other influencers
- Actively **promote** developed models as an enabler for grid extension in North America with all members of the value chain – including utilities
- **Influence** more actively as part of the North America power industry



Value can be Realized with Coordinated Action

Even a modest upside has a sizeable impact for the industry...

- Reduction in repairs, operations and maintenance over the life of the system
- Streamlined approval process – easier rights-of-way, better project timelines
- Improved reliability – enhanced reputation, happier customers
- Increased volume for materials suppliers and cable makers

While the downside of this initiative is very low...

- Our investment will be in resources to generate the data and models, align the industry message, and promotional activities (direct and indirect)

Call to Action

- We see value in increasing our engagement in supporting the North American power industry to accelerate the ability to objectively evaluate all infrastructure solution options
- To further this initiative we invite key industry stakeholders to join our growing network
- Let's discuss ways in which your company can contribute to this initiative



Organization and Your Participation

- Strict alignment to anti-trust guidelines is mandatory and non-negotiable
- Open membership aligned around a common theme and includes all interested members of the value chain
- Group is engaged in awareness building activity, member recruitment and data-driven projects
- Proposal for up to nine board level members – currently have five
- Membership in two additional categories
 - Partner
 - Associate

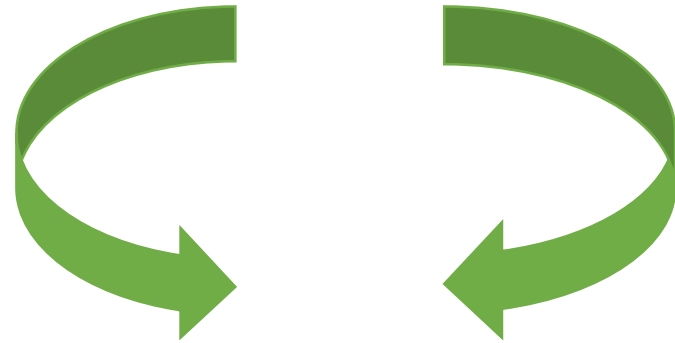


Organization and Your Participation

Membership Level	Key Benefits	Cost/yr.
Board	<ul style="list-style-type: none"> •Up to three people from a board member company can attend each meeting •One director elected who provides a single vote for direction and decisions of the group •Logo on the web site homepage and member page and inclusion in other promotional activity as appropriate •Members-only access to meeting minutes and important documents/information 	\$30,000
Partner	<ul style="list-style-type: none"> •Opportunities to work on projects in lieu of higher fees •Logo in member section of web site •Attendance at meetings by board invitation •Members-only access to meeting minutes and important documents/information 	\$10,000
Associate	<ul style="list-style-type: none"> •Act in an advisory capacity to the group •Logo in member section of web site •Members-only access to meeting minutes and important documents/information 	\$1,000

Membership Targets

- Resin / Compound Manufacturers
- Cable Manufacturers
- Engineering Firms
- Installation Contractors
- Equipment / Accessory Manufacturers
- Utilities
- Public Utility Commissions



...anyone who could be impacted
by this effort

Membership Fees Support Multi-Phase Initiatives



Purpose:	Reinforce group's legitimacy, commitment, and reputation	Compile data and build models	Influence policymakers to adopt more undergrounding
Budget Activities:	<ul style="list-style-type: none"> Execute communications strategies to reinforce brand, direct potential members/ influencers to website, and other tools to continue communicating progress against goals 	<ul style="list-style-type: none"> Produce SOW for various projects and identify appropriate service partners and/or Partner member who can generate the data and build user-friendly models to help with the comparisons of OVHD & UGRD Communicate results One project complete, two new projects underway. 	<ul style="list-style-type: none"> Create and execute a communications plan to reach key policymakers to include the adoption and use of the new models when evaluating and making rate-case decisions
Budget:	\$40K-\$80K/yearly	\$30K - \$60K/yearly	TBD
Timeline:	Ongoing	Ongoing	Ongoing

Note: Budgets can be tailored to match membership dues collected

Phase 1: Driving Awareness

Brand Identity – complete

- Logo
- Trade mark and logo mark filed, cleared, registered

Ongoing communications

- Web site – www.pdi2.org
- Literature
- Display unit for events
- LinkedIn business page
- Editorial placements

Future consideration

- Digital, social and traditional PR campaign
 - Print/digital/social advertising
 - Press outreach
- Other supporting collateral



Phase 1: Membership Building

- Board member recruitment efforts – three new member organizations since original charter – membership now encompasses compounders, cable makers, engineering, accessories and installers
- Participated in Spring and Fall ICC 2017
 - Tabletop Exhibit
 - Reception/Q&A Session
- Media briefings at IEEE PES T&D 2018



Thank You

www.pdi2.org



Benefits to Exploring Other Options

- Each mile of OH circuit is equivalent to 3 cable miles. For a cable manufacturer 1000 miles can have a value of \$ 700,000,000
- By assisting transmission system operators and decision makers with the creation of a framework for intelligent undergrounding of HV lines, there will be a sizeable positive financial impact to our industry

