

# Storm Hardening



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**Commonwealth Edison Company**

# Exelon Utilities

## **BGE** (Baltimore, MD)

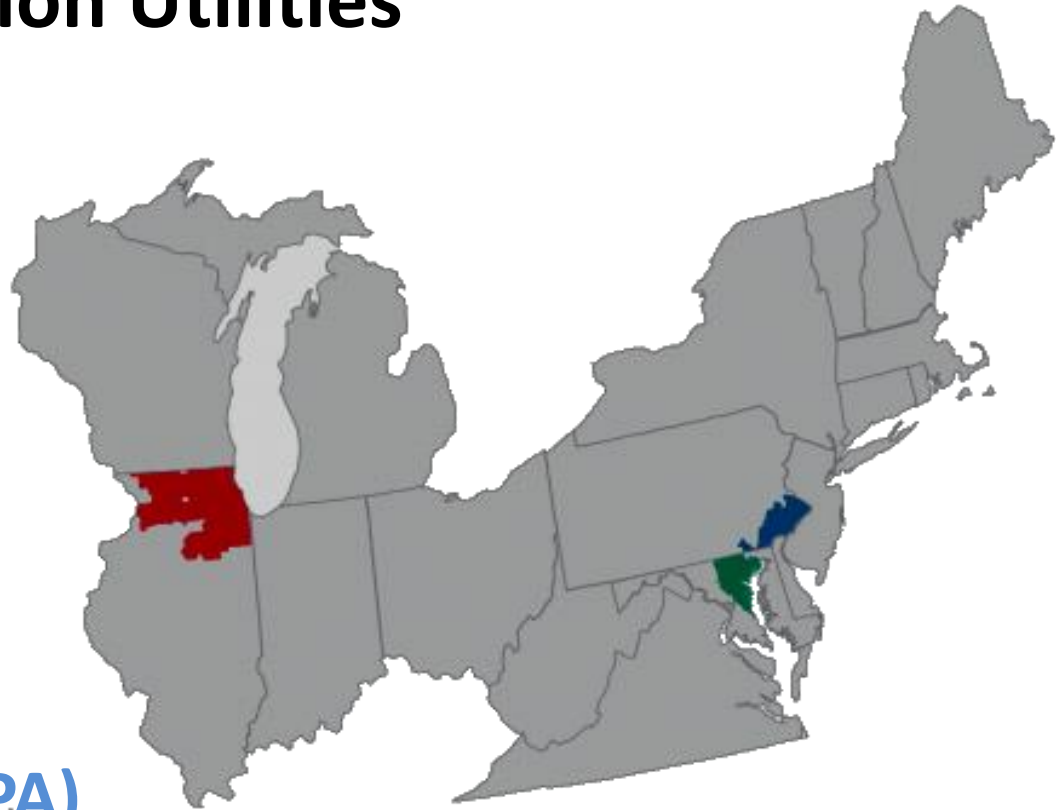
- 1.2 million electric customers
- 0.7 million gas customers
- Service Territory: 2,300 sq mi
- 15,600 miles of underground cable
- 7,236MW

## **ComEd** (Chicago, IL)

- 3.8 million electric customers
- Service Territory: 11,300 sq mi
- 29,700 miles of underground cable
- 23,753MW

## **PECO** (Philadelphia, PA)

- 1.6 million electric customers
- 0.5 million gas customers
- Service Territory: 2,100 sq mi
- 8,800 miles of underground cable
- 8,983MW



Exelon and Constellation completed their merger on March 12, 2012.

We are one of the largest integrated energy provider in the United States.

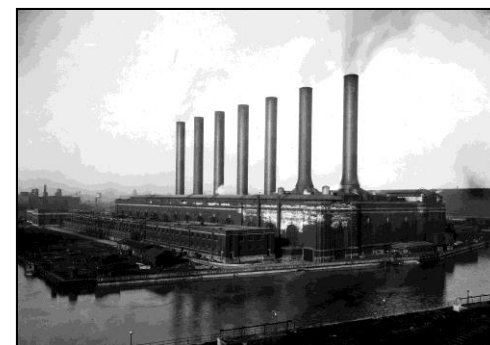
6.6 million electric customers

# Energy Infrastructure Modernization Act (EIMA)

- In October 2011, the Illinois General Assembly enacted the Energy Infrastructure Modernization Act (EIMA).
- This industry leading legislation was designed to addresses:
  - Regulatory reform
  - Infrastructure modernization
  - Smart Grid investment
  - Reliability performance metrics

# Regulatory Reform - The Case For Change

- The prior regulatory model was developed by ComEd's founder Sam Insull.
  - 100 years ago...
- Rate case outcomes have been unpredictable and inadequate.
  - 1982, 82% recovery.
  - 1987, 17%.
  - 2005, 23%.
  - 2007, 76%



**No business could commit to modernization investments if it only recovered 17% of those costs!**

# Infrastructure Investment Work

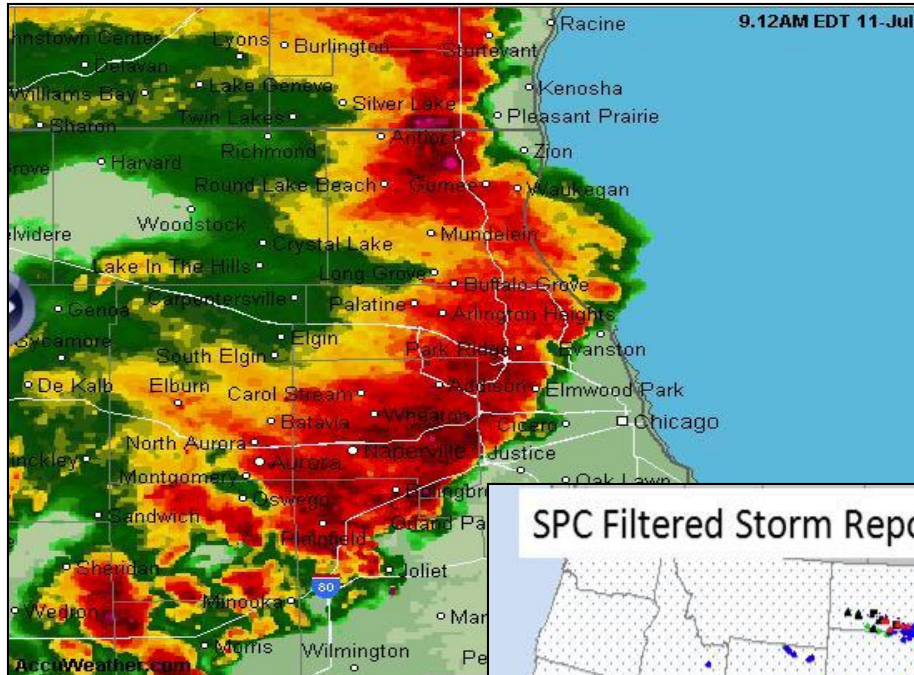
- \$1.3B in infrastructure upgrades:
  - URD Cable
  - Mainline Underground Cable System
  - 69kV Transmission Cable
  - Wood Poles
  - Storm Hardening (\$200M)
  - Training Facility Upgrades
- \$1.3B in smart grid upgrades:
  - Distribution Automation
  - Substation Micro-processor Relays
  - Advanced Metering Infrastructure (AMI)
  - Cyber-secure Data Communications



**Objective is to improve system performance through accelerated investment in programs that address aging distribution infrastructure, storm hardening and expand smart grid technology.**

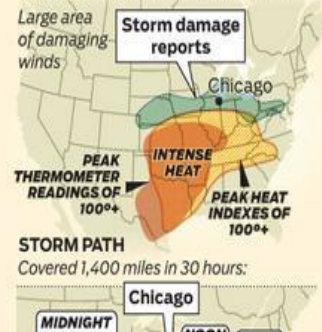


# July 2011 Derecho



**640+ wind damage reports over 30 hours across a 1,400 mile swath**

**Monday's storms**  
DAMAGING THUNDERSTORMS ERUPT ON PERIPHERY OF INTENSE HEAT



**1,400-MILE DERECHO**  
A widespread, long-lived windstorm associated with a band of rapidly moving thunderstorms

**HURRICANE-FORCE GUSTS IN THE CHICAGO AREA**

Michigan City, Ind.	85 mph
Mishawaka, Ind.	81 mph
Rockford	80 mph
New Holland, Mich.	80 mph
Chicago Academy	76 mph
Chicago Crib	73 mph
Mundelein	72 mph
Evergreen Park	72 mph
Chicago	70 mph
Chicago	70 mph
Chicago	65 mph
Chicago	65 mph
Chicago	60 mph
Chicago	60 mph

**WHY SUCH STRONG, FAST-MOVING THUNDERSTORMS?**

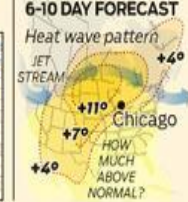


**Wednesday**

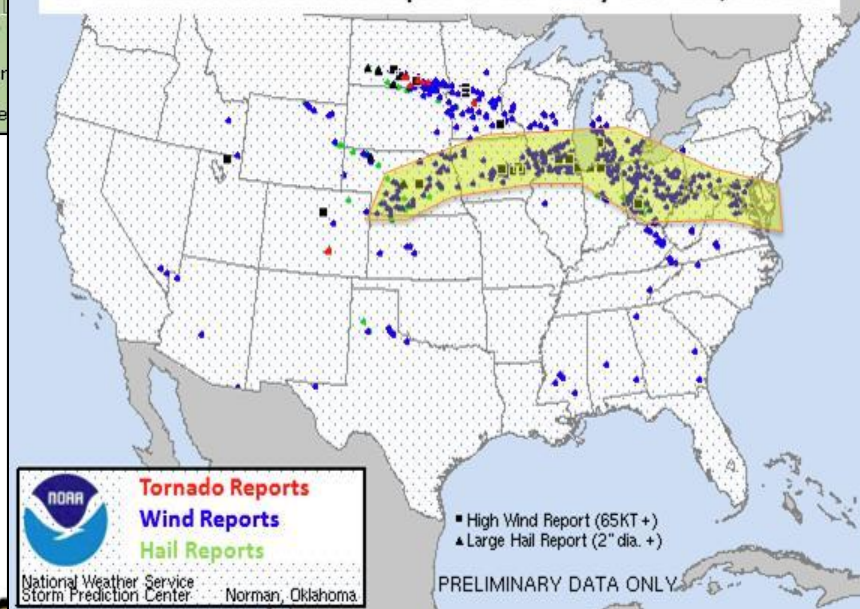
**COOLEST DAY OF COMING WEEK**



**Longer range**



## SPC Filtered Storm Reports for July 10-11, 2011



**NORA** Tornado Reports  
Wind Reports  
Hail Reports

National Weather Service  
Storm Prediction Center  
Norman, Oklahoma

**~900,000 customers affected**



# July 2011 Derecho



# Storm Hardening

- Aimed at reducing the susceptibility of certain circuits to storm-related damage, including:
  - High winds
  - Thunderstorms
  - Ice storms
- Improvements may include:
  - Overhead to underground conversion
  - Installation of tree & wildlife resistant spacer cable
  - Enhanced vegetation management or removal
  - Other engineered Solutions
    - Fuses/TripSaver
    - Automation



## Storm Hardening – Criteria

- Prioritize the selection of circuits based on each circuit's historical susceptibility to storm-related damage and the ability to provide the greatest customer benefit upon completion of the improvements.

Does **NOT** make circuits **immune to future damage** from storms or other sources

# Storm Hardening – Criteria

## 4/12kV Mainline Circuits

- Circuits are prioritized based on their Reliability Score , Vegetation Score, and Customers Served.
- **Reliability Score factors in:**
  - Weighted average of the overhead circuit SAIFI (4 year)
  - Weighted average of the vegetation related circuit SAIFI (4 year)
  - Number of spans with multiple splices per overhead mile
  - Customers served
- **Vegetation Score factors in:**
  - Weighted average of the vegetation related circuit SAIFI (4 year)
  - Customers served
  - Recent reliability has higher weighted impact
- Circuits must meet the certain gates to qualify for storm hardening
  - Engineering solutions:
    - Vegetation Gate for Underground Conversion or Spacer Cable = Vegetation related SAIFI of 1.00 or greater for three or more years in the past four years
    - CAIDI Gate = CAIDI > 300 minutes based on the past four years average
  - Vegetation Trimming Only
    - Vegetation Gate for Enhanced Tree Trimming = Vegetation related SAIFI of 0.75 or greater for two or more years in the past four years
    - CAIDI Gate = CAIDI > 300 minutes based on the past four years average

# Storm Hardening – Criteria

## Fused Taps

- Fused Taps prioritized based on Reliability Score and Average Customer Interruptions per Outage
- **Reliability Score factors in:**
  - Weighted average of the number of overhead outages (4 year)
  - Weighted average of the number of vegetation related outages (4 year)
  - Average customer interrupted per outage (4 year)
- Recent reliability has higher weighted impact
- Fuse Tap Storm Hardening will be completed on all fuse taps that meet the certain gates
  - Vegetation Gate = 1 or more vegetation related outages for two or more years in the past four years
  - CAIDI Gate = CAIDI > 300 minutes based on the past four years average



# Storm Hardening –

## Evolution from Identification to Construction

- Reliability Reporting group creates candidate lists.
- Regional Reliability Engineering reviews lists for engineering solutions.
- Centralized Reliability Programs group performs challenge sessions
- Design Engineering and/or Engineering Contractors create the designs.
- ComEd and/or Contractors perform the construction.
- Projects and Contracts group has oversight of the execution of the construction.

# Engineering Solutions

- TripSaver:
  - Transient fault protection
  - Cutout mounted recloser resets itself and avoids sustained outage due to trees and wildlife.
- Spacer cable:
  - Overhead installation of covered primary wire that can withstand tree branches and wildlife contact.
- Undergrounding:
  - Replacing overhead primary with mainline cable.
  - Replacing overhead primary behind fused taps with URD primary and reconnecting to existing secondary on the poles through pedestals.





# Engineering Solutions

- Spacer cable



*(Sleepy Hollow)*

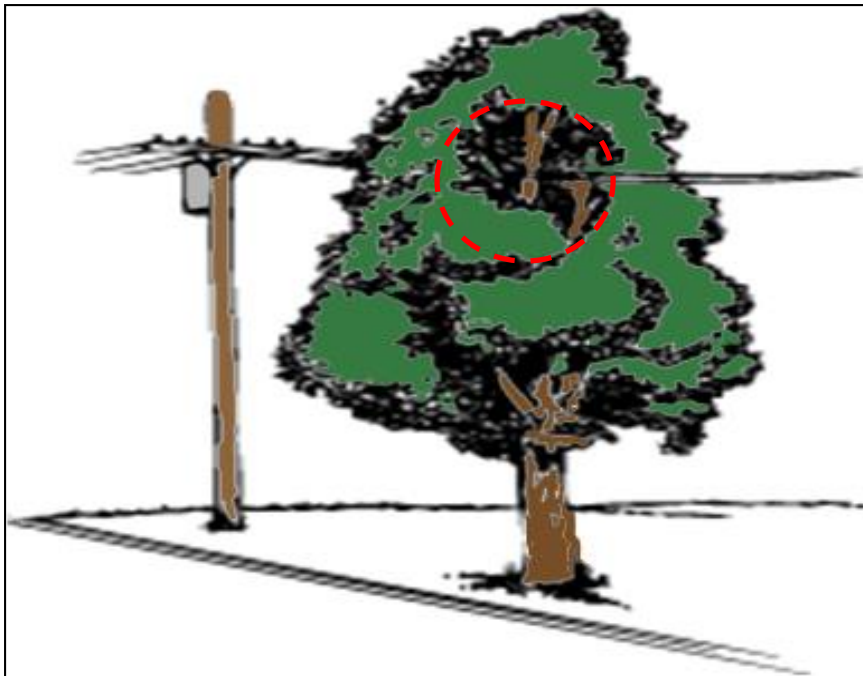


*(Mt. Prospect)*

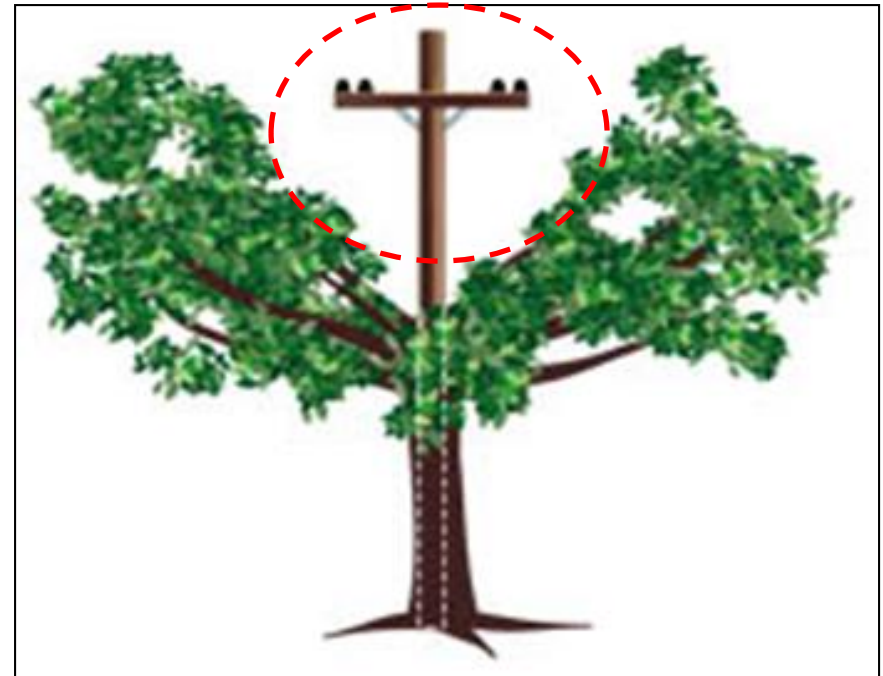


# Enhanced Vegetation Trimming

- Expanded trim
  - Includes pulling overhang and pruning of remaining trees



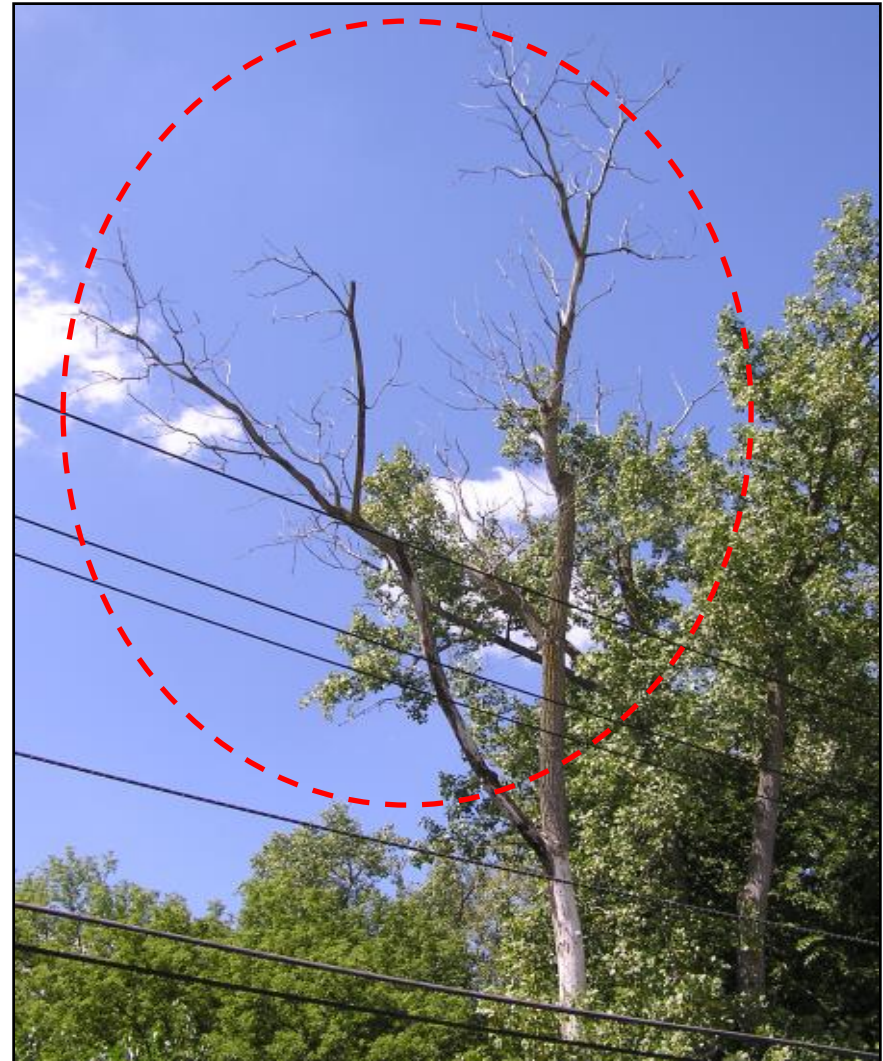
Standard - Key-hole trim



Enhanced - No overhang trim

# Enhanced Vegetation Trimming

- Targeted trimming and removal of dead/ dying trees





# Enhanced Vegetation Trimming – Before & After

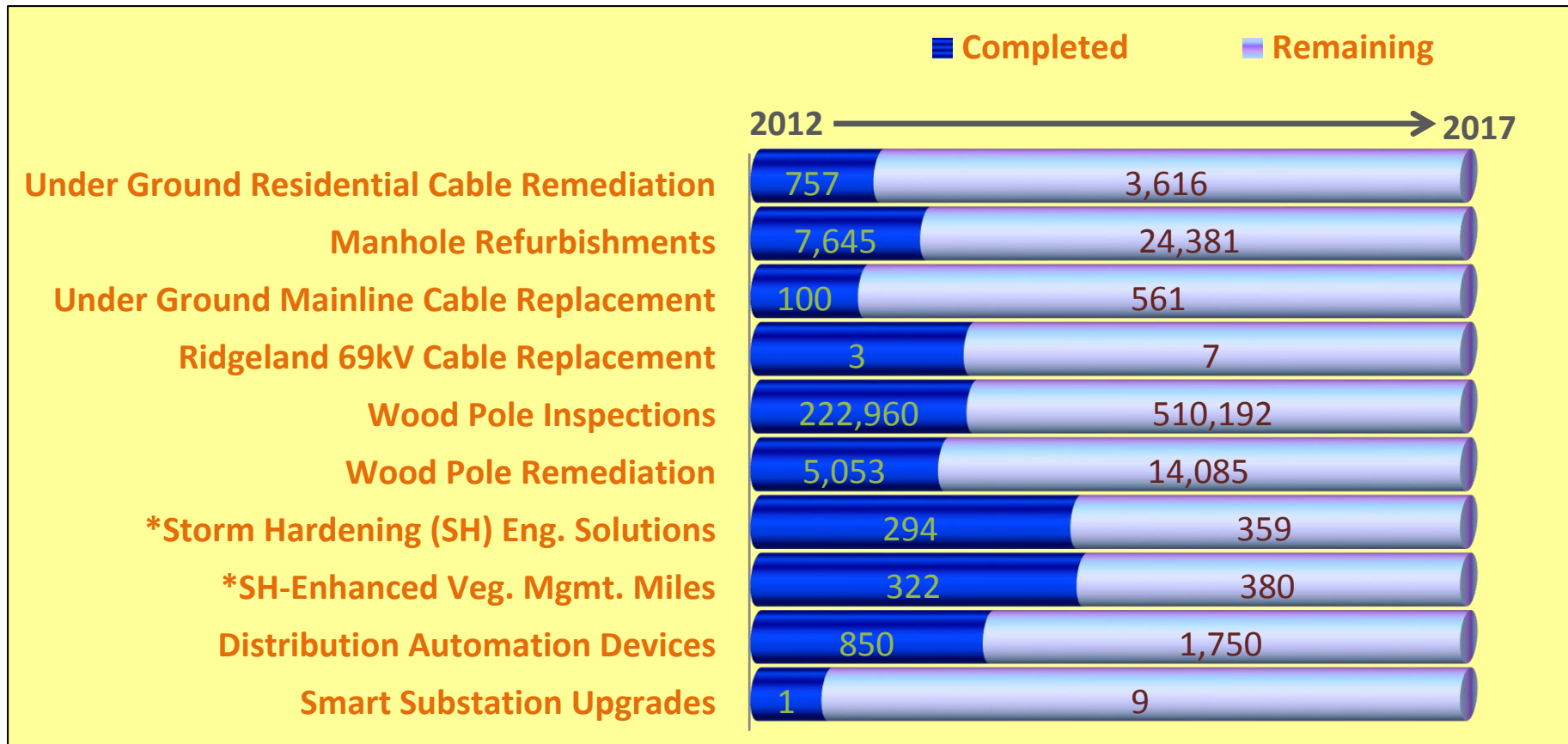




# Challenges

- Rear lot construction...
  - Equipment access
- Customer easements...
  - Rights

# EIMA - Grid Infrastructure Programs



*Over 600,000 customers are benefiting from work already completed*