

NECA • BICSI
SUMMIT 2023

How the Rural Broadband, 5G, and Other Fiber Applications are Changing and Creating Jobs

What you need to know and how to be a part.



Sean Kelly, RCDD

Technical Director, Light Brigade

By the end, you will be able to:



- 1 Understand the technician shortage problem and the lack of training
- 2 Summarize the details of the Infrastructure Investment and Jobs Act
- 3 Demonstrate understanding of 5G, Sensing, and Air Blown fiber uses
- 4 Recognize related and adjacent opportunities for your organization

Technician Challenges

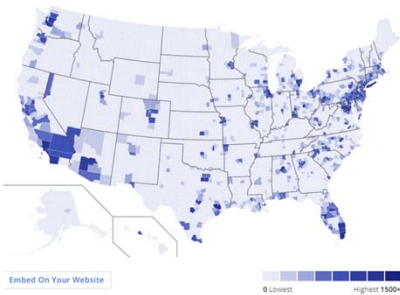
- Market Research Future¹
 - 2021 – Fiber optics market value was \$7.3B
 - Between 2022 and 2030 it is expected to grow to \$13.7B
- GMSA Intelligence²
 - The US will experience one of the fastest global 5G migration and adoption
- New Technician Estimates³
 - Fiber Broadband Association – Estimates 205,000 through 2026
 - Other estimates go as high as 850,000
 - Government Accountability Office – estimates 34,000 this year for broadband
- Wage Disparity⁴
 - Average hourly wage for fiber splicing is \$90/hour in NYC vs. \$17 to \$24/hour in Arkansas
 - Where we need fiber the most, we're not paying enough, and experienced techs are not willing to work there
 - Some are getting paid by the fusion splice or “burn” as opposed to by the hour – Those rates vary too



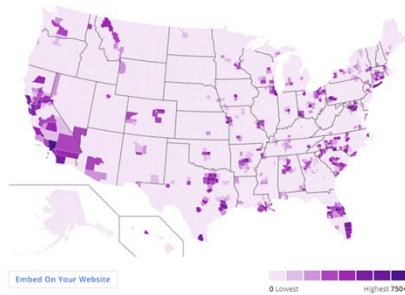
Technician Challenges

Cable Technicians

Located

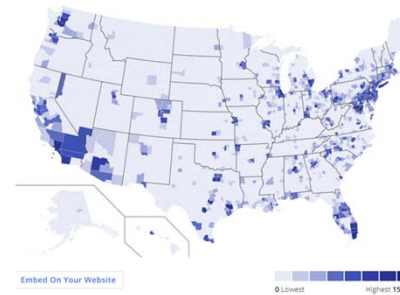


Demand

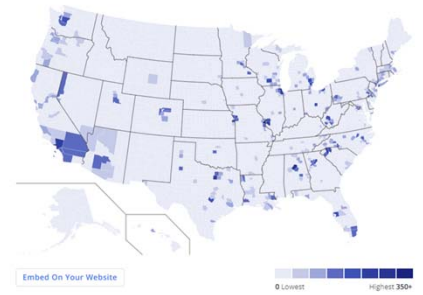


Cable vs. Broadband Technicians

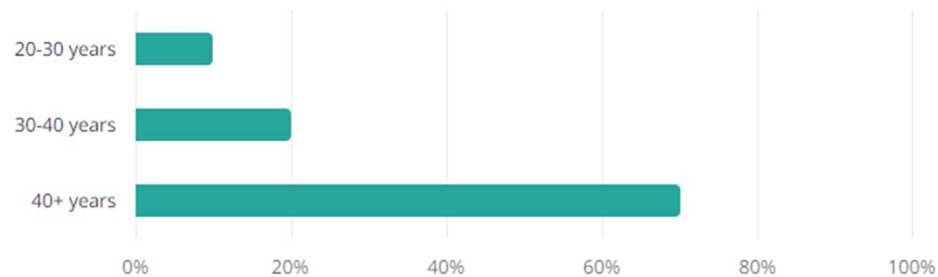
Located



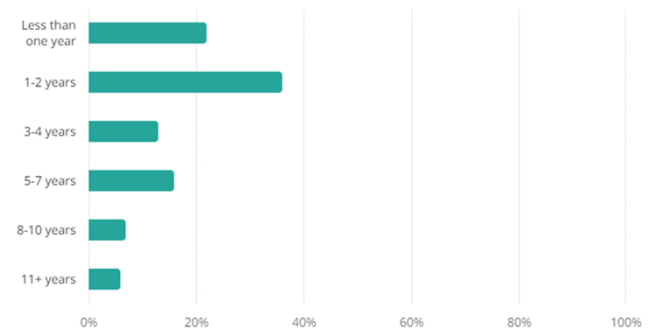
Located



Cable and Broadband Technician Age Distribution



Average time staying in a job



Source: zippia.com

Most Current Fiber Technician Job Postings

Especially Tier-3 last-mile providers and new small entrants⁵

REQUIREMENTS

Valid Drivers License

Willingness to Travel

Work on Ladders and in Confined Spaces

Ability to Distinguish Colors

UNSKILLED

SKILLED

RESPONSIBILITIES

Splicing Loose-Tube and Ribbon Fiber Cables

Constructing Fiber Enclosures

Dressing Fiber Cables

OTDR Testing & Troubleshooting

Trained & Skilled Workforce

The “Boomers and GenX”



**Formal
Education**



**Certification/
Credentialing
Career Path**

The “Next Generation”



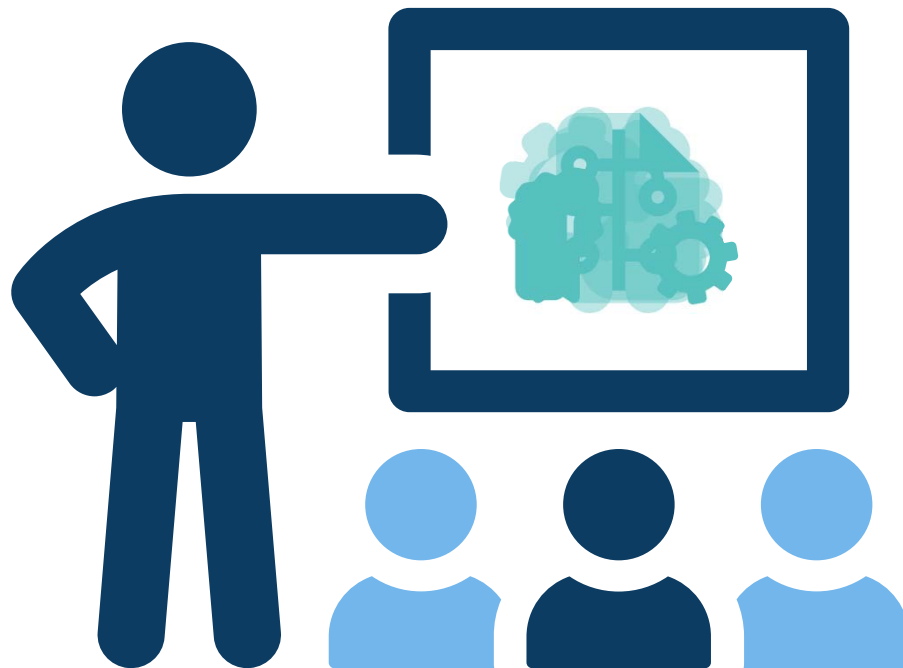
Tik Tok



YouTube



Trained & Skilled Workforce

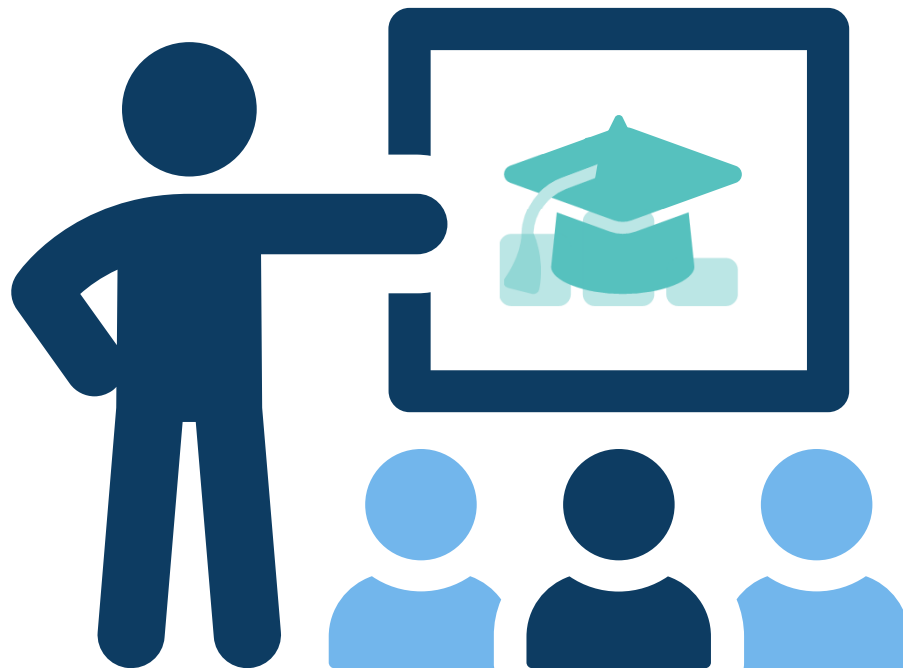


Training should be...

High Quality

- On-the-job training
- Theory and practical based
- Related to student outcomes
- Relevant to the workforce

Trained & Skilled Workforce



- Properly trained staff how
much the **instructor** knows,
but how well the instructor
- YouTube does not deliver
makes sure the **student**
skilled workers!
knows.

Trained & Skilled Workforce



Time is Money

- Proper training prevents additional time and money for reworks
- A skilled workforce is an efficient workforce



Untrained and Unskilled Leads to:

- Mistakes
- Poor workmanship
- Decreased reliability
- Customer dissatisfaction
- Bad company reputation



Remember

- You will only become aware of your poor installation practices when it is too late.
- This will cost you money or worse; your reputation.

\$1.2T Infrastructure Investment and Jobs Act



Passenger and Freight Rail
\$66B



Electric Grid Upgrade (smart)
\$73B



Broadband (FTTH)
\$65B

These are the three fiber-rich opportunities

Funding Available for Broadband

Rural Digital Opportunity Fund (RDOF)

- Phase 1 - \$9.2B (Planned)
- ~\$6B Reality after rejections and defaults.

IIJA Broadband Program (\$65B)

\$48B Allocated to Broadband Infrastructure

Broadband Equity, Access, and Deployment (BEAD) \$42.5B

Tribal \$2B

Middle Mile \$1B

Digital Equity \$2.75B

Total cost will be 2-3X Federal Contribution

Being Compliant



- Fiber Optic Cable – “Construction Material” *
 - Must be manufactured in the United States
 - 100% of sub-assemblies and primary components must be US sourced
- Fiber Optic Connectivity – “Manufactured Product”
 - Connectors, Adapters, Hubs, Terminals, Closures, etc.
 - Must be manufactured in the United States
 - Must meet a 55% domestic content requirement
- Equipment
 - Splicers, OTDRs, Test Equipment, Tooling, etc.
 - Buy America does not apply to equipment
- The entire project must comply, not just the funded portion

* According to current Office of Managing Budget (OMB) Guidance

Compliance Challenges

Products Impact Risk



US Manufactured Optical Cable

Must meet US Country of Origin and content requirement

MEDIUM



Enclosures, Terminals

Most optical connectivity being manufactured by U.S. based vendors being done outside U.S. today with Mexico making up a primary source country

MEDIUM



Field Installable Connectors

Challenged to meet both U.S. manufacturing and domestic content requirement

HIGH

Market Impact



Hyperscale and Colocation

Segment not a target for federally funding

LOW



Dominant RBOCs

Will potentially apply for funding for regions where self-funding is not feasible

MEDIUM



Tier 1 Telecoms and MSOs

Other Tier 1s likely to seek funding as they did in RDOF

MEDIUM - HIGH



Tier 2&3 Telecoms, Electric Coops

Segment most impacted by federal funding

HIGH



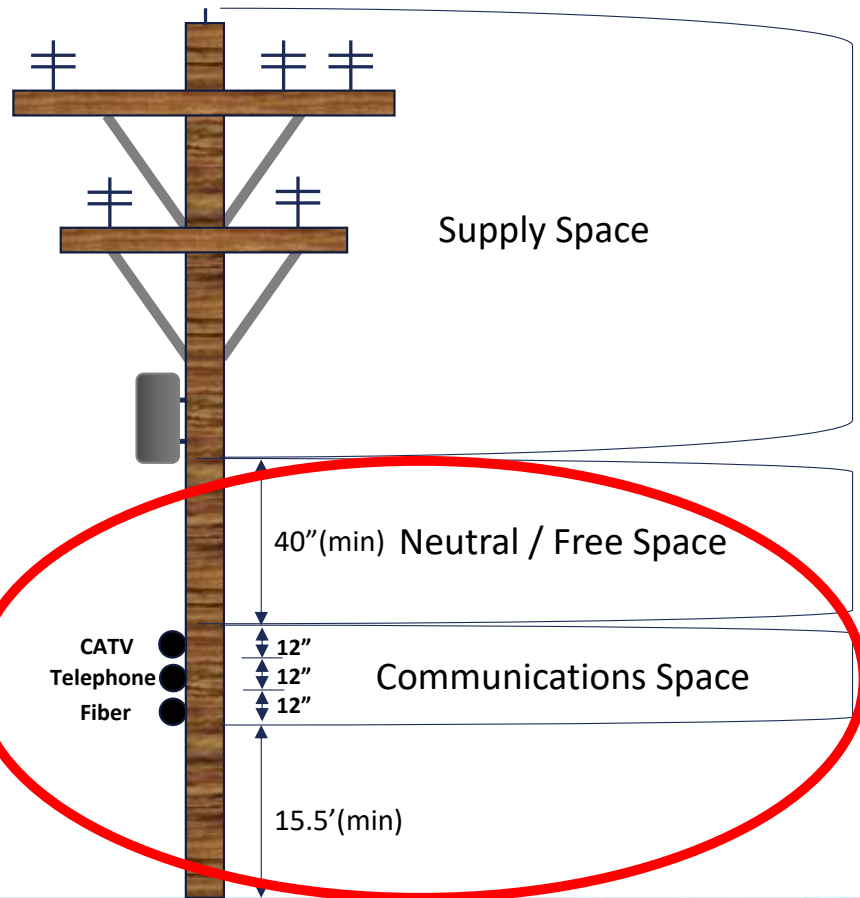
Investor-Owned Utilities

Major portion of electric grid funding flowing through States/Municipalities must meet "Build America, Buy America"

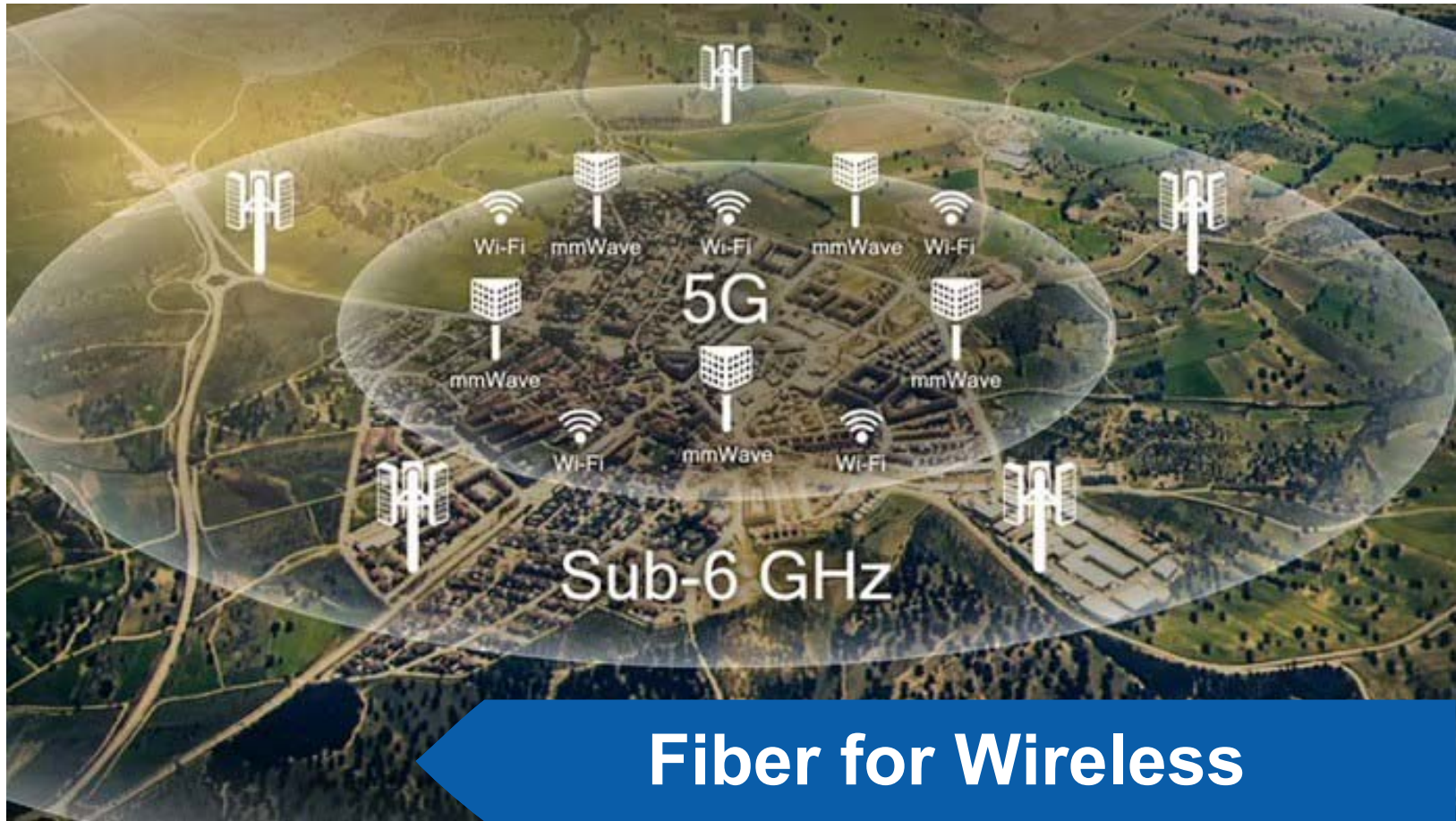
MEDIUM

Courtesy Sean Adam - AFL

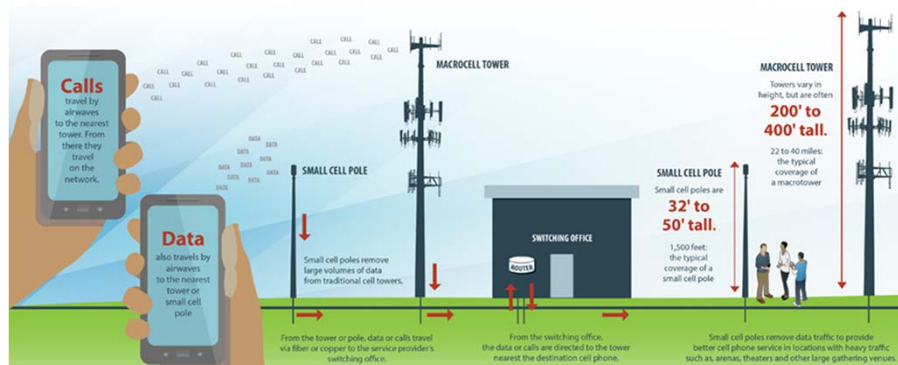
>60% of Funding Will be Construction Costs



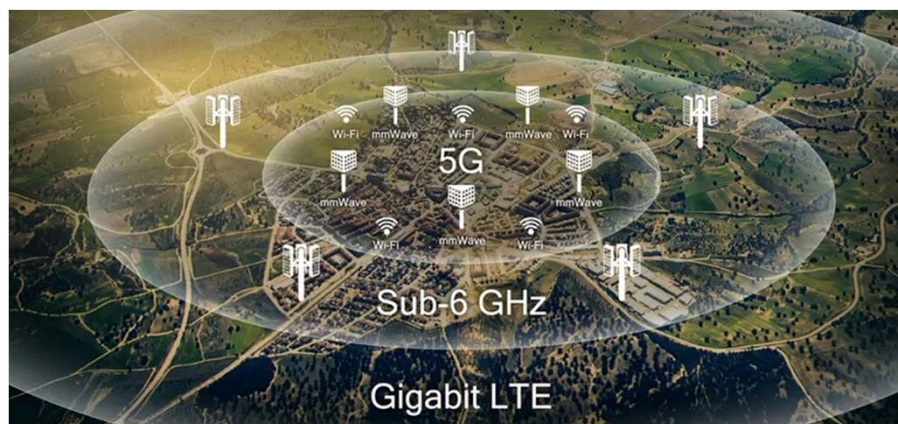
- Less than 20% will go to actual fiber infrastructure
- *Make Ready* will be a major portion
 - Permitting, Licensing, and Approvals
 - Delays
 - Pole owner
- Many current poles do not meet spacing requirements and will need to be corrected to accommodate or meet permit requirements.
- Some poles do not have available space and will need a replacement or secondary unit.
- Cyber Security and Cyber Supply Chain Risk⁵



The Migration to 5G – There are two 5Gs



Source: <https://sdncommunications.com/blog/for-network-building-team-2017-will-be-the-year-of-small-cell-poles>



Source: <https://contactsunny.medium.com/sub-6-and-millimeter-wave-mmwave-frequencies-for-5g-all-you-need-to-know-3c43266047d>

Sub-6GHz

- Mid-Band 5G technology
 - Better speeds than LTE (100-400Mb/s)
 - Shorter coverage area than LTE
 - May share macrocell tower or be a small cell

Millimeter wave (mmW)

- The “fast” 5G technology (1-10Gb/s)
- Extremely High Frequency (30-300GHz)
 - Current mmW 5G spectrum (24-56GHz)
- Low latency
- Sensitive to physical barriers
- Very small coverage area = many microcells
- Enables the Internet of Things (IoT)

Microcells – The path to realizing 5G

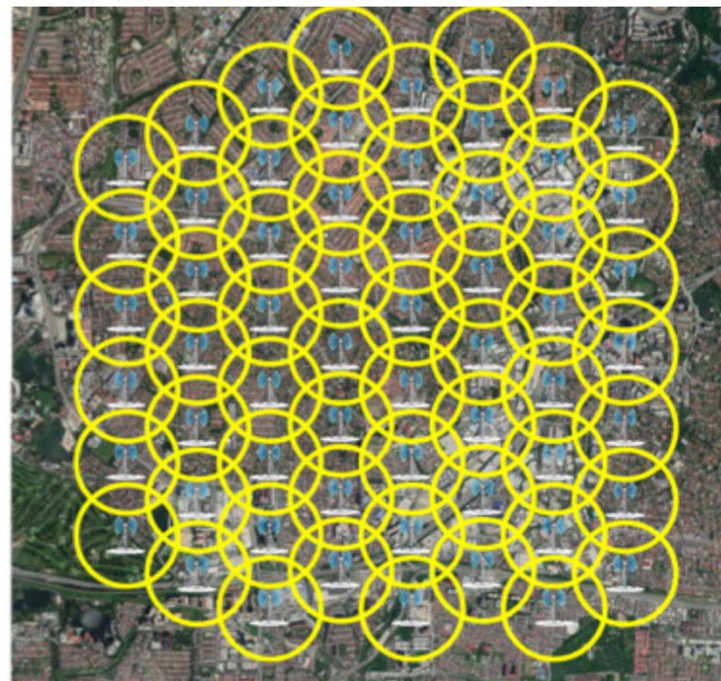
- Implementation of full 5G promises improved connectivity, which will ultimately provide:
 - Enhanced mobile broadband
 - Alternate residential broadband
 - Ultra-low latency
- Microcells will augment macrocells
- Local edge computing to support low latency and ubiquity of 5G
- Microcells are typically carrier specific as opposed to macro towers that may serve multiple carriers.



Comparison of 4G LTE coverage area vs. 5G



4G Network Cell coverage - 25 km²

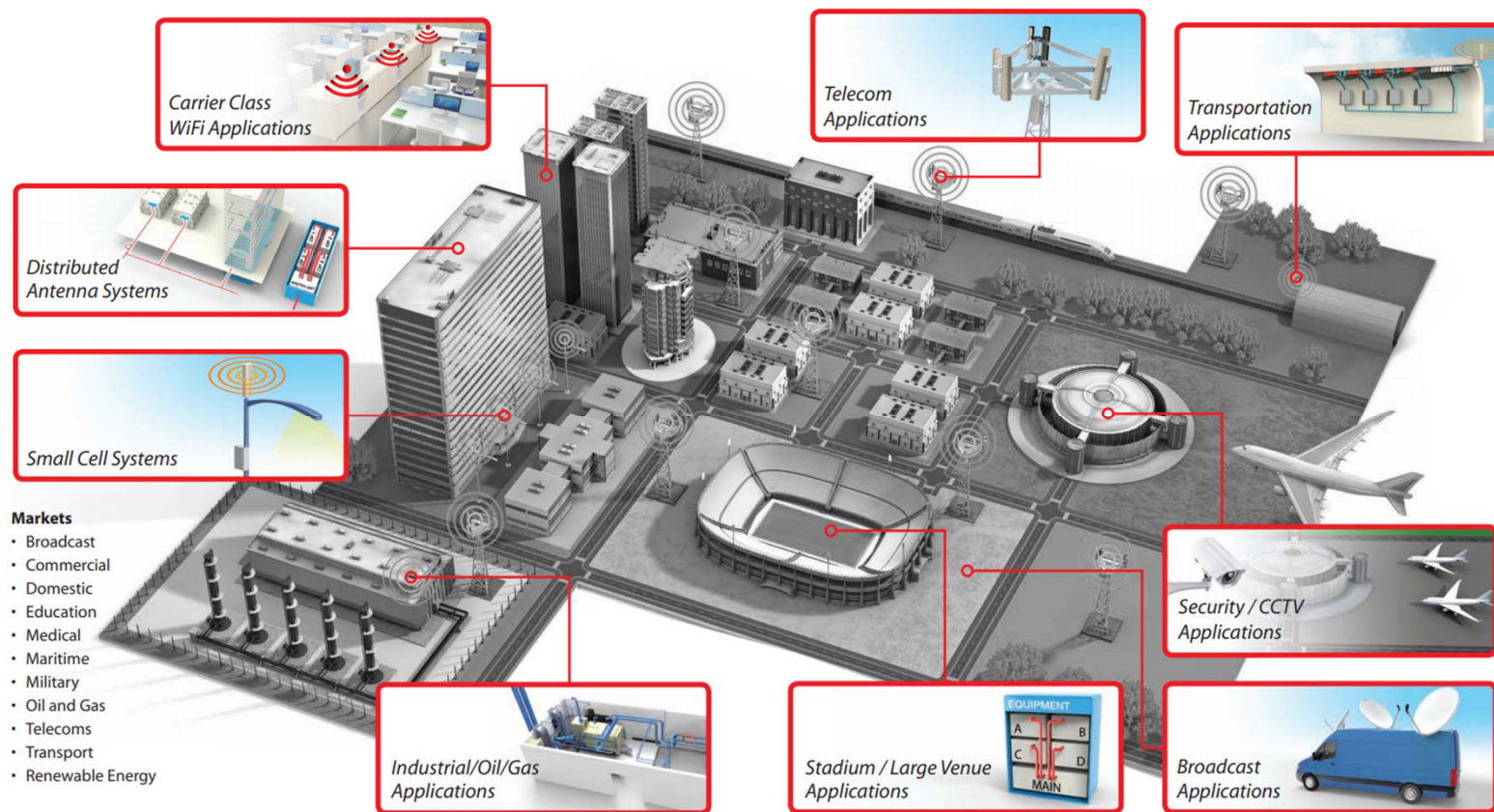


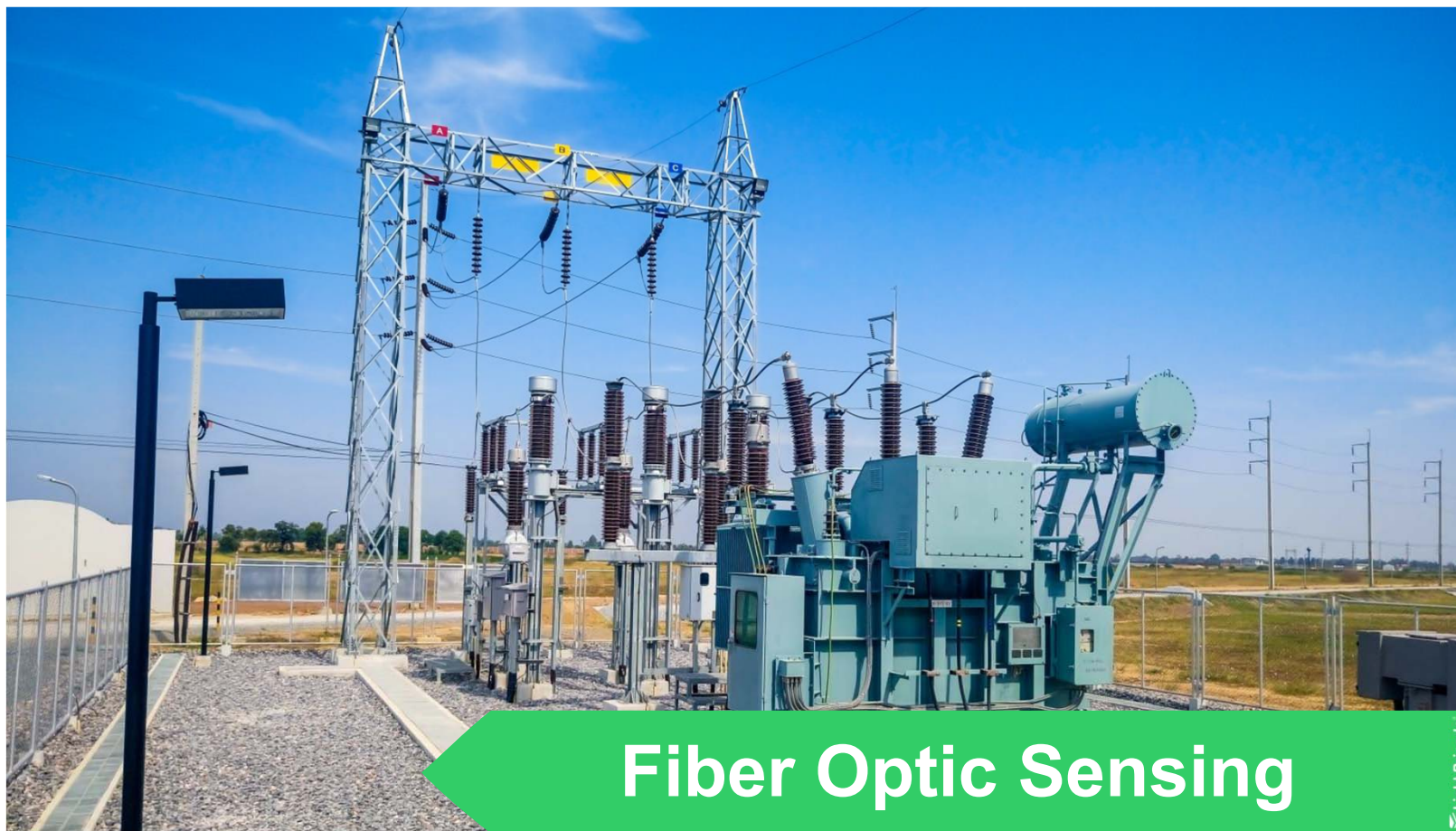
Equivalent 5G Network Cell coverage - 60x0.04 km²

Courtesy Senko

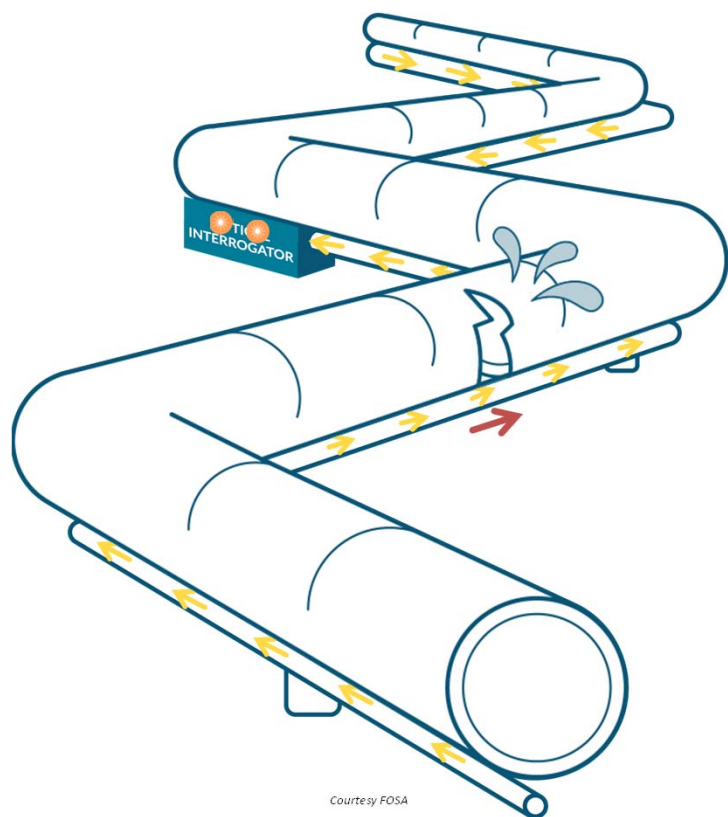
Fiber is required to each yellow circle

Fiber ~~Wireless~~ is everywhere





Fiber Optic Sensing



Courtesy FOSA

- Monitoring of cables from a single location
 - 1000s of sensing points
 - No power – passive
 - Temperature, Strain, Vibration, Magnetic Field, Radiation, and more.
- Distributed
 - Raman Backscatter
 - Brillouin Backscatter
 - Rayleigh Backscatter
- Point Based
 - Distributed Feedback Laser w/ Fiber Bragg Grating
 - Fabry Perot Laser

Types of Fiber Optic Sensing

Temperature



Applications:

- Leakage detection (pipelines)
- Well inspection
- Fire prevention
- Environmental

DTS

**Distributed
Temperature Sensing**

Vibration



Applications:

- Flow control
- Leakage
- Intrusion detection
- Seismic analysis
- Intrusion alarm

DAS

**Distributed
Acoustic Sensing**

Strain



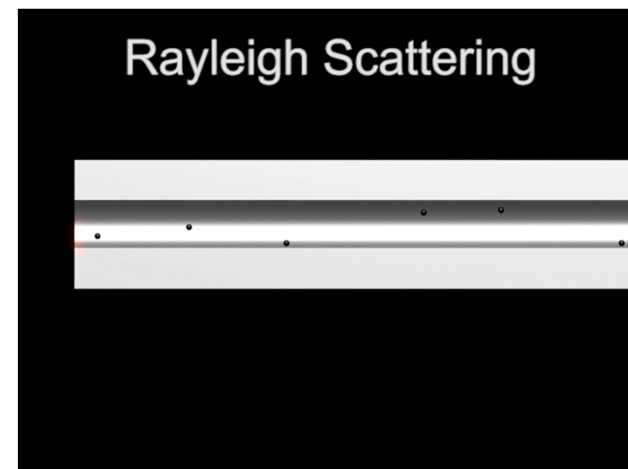
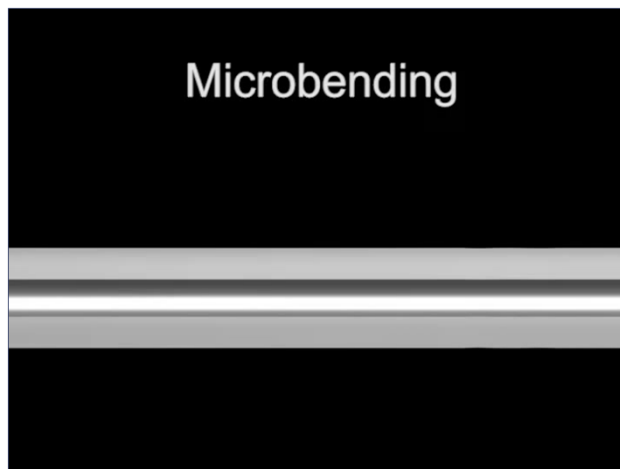
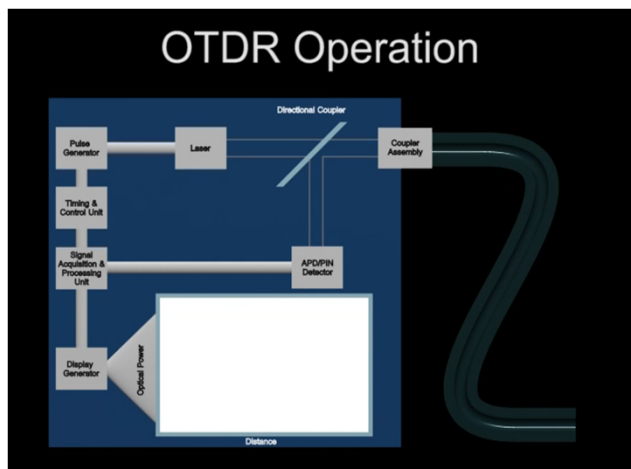
Applications:

- Geotechnics
- Structural monitoring
- Process optimization

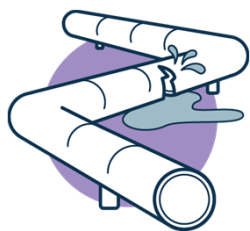
DSS

**Distributed
Strain Sensing**

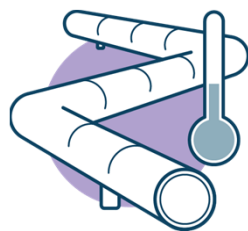
Fiber Optic Sensing – Familiar Concepts



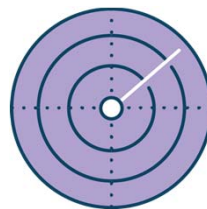
Fiber Sensing Applications



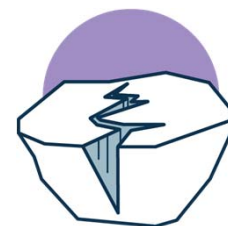
Pipeline Condition Monitoring



Pipeline Heat Trace Monitoring



Third Party Intrusion/Security



Geo-Technics



Transport Monitoring



Oil & Gas In-Well Monitoring



Industrial Process Monitoring



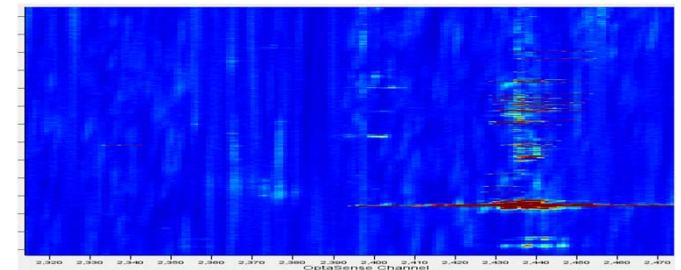
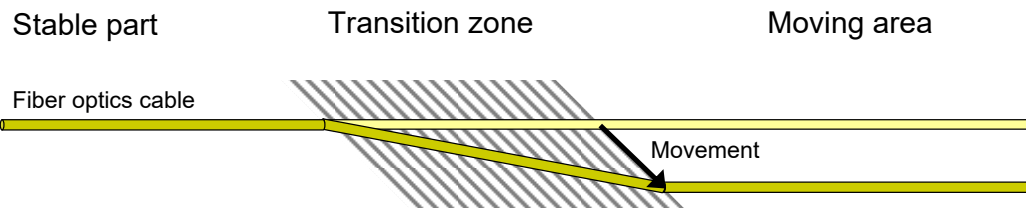
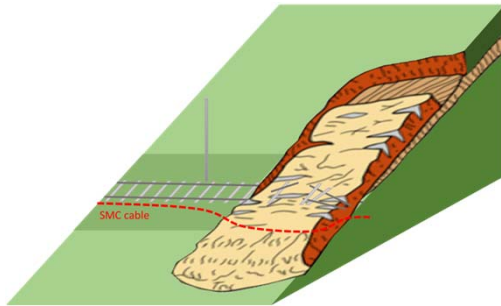
Structural Health Monitoring



Power Cable Monitoring

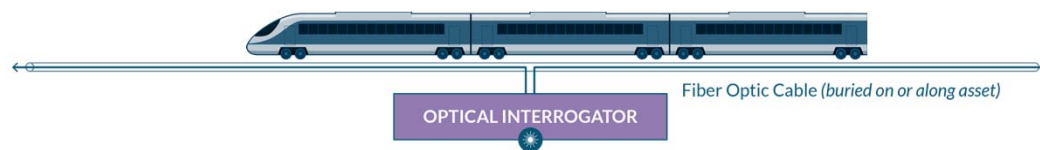
Courtesy FOSA

Sensing Applications



Courtesy FOSA

Sensing Applications



Courtesy FOSA



Air Blown Fiber

Light Brigade



Air Blown Fiber - ABF

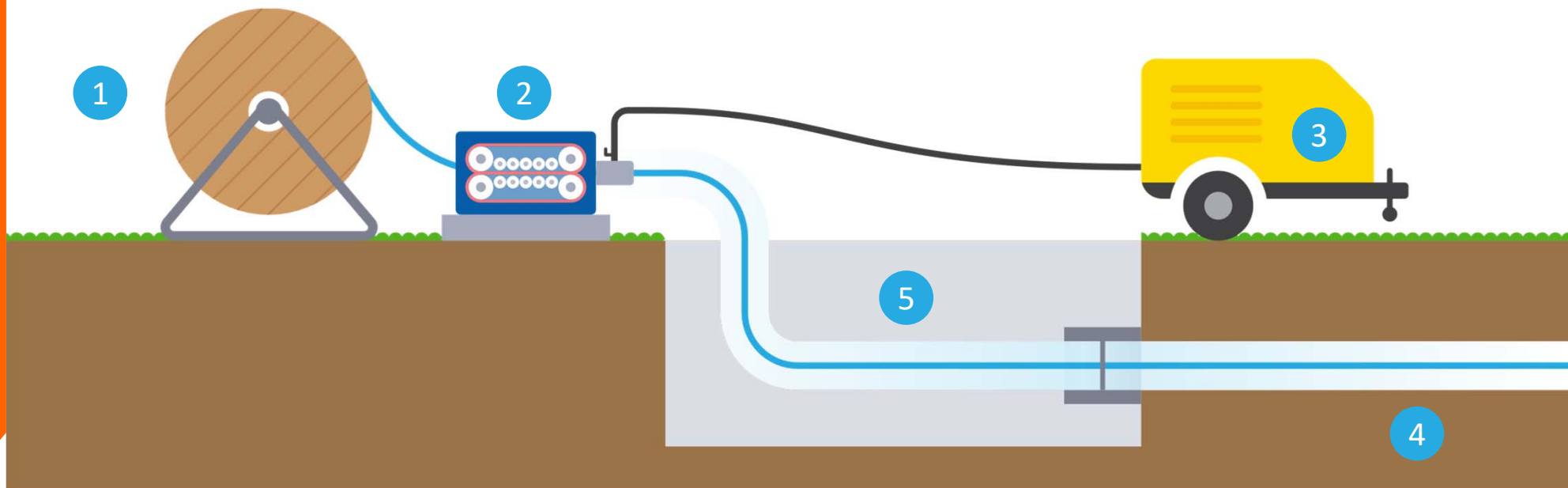
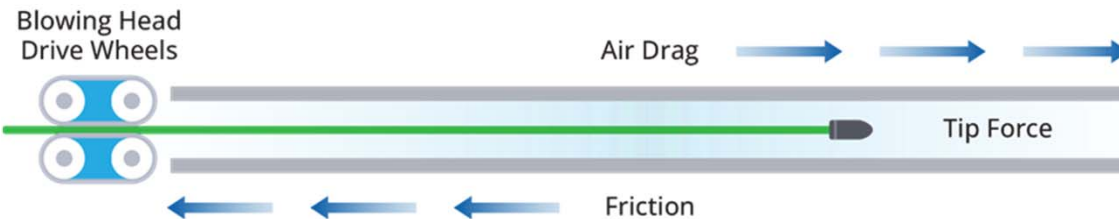
- Low-strain pushing force combined with high-speed compressed air.
- Reduces friction between cable and duct.
- Method of choice for urban and long-haul installations.
- Cables are installed virtually stress-free.
- 40% cost savings are common.



Courtesy Hexatronic

Basic Blowing Setup

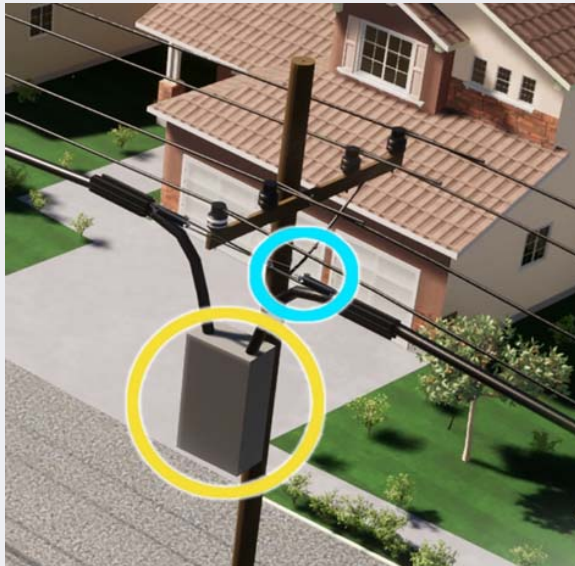
1. Cable drum with drum jack
2. Cable blowing device
3. Compressor
4. Cable duct
5. Subterranean splice chamber



Air Blown Fiber Installation



Underground

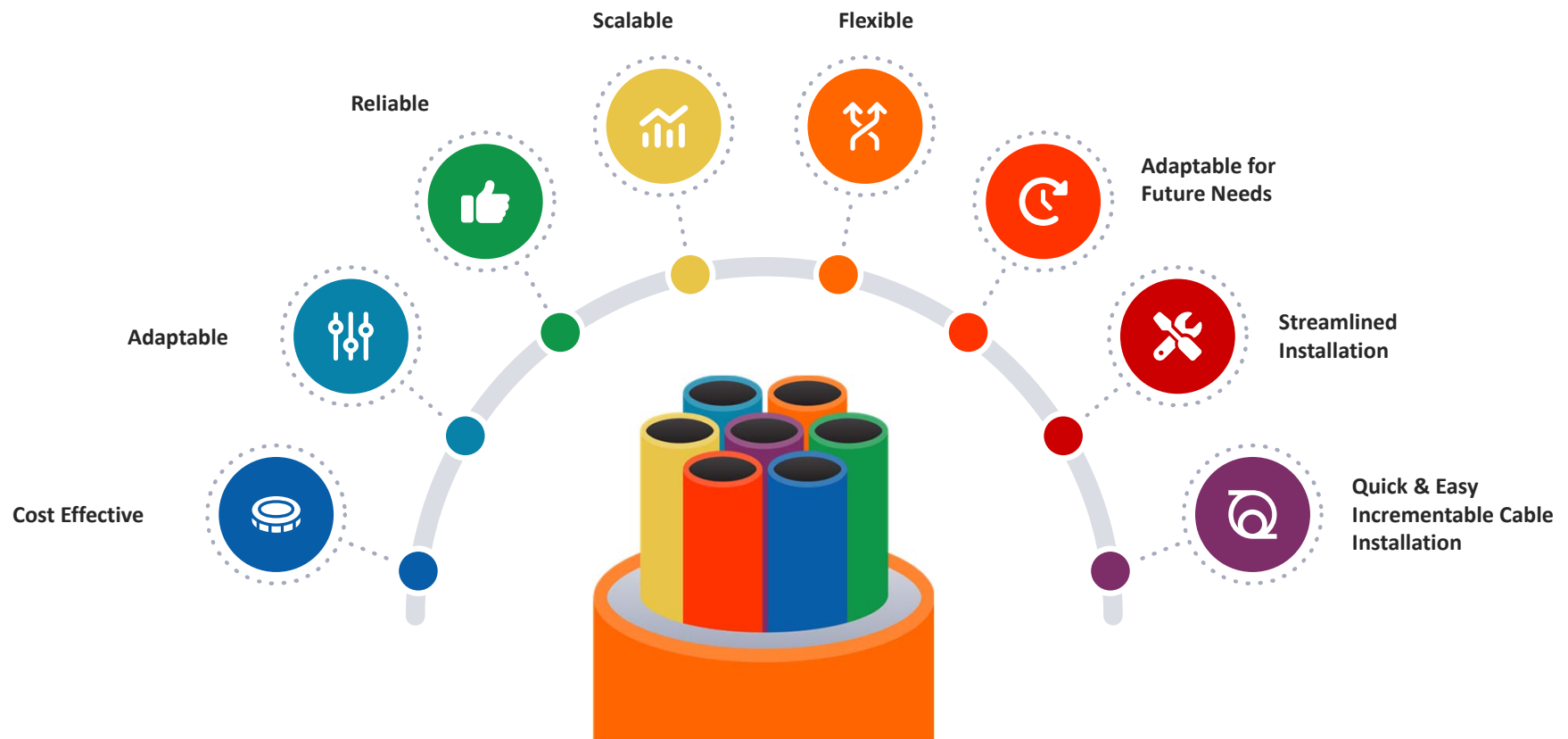


Aerial

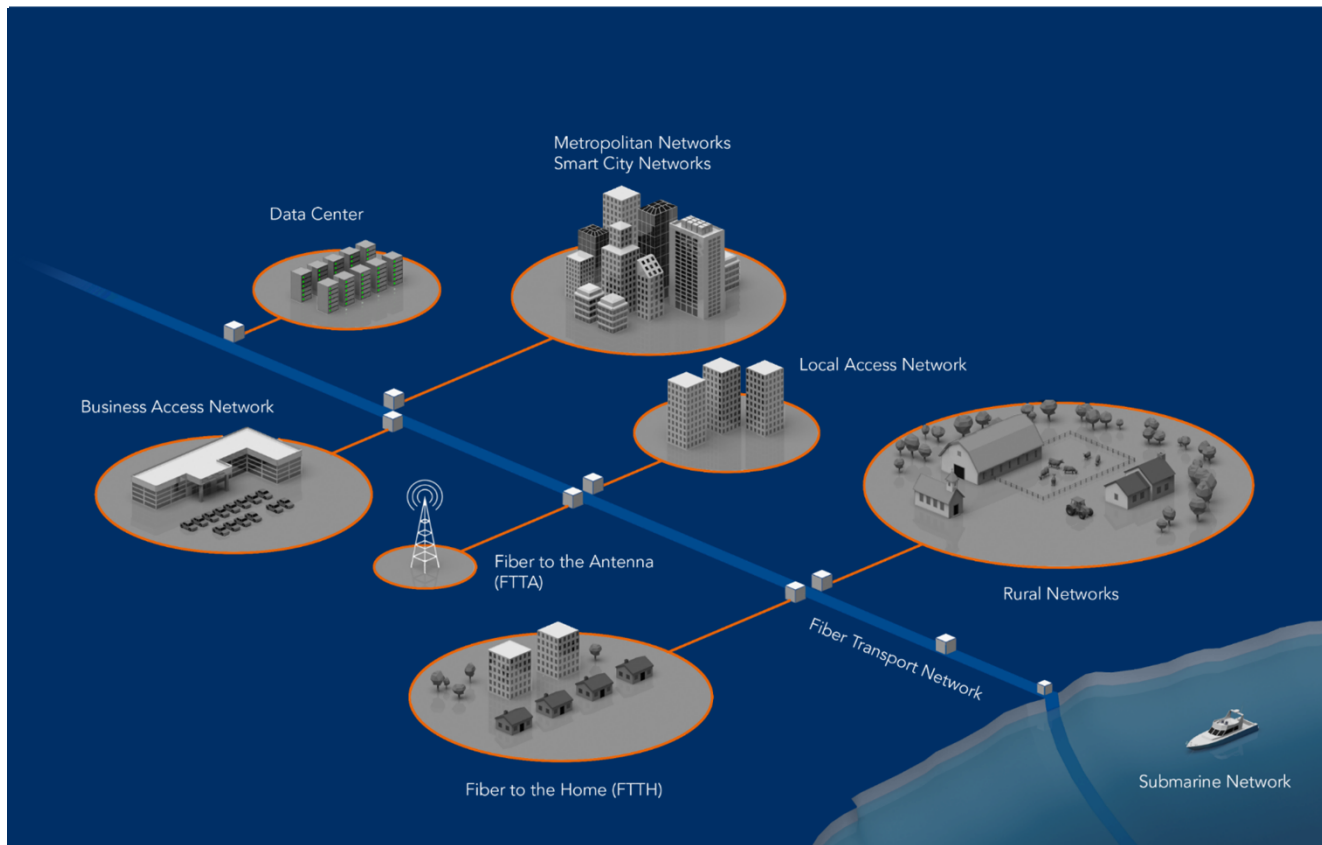


Premises

Air Blown Fiber Advantages



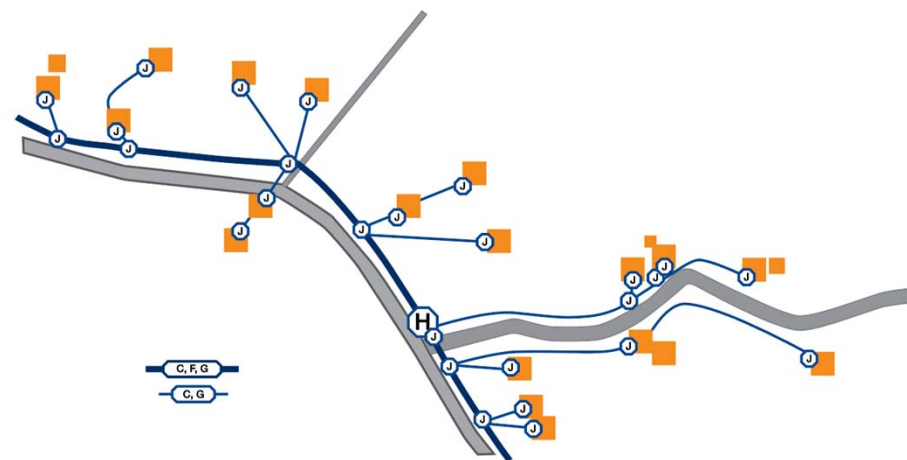
Air Blown Fiber Applications



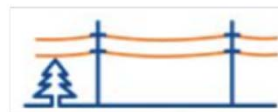
Courtesy Hexatronic

Air Blown Fiber – How and What

- Compressed air or nitrogen
 - Blow fiber units or microcables
 - Typical rates up to 300' per minute
- Microcables (12-864F)
 - 12-864F
 - Distance 6600' and beyond
- Fiber Units
 - 1-12F
 - Typical maximum distance 3300'
- Microducts
 - Pathways for routing ABF
 - Aerial, buried, or in-building



Courtesy Hexatronic



Aerial installation

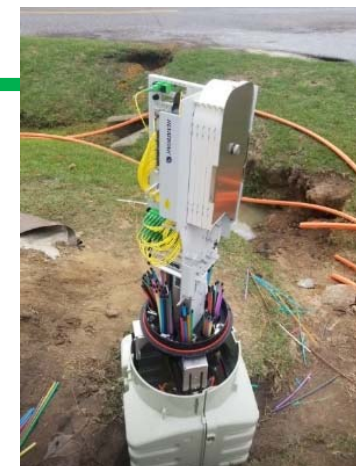
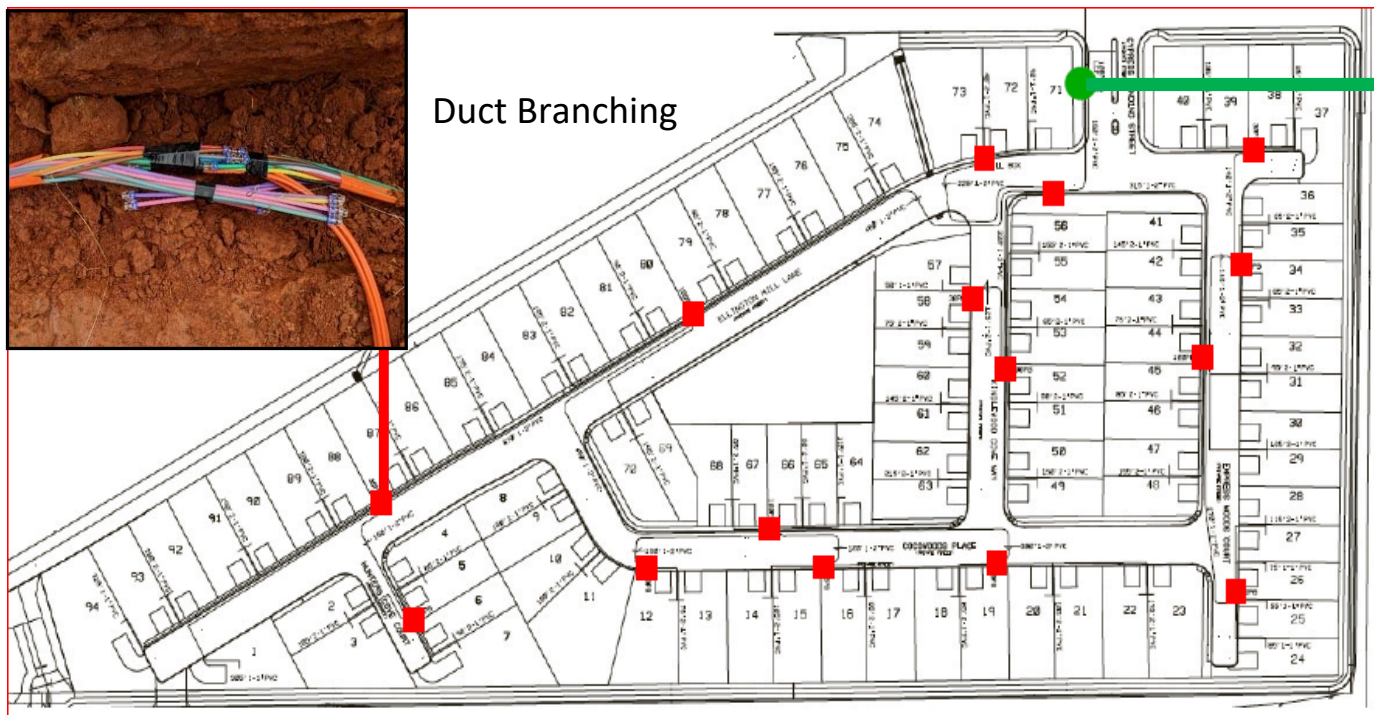


Ground installation



Indoor installation

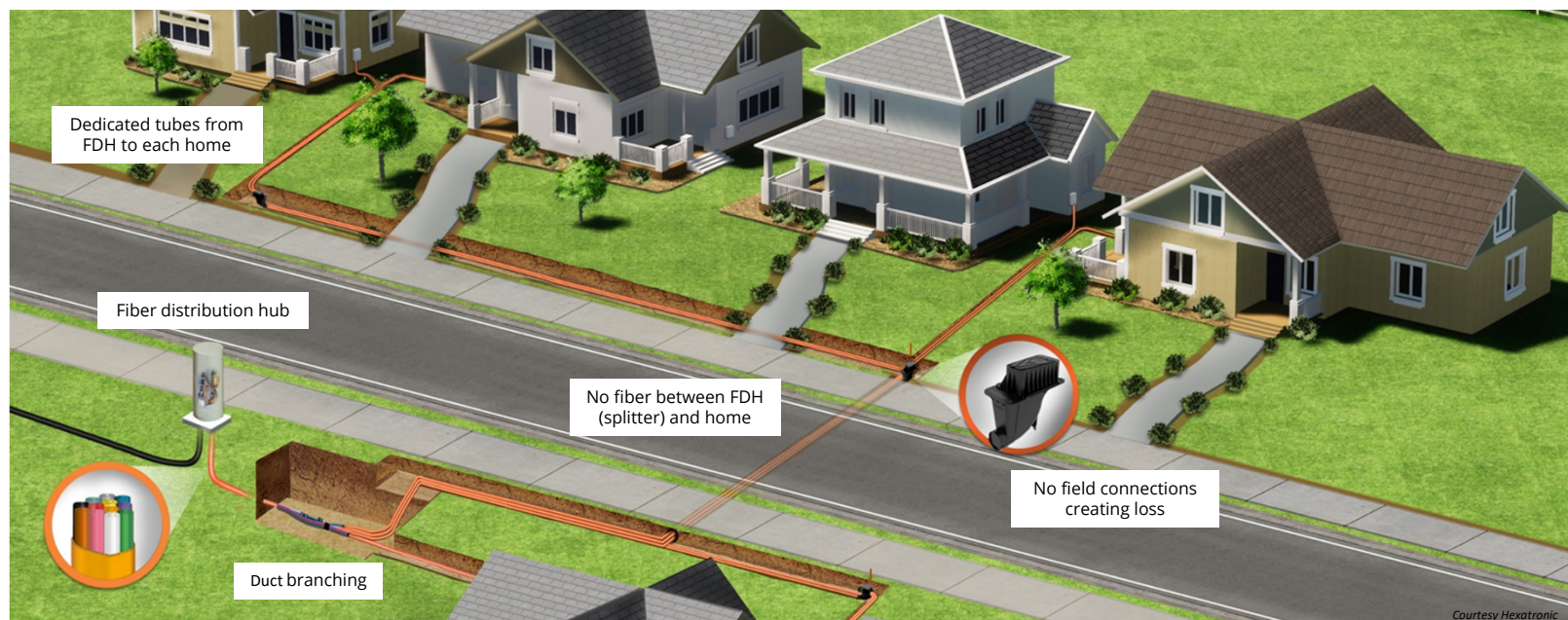
Elements of an ABF Installation



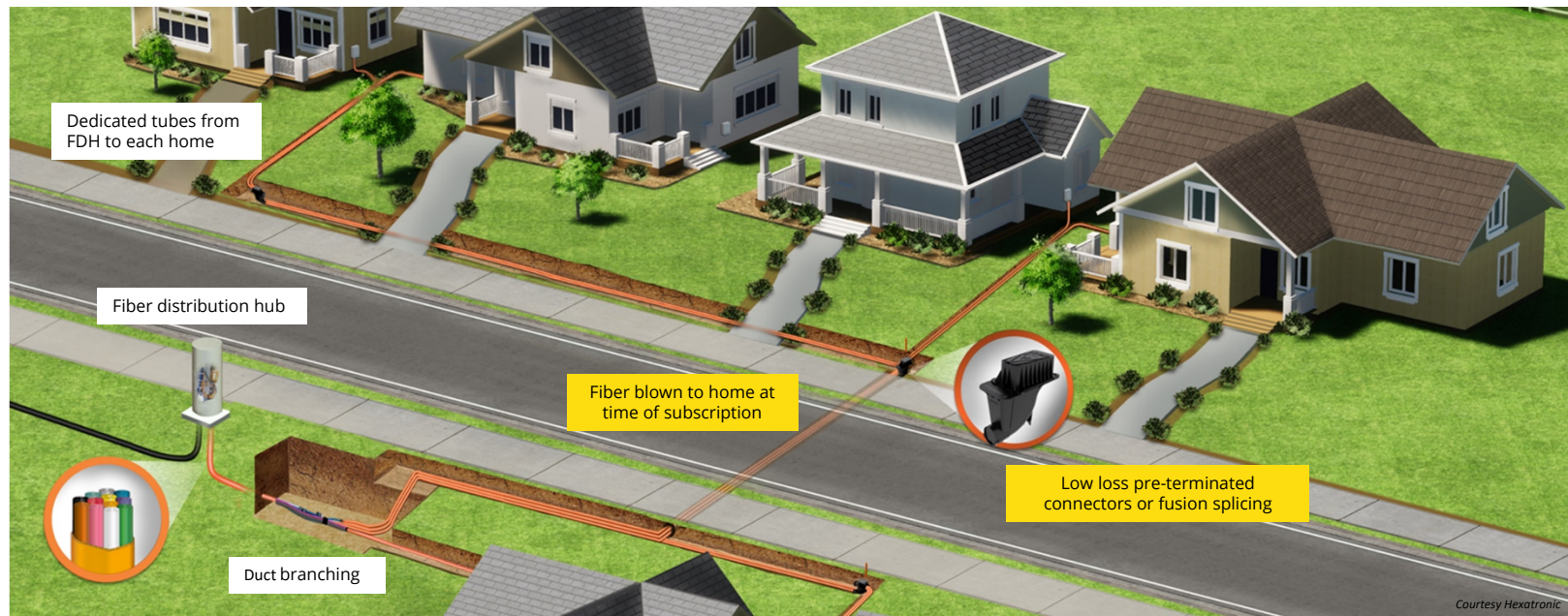
Fiber Distribution Hub

Courtesy Hexatronic

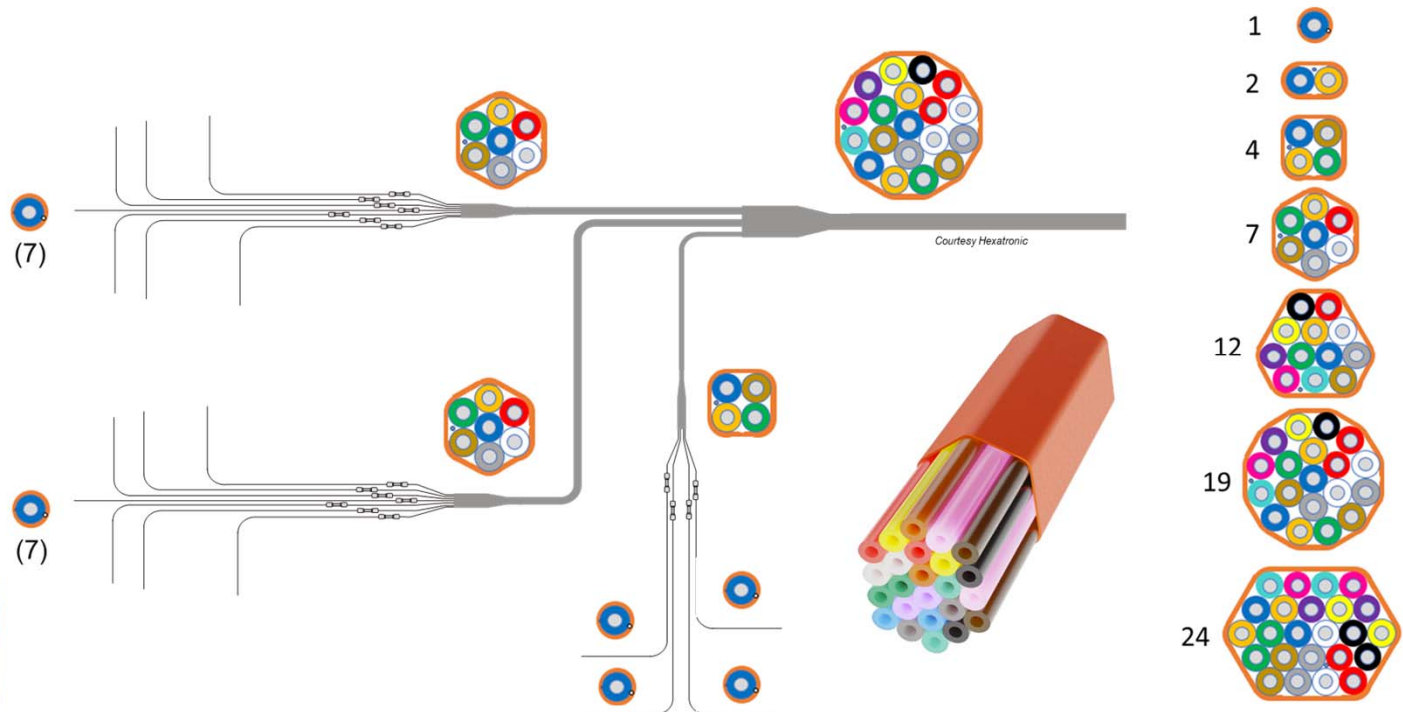
ABF - Homes Passed



ABF - Homes Connected



Microducts for Fiber Optic Cables



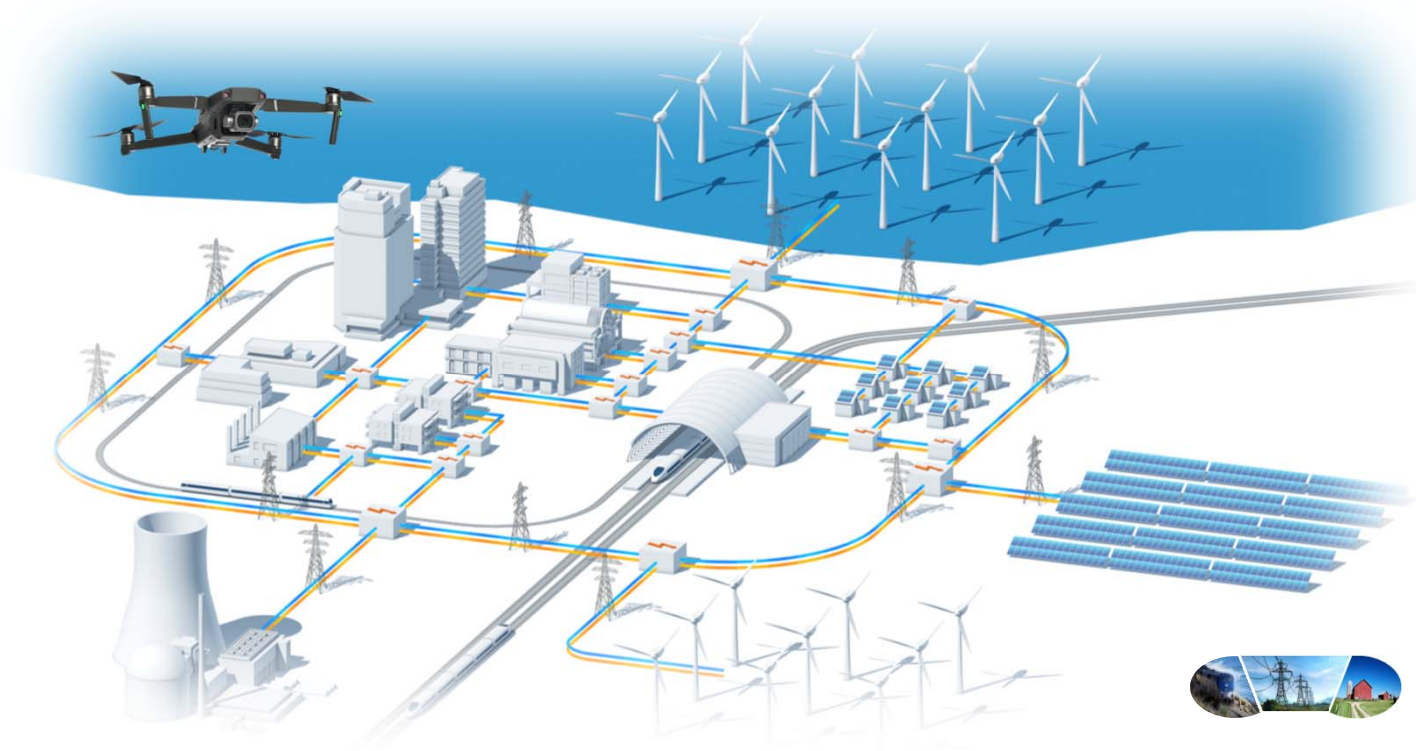
Microduct Cables

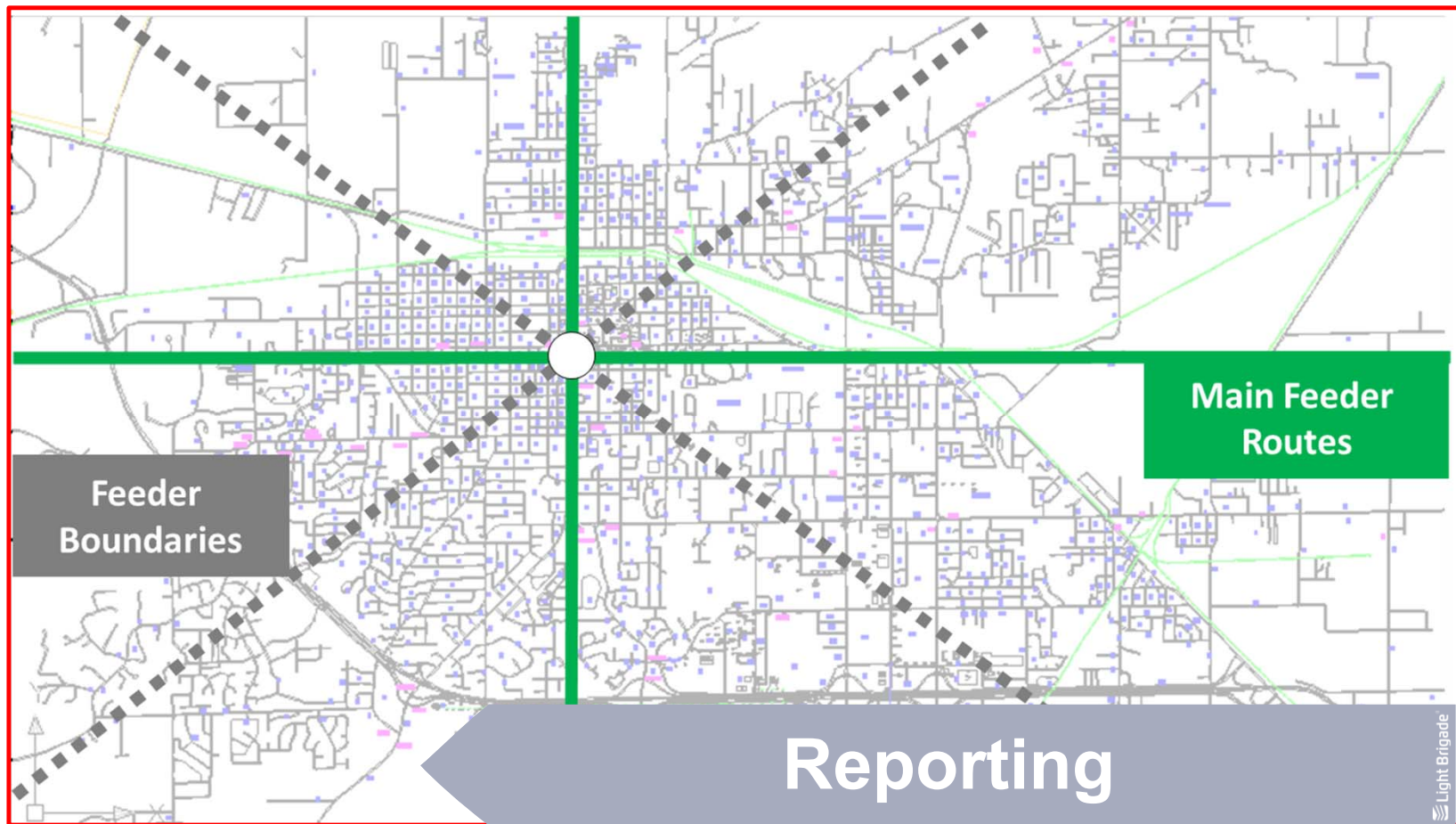


Courtesy Hexatronic

Utility/Co-op Smart Grid

- Communication
- Data Transfer
- Asset Monitoring
- Sensing
- FTTx/ISP
- Dark Fiber
- 5G
- Wireless





Importance of Reporting

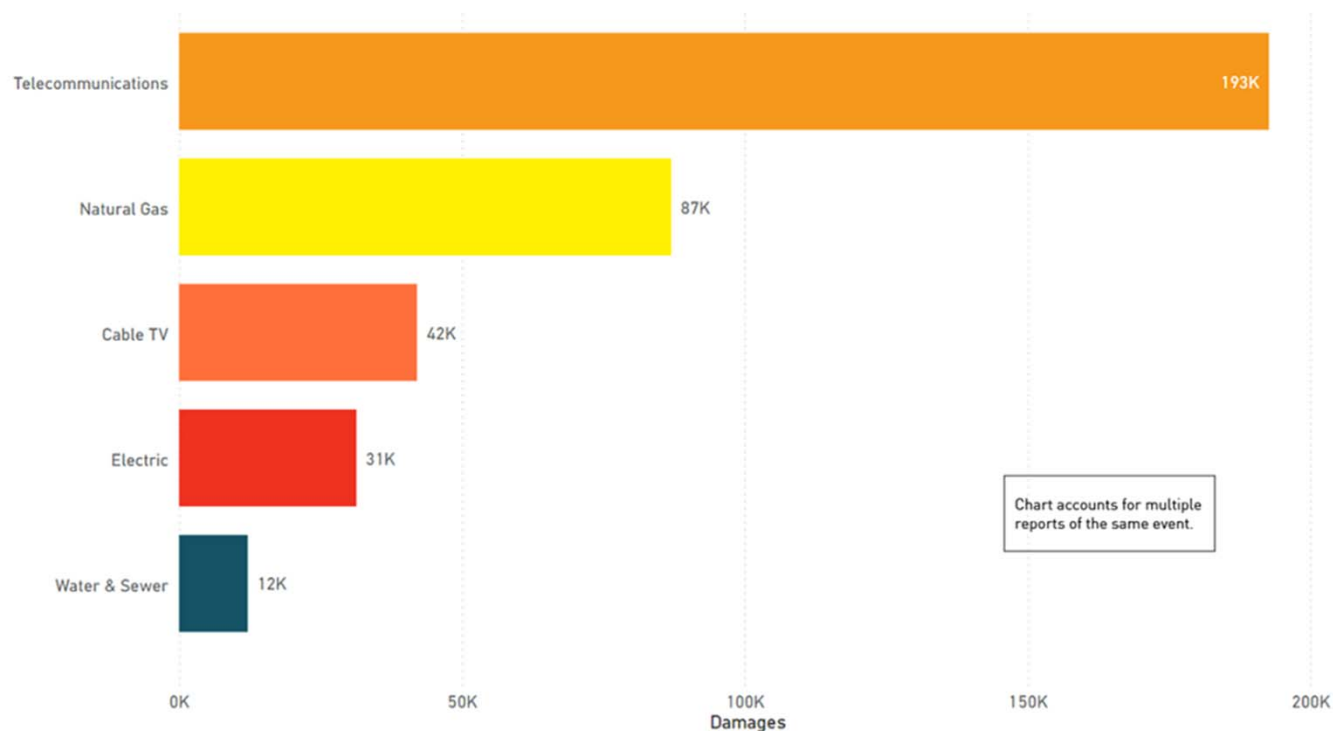


**Know what's below.
Call before you dig.**

- Telecommunications is the leading facility damaged of all utilities as the result of not calling or not abiding by locators?
- These damages are not always by another trade.
- One of the largest problems is the lack of self-reporting of where telecommunications lines are placed so 811 knows where to mark.
- Bottom line, we have a bad reputation for not reporting location information and not calling before we dig!
- Nobody wants to find rainbow roots!

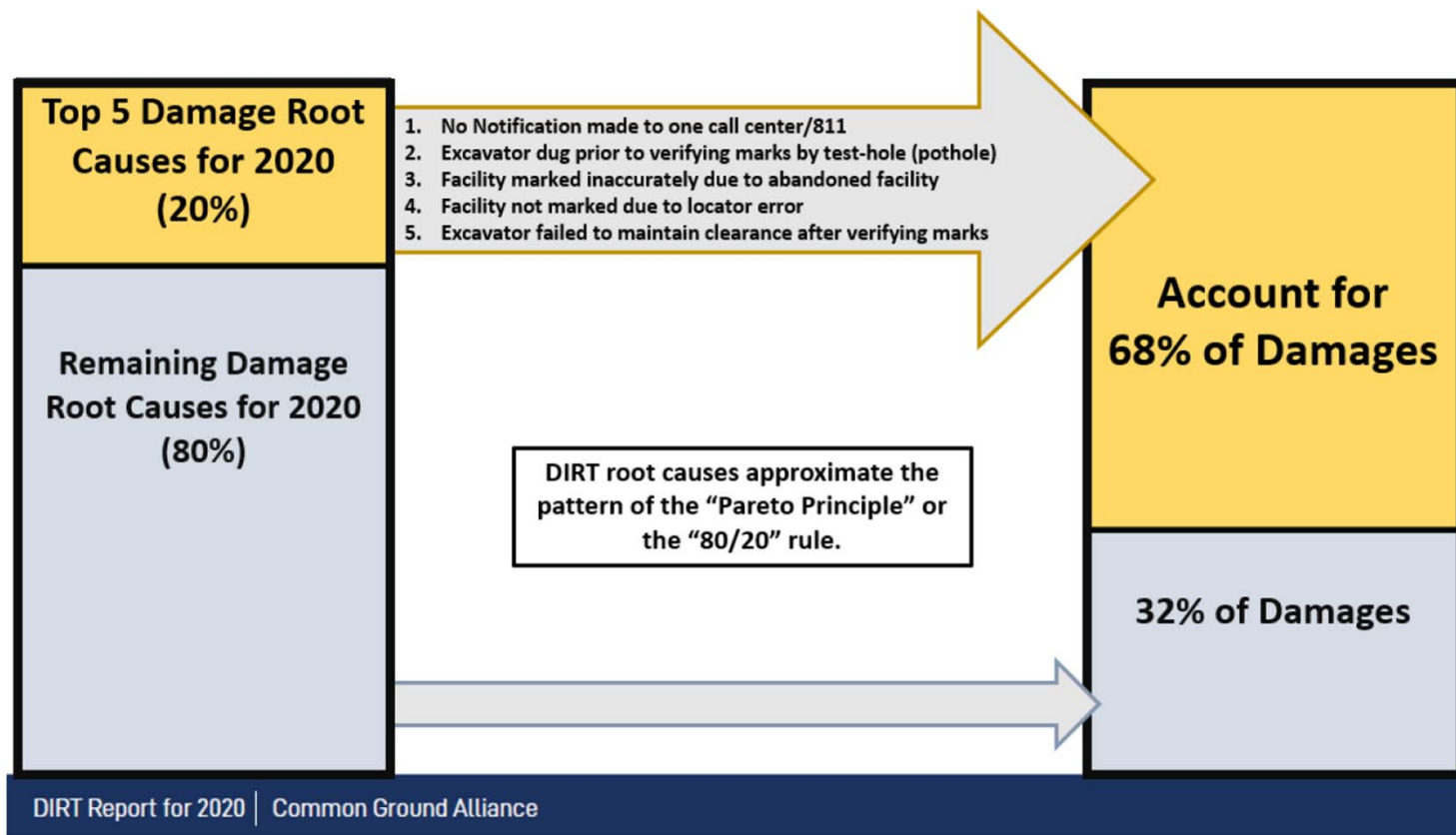
Importance of Reporting

Damages by Facility Operation



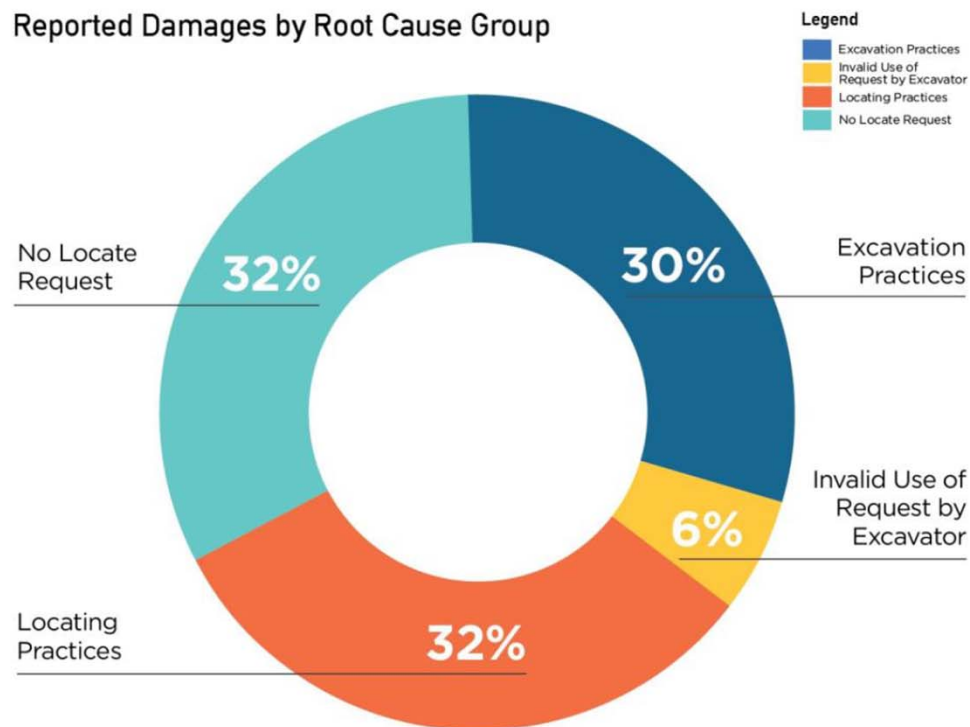
DIRT Report for 2020 | Common Ground Alliance

Underground Installation Techniques



Underground Installation Techniques

Reported Damages by Root Cause Group



Report what you lay to prevent others from digging it up.

Call for location identification before you dig something up.

Failure to do so can lead to extremely costly repairs

Q&A Discussion



Thank you for attending!

**Light Brigade®**
FIBER OPTIC TRAINING



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Scan the QR code and add me to your contacts.

¹ <https://www.marketresearchfuture.com/reports/fiber-optic-market-1169>

² <https://www.gsma.com/publicpolicy/wp-content/uploads/2018/03/The-5G-era-in-the-US.pdf>

³ https://www.wsj.com/articles/high-speed-internet-plan-worker-shortage-be83a843?st=mwp25ufj0kizz1k&reflink=desktopwebshare_permalink

⁴ <https://www.cablinginstall.com/design-install/article/14292878/bridging-the-digital-divide-faces-a-workforce-challenge>

⁵ https://cdn.baseplatform.io/files/base/ebm/isemag/document/2023/05/2305ISE_DE.646fa729c136a.pdf#page=42