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**Electricity & Trees:  
Not Perfect Together  
or  
Why Utilities Do What They Do**



# DISCLAIMER

Opinions expressed by the presenter are strictly that of my own opinion based on over 11 years in municipal work; 25 years in utility work and a few years of consulting in the private/commercial industry. Any such opinions are not to be construed as supportive, argumentative or insulting to any utility company, which in some cases may be viewed as justified. Nor do statements I make reflect current policies of utility companies.

**IN SPITE OF US - TREES ARE  
RESILIENT**











# BASIC COMPONENTS OF THE ELECTRICAL SYSTEM

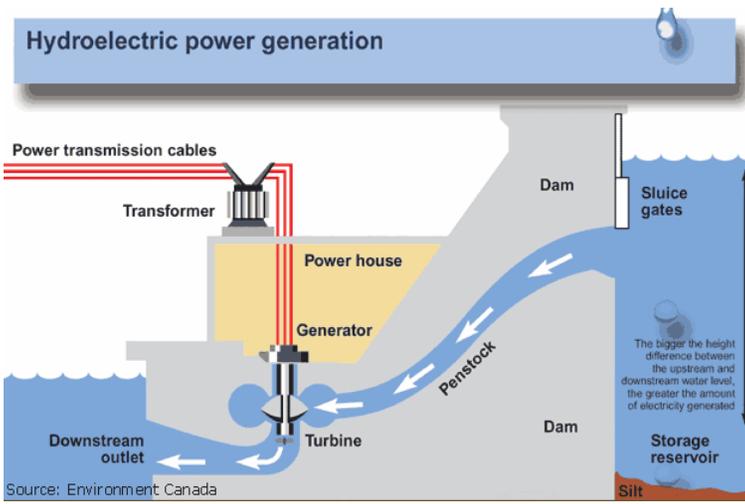
GENERATION

TRANSMISSION

DISTRIBUTION

OVERHEAD

UNDERGROUND





# How Electricity Works

## A typical Distribution System

### *The Tie Station....*

Large power transformers at the tie station step ultra high transmission voltages down to very high sub-transmission voltage levels (44kV-100 kV)







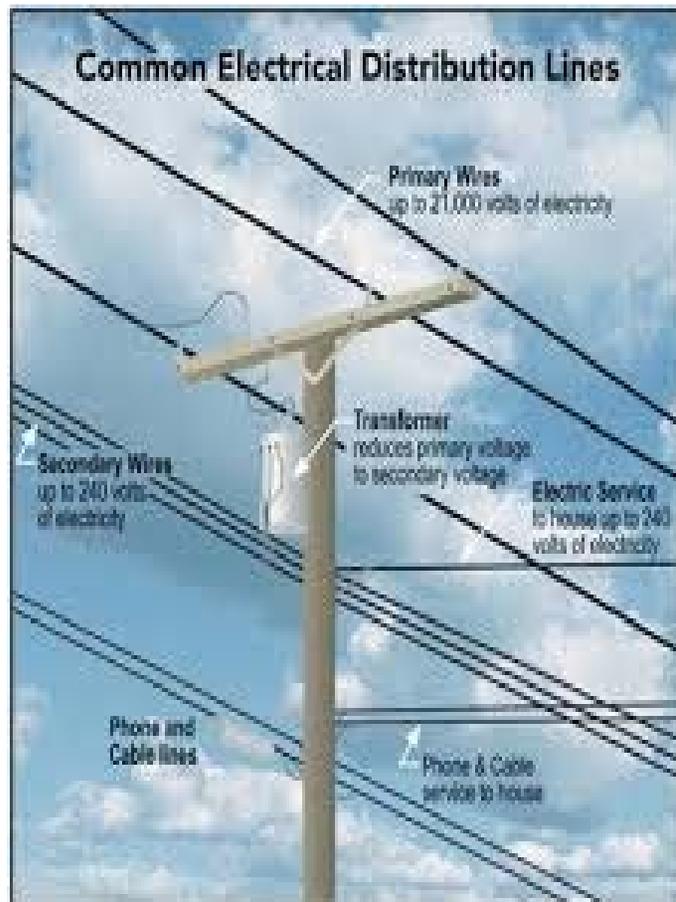


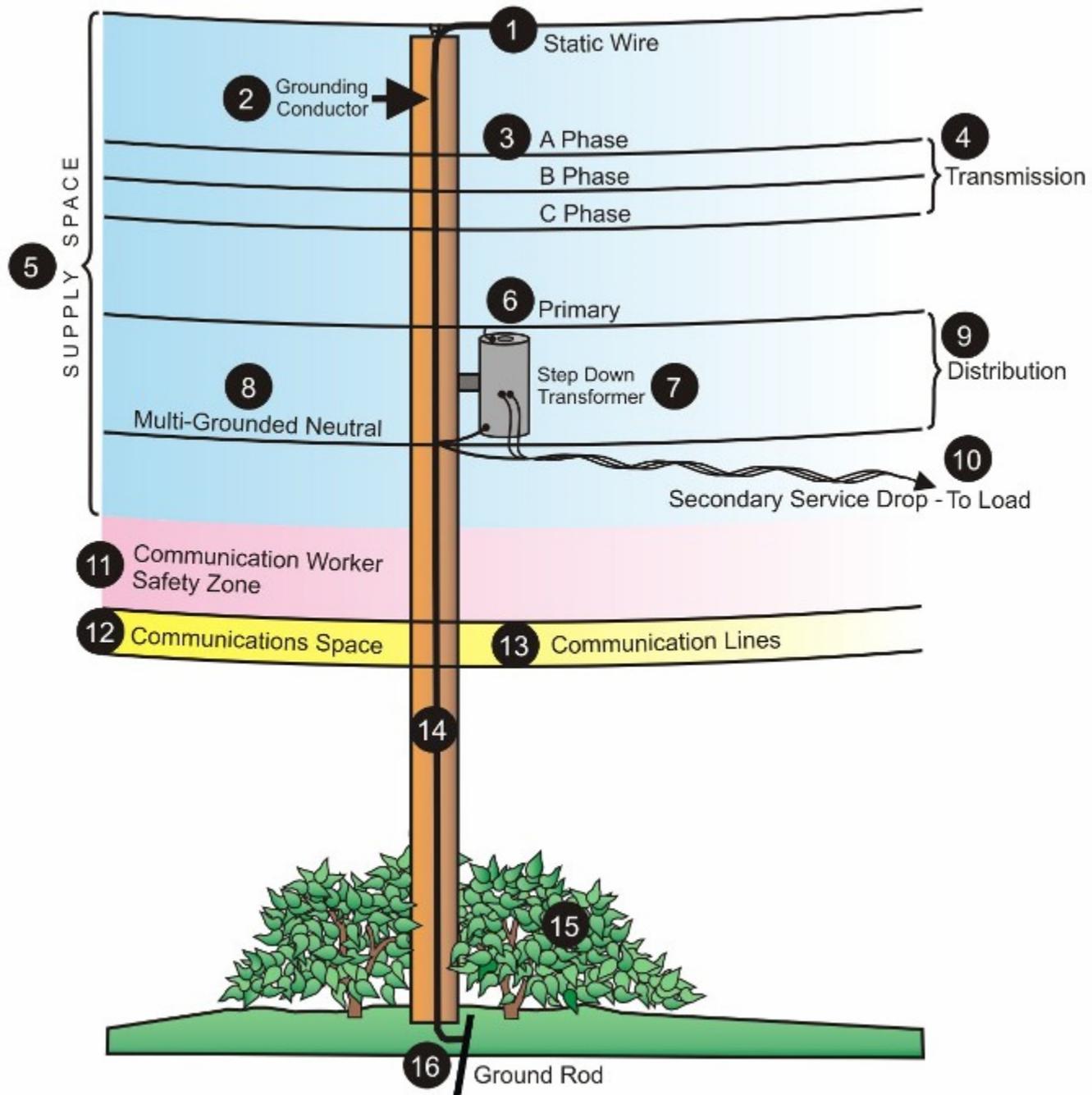
# Identifying Electrical System Components



**Service Drop**

## Common Electrical Distribution Lines







# PRIMARY CIRCUIT CONSTRUCTION

Primaries:

Single phase

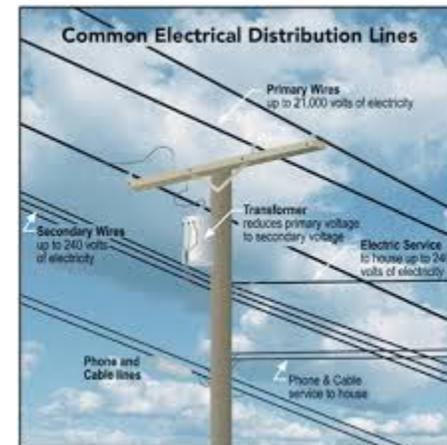
Two phase

Three phase

Spacer cable



# PRIMARY, TRANSFORMER, SECONDARIES







<https://www.youtube.com/watch?v=KwnEOUEYWZM>

# Roots Follow Sidewalk Pavers



# SAFETY IS PARAMOUNT TO THE ELECTRICAL SYSTEM

- SILENT KILLER
- TRAVELS AT THE SPEED OF LIGHT
- NORMALLY, YOU CANNOT SEE IT
- HOW DO YOU KNOW IF IT IS ENERGIZED?

# SAFETY

- CONDUCTORS
  - Aluminum
  - Copper
  - Most metals
  - Carbon
  - water
- INSULATORS
  - Pure rubber
  - Fiberglass

# SAFETY

- ONE OTHER CONDUCTOR:
  - The human body
  - Electricity wants to get to the earth
  - Human bodies will display an entrance wound and an exit wound where the electrical energy goes to the ground

# ELECTRICAL BURN VICTIMS



# SAFETY

DIRECT VS INDIRECT CONTACT

Is one any less severe than the  
other?

# SAFETY

- UTILITIES REQUIRE USE OF PROPER SAFETY EQUIPMENT
  - Rubber goods: gloves, sleeves and boots
  - Flame retardant, 100% cotton clothing
  - Buckles and snaps are non-conductive
  - Of course eye and head protection (ear protection when required)
  - Footwear

# SAFETY

- PLAYTEX GLOVES ARE CONDUCTIVE
- FIRE DEPARTMENT BOOTS ARE CONDUCTIVE
- BUCKET TRUCKS CAN BE CONDUCTIVE
- AERIAL RESCUE
  - Where is your clean rope?
  - Do you know what to do in the event of an emergency?





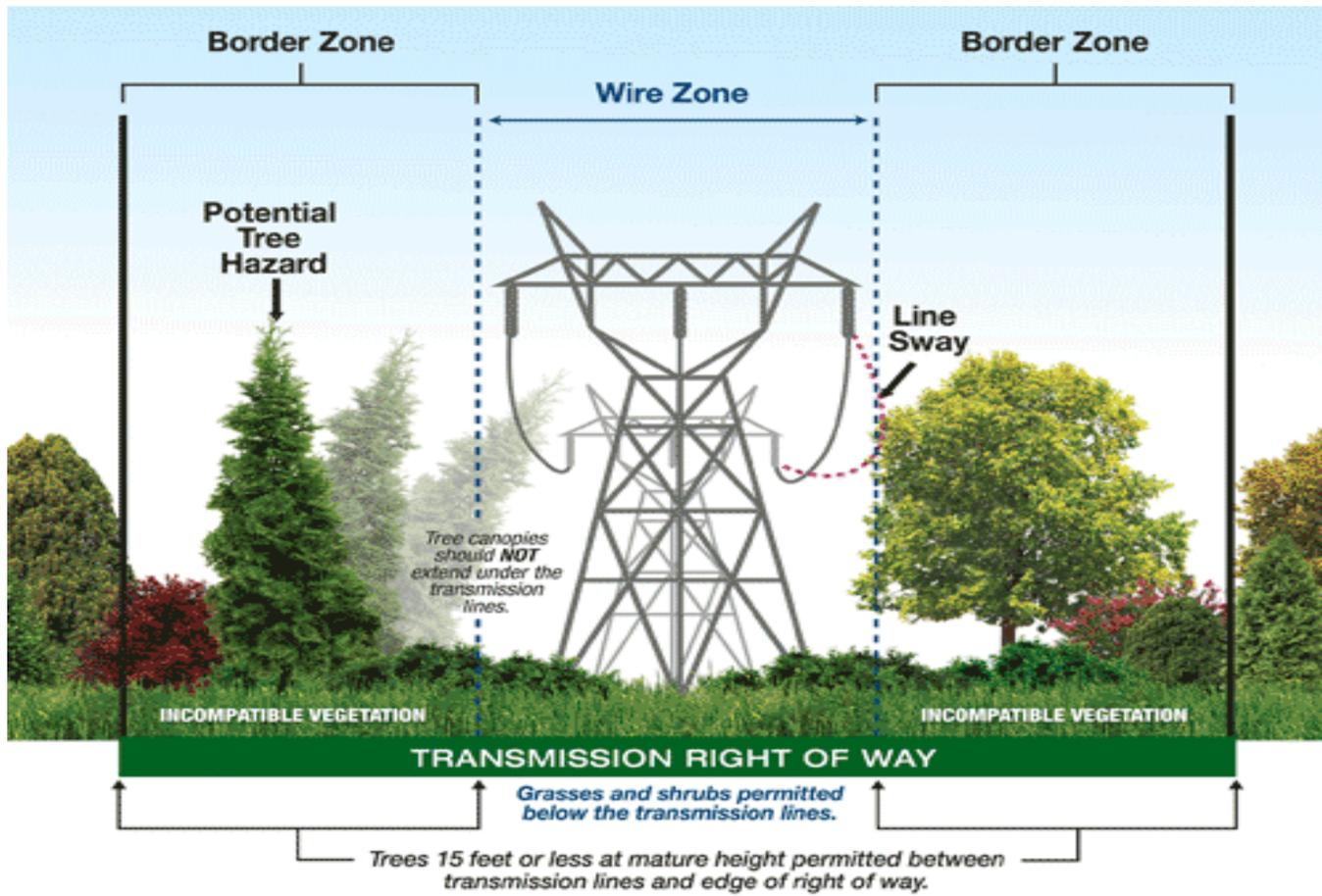
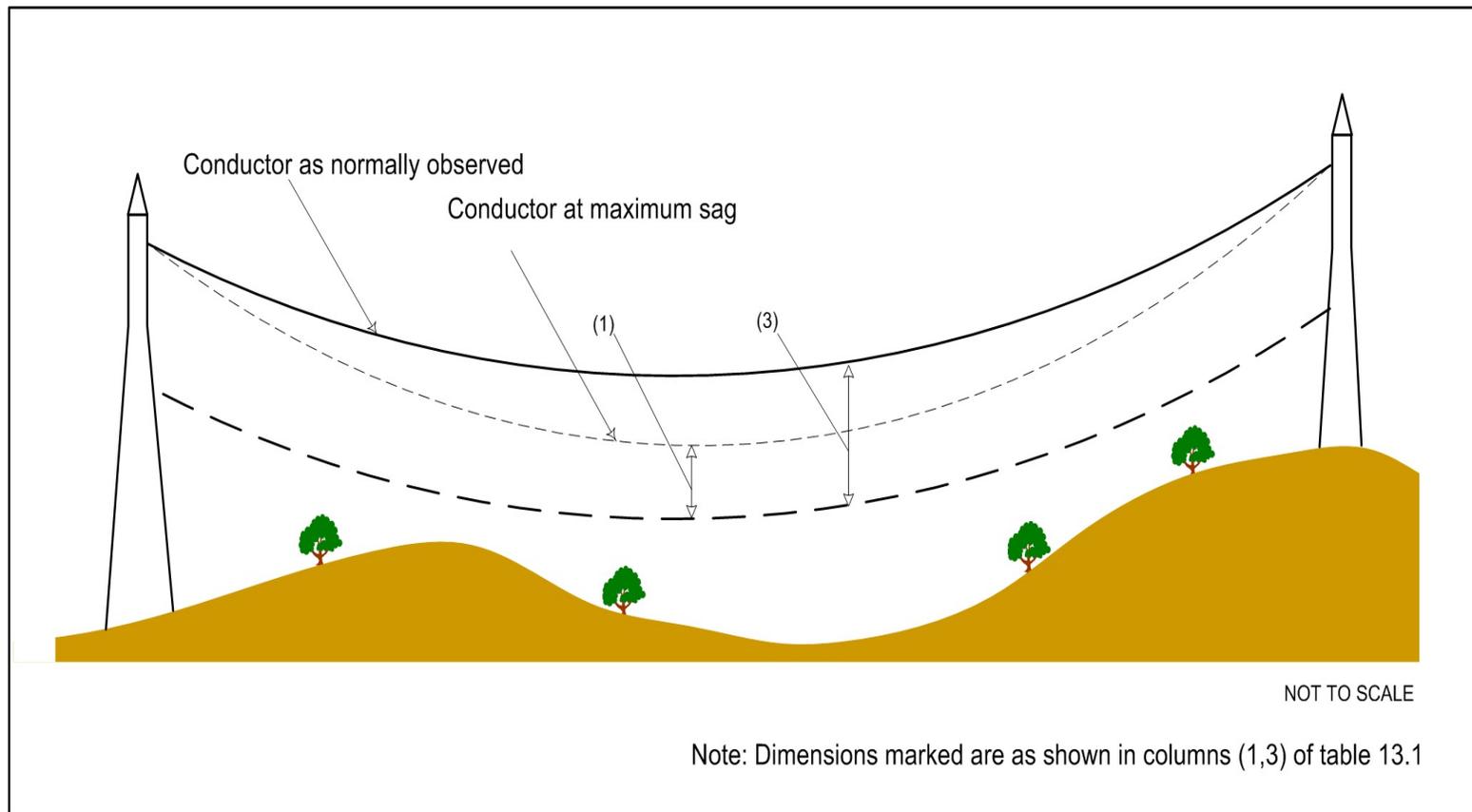
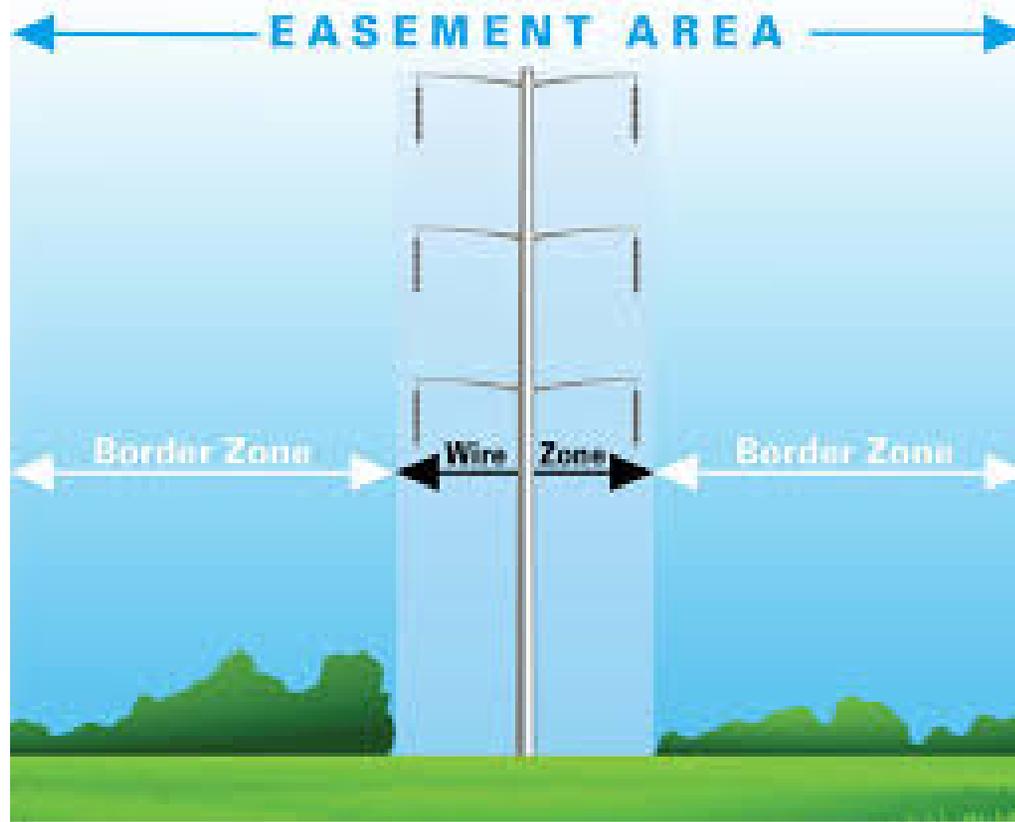


Figure 13.2: SIDE VIEW OF THE TRANSMISSION LINE







# RELIABILITY

TREES HAVE BEEN GETTING THE BAD RAP IN THE UTILITIES EYES FOR MANY YEARS

- some of these are justified;
- many are not.

LET'S DO A QUICK HISTORICAL REVIEW TO FULLY GRASP WHAT DROVE ACTIVITIES IN THE WORLD TODAY

# RELIABILITY

- An un-named utility had:
  - A cable (underground) Transmission failure feeding the Jersey Shore;
  - It was a hot July weekend
  - Affected the shore communities
    - Vacationers
    - Boardwalk concessions
    - Restaurant businesses

# RELIABILITY

ANOTHER NJ UTILITY HAD THEIR TURN IN THE HOTSEAT:

- Labor Day weekend, 1998
- Microburst hit the Central part of the state
- There was enough physical plant damage that resulted in the last customers being restored about 5 days after the storm

# RELIABILITY

- THESE 2 EVENTS CAUSED THE NJBPU, TO FORMALLY ANNOUNCE THEY WERE GOING TO INSTITUTE RELIABILITY STANDARDS FOR THE UTILITIES IN THE STATE.
- VEGETATION MANAGEMENT MANDATE WAS PUT TOGETHER BY THE BPU

# RELIABILITY

## VEGETATION MANDATE

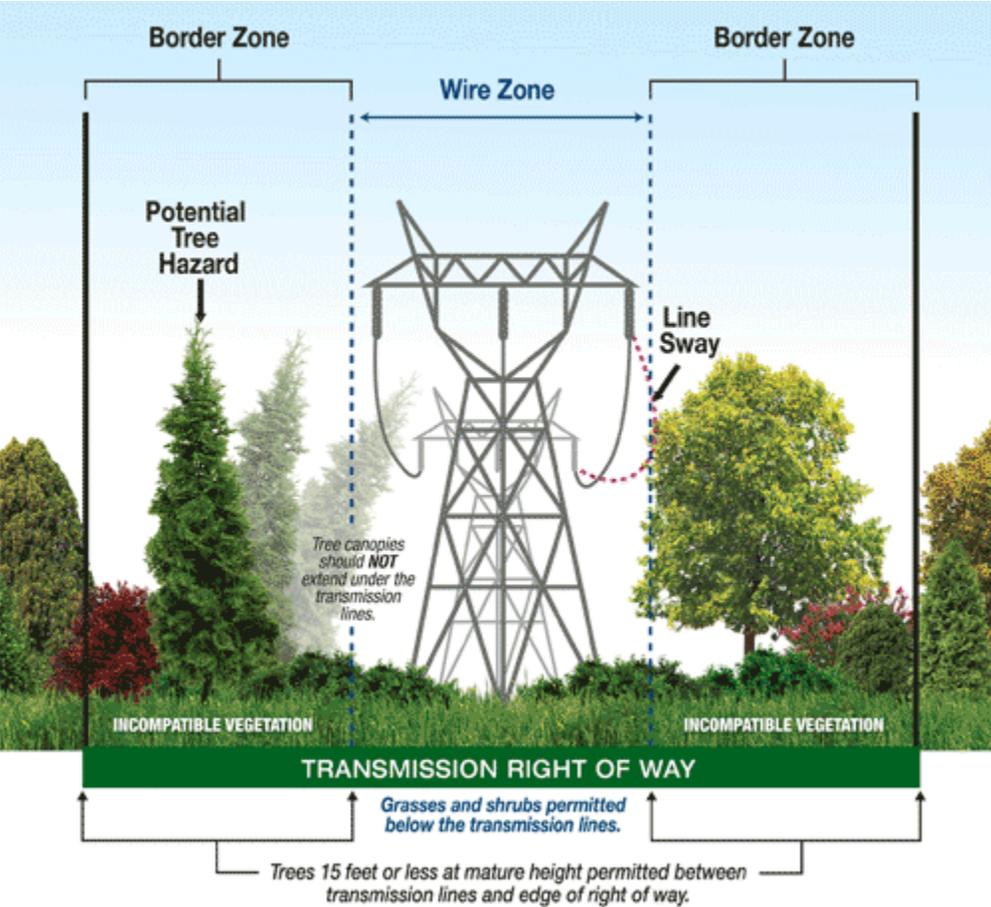
- INSPECT AND TRIM, IF NECESSARY
- RECORD KEEPING
- ORIGINAL VERSION HAD MIXED UP TRANSMISSION AND DISTRIBUTION VEGETATION MANAGEMENT PRACTICES
  - It was somewhat worked out

# RELIABILITY

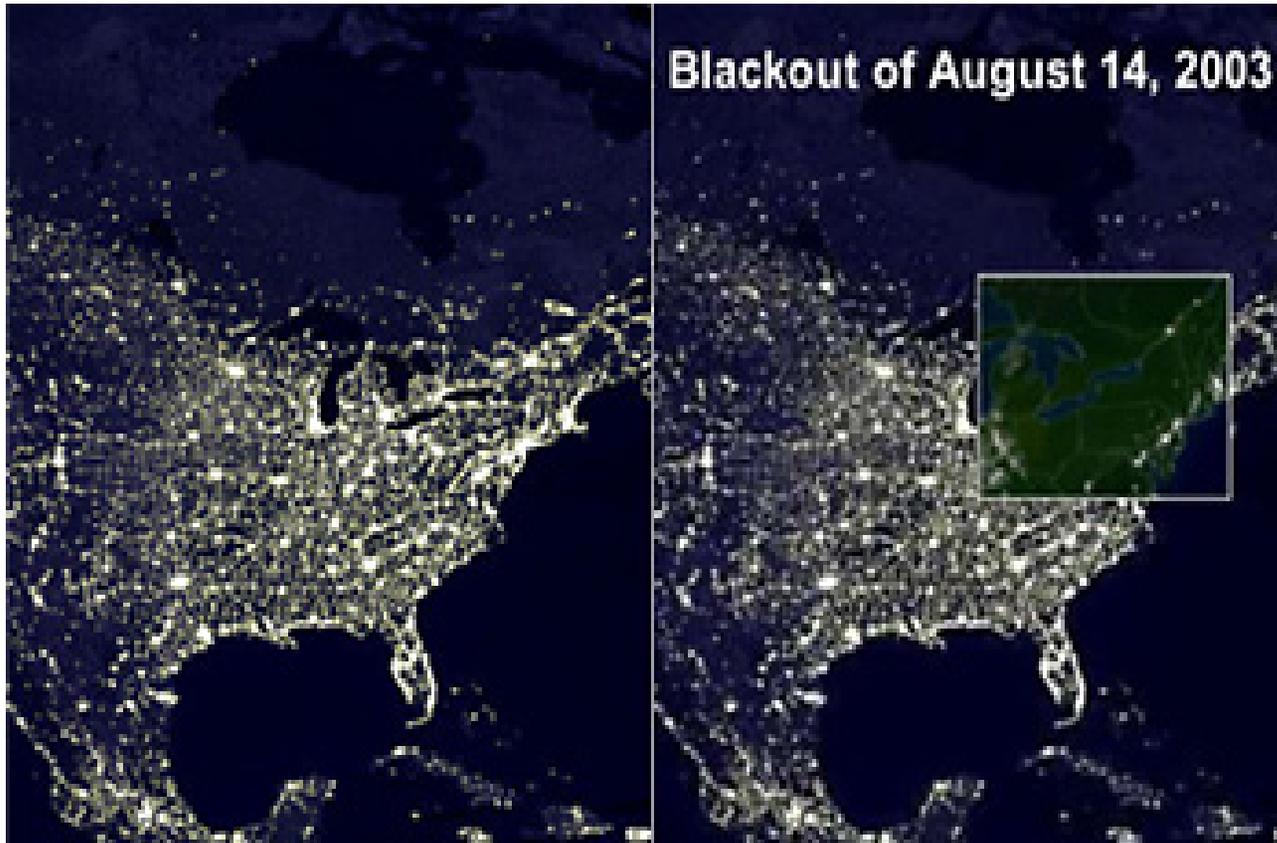
- DISTRIBUTION
  - NOTIFICATION TO CUSTOMERS
  - NOTIFICATION TO MUNICIPALITIES
  - PUBLIC NOTICES
  - RECORD KEEPING OF NOTIFICATION AND RECORD KEEPING OF DATES OF INSPECTION AND WHEN THE CIRCUIT WAS TRIMMED

# RELIABILITY

- TRANSMISSION
  - INSPECT AND TRIM ONCE EVERY 4 YEARS (actually this was not enough – will touch on this later)
  - ADOPTED THE BORDER ZONE AND WIRE ZONE CONCEPT WITH SOME TWISTS



# BLACKOUT 2003





# ELECTRICAL GRID

- Caused a national concern as to how vulnerable the electrical grid in the country is



# CAUSE

- A number of things/events contributed to the blackout:
  - Hot, humid August day
  - A number of transmission lines were out of service
  - Basically all the load was on one line
  - Transmission line sagged under load and it was close enough to use a tree as the path to ground (didn't touch tree)

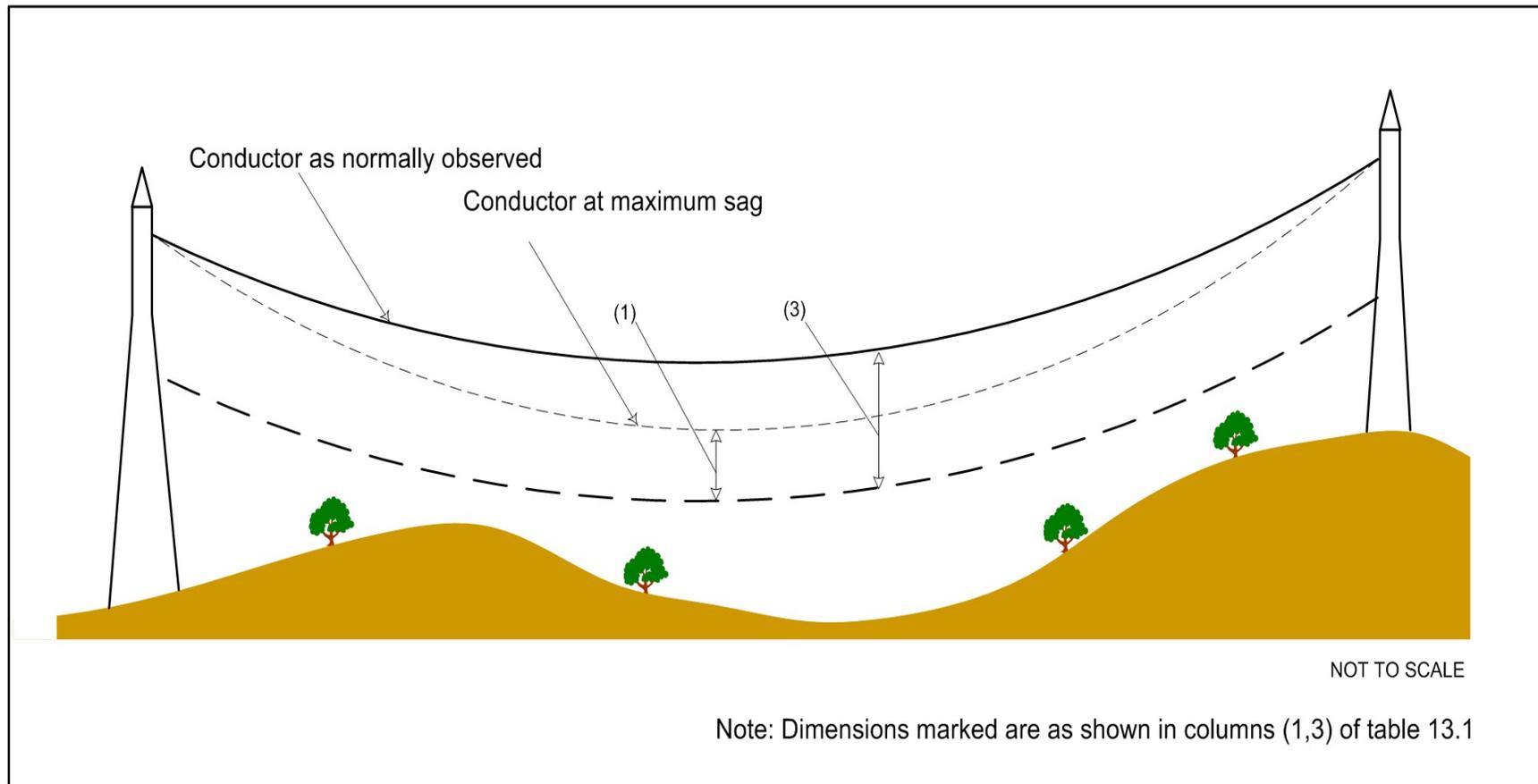
# BLACKOUT FALLOUT

- Federal government told the utilities to clean up their acts or they will get directly involved.
- National Electric Reliability Council took the lead to formulate new transmission vegetation management standards.
- I was on the first committees to analyze and draft standards.

# BLACKOUT FALLOUT

- NERC, FERC ALL GOT INVOLVED
- NEW STANDARDS WERE DRAFTED
- ACTUALLY ON 2<sup>ND</sup> REVISION
- HIGHLIGHTS:
  - NO GROUNDLINING IN WIRE ZONE, BUT CRITICAL CLEARANCES WERE IDENTIFIED
  - ANNUAL INSPECTIONS
  - AUDITS
  - MANDATED A VEGETATION MANAGEMENT PROGRAM FOR TRANSMISSION SYSTEM

Figure 13.2: SIDE VIEW OF THE TRANSMISSION LINE



# BLACKOUT FALLOUT

- FINES, FINES & FINES
  - TO THE TUNE OF ABOUT A MILLION A DAY PER OCCURANCE
  - THE LAST THING ANY UTILITY WANTED WAS TO BE THE ONE THAT HAD A TRANSMISSION LINE TRIP DUE TO VEGETATION AFTER THE STANDARDS WERE ADOPTED (some fines were subsequently issued).

# Other Things Contributed...

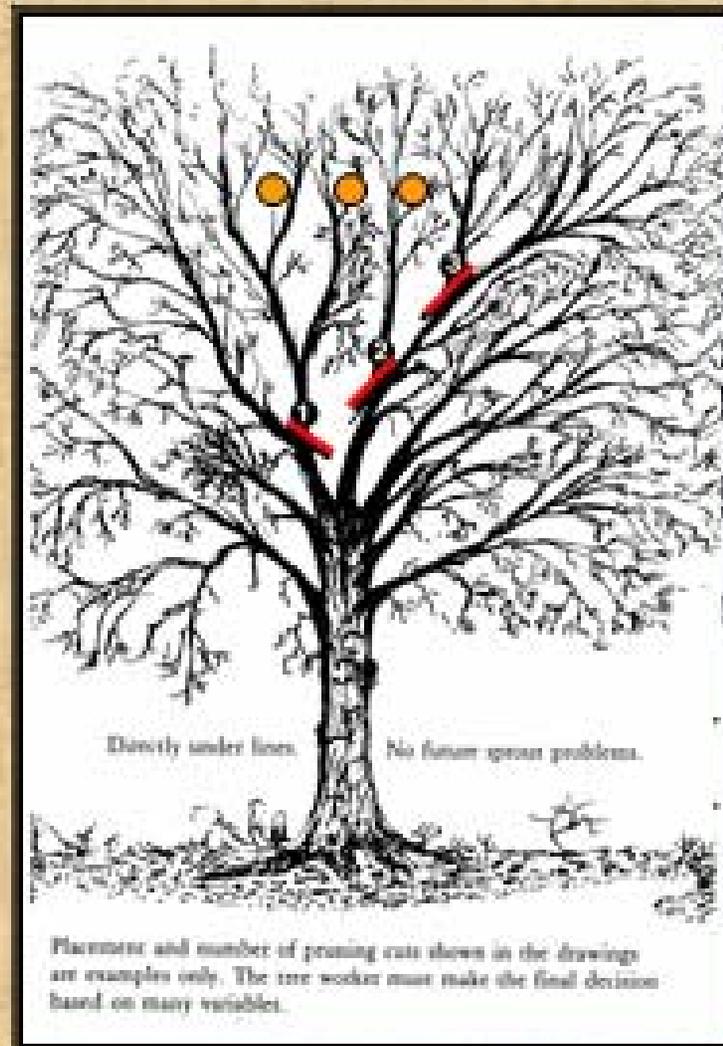
- HURRANCE IRENE 2011
- OCTOBER SNOWSTORM 2011
- HURRICANE SANDY 2012



- UTILITIES WERE CRITISIZED FOR HURRICANE SANDY STORM RESPONSE
- UTILITIES BLAMED THE TREES AND THE SHADE TREE COMMISSIONS FOR PREVENTING 'FULL' CLEARANCE.



# PRUNING FOR UTILITY LINE CLEARANCE

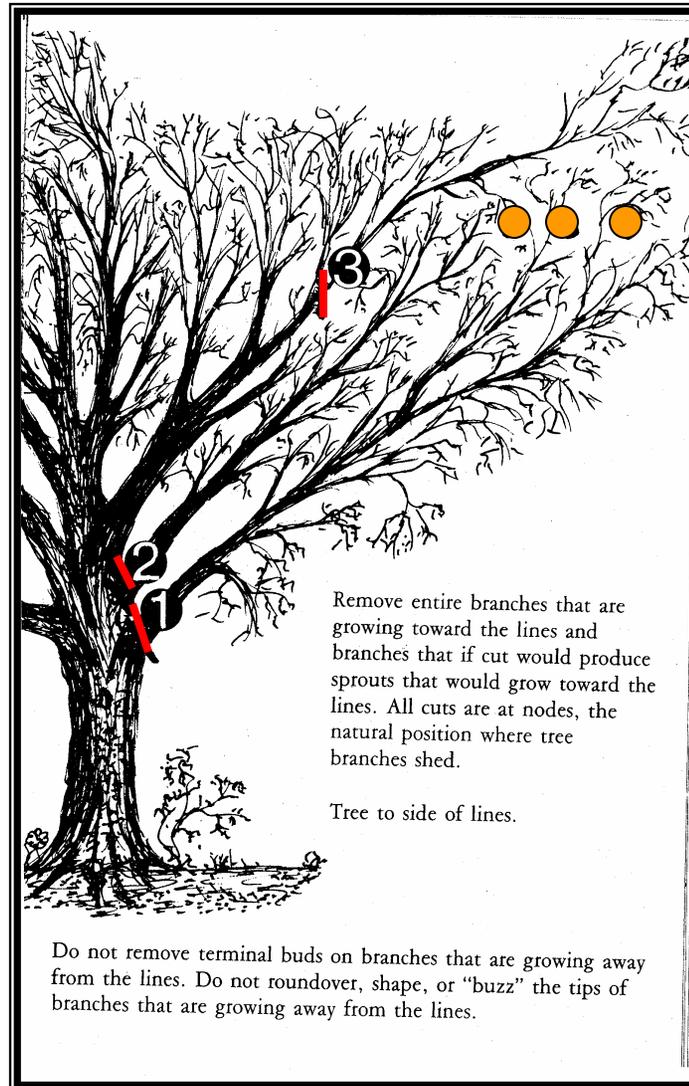


# PRUNING FOR UTILITY LINE CLEARANCE

- These forms are possible with correct pruning:



# PRUNING FOR UTILITY LINE CLEARANCE







# Revised NJBPU Standards

It includes a section on penalizing the utility for poor reliability







# **CHECK LIST FOR MUNICIPALITIES IN** **PREPARING FOR TREE RELATED** **EMERGENCIES**

## **Assemble a contact list of 24/7 Emergency Responders:**

1. County Office of Emergency Management
2. Local O.E.M. Manager/ Local Municipality Administrator
3. Local Police and Fire Dispatchers
4. Electric Utility Contacts
  - District Forester
  - Current Line Clearance Contractor
5. Emergency Tree Contractor
6. Cable TV Contact
7. Phone Service Contact
8. Gas Utility Contact
9. Shelter Volunteers

**Schedule an annual meeting with key players from the above list.**

- \* Provide adequate safety training for all municipal workers and establish standard operational procedures for tree related emergency response.**
- \* Insure that there is an ample supply of barricades, traffic cones and safety equipment. Insure there is access to gasoline supplies.**
- \* Conduct an annual Windshield Tree Survey of County, State and Municipal Roads by a qualified tree expert.**

**Notify respective county, state, municipal and private landowners of the location of potentially hazardous trees .**

**Request a sufficient tree removal and maintenance budget to address hazardous conditions as identified in the Windshield Tree Survey.**

**Develop specifications, go out to bid and award a tree maintenance contract on an hourly basis for emergency tree services with a required minimum response time of less than 2 hours.**

**Identify electric, cable and telephone span guys attached to trees and have them removed and relocated to ground anchors or anchor utility poles to avoid a “domino effect” of tree failure.**

**Identify a staging area to haul and process tree related waste.**

**Utilize road reconstruction projects to pro-actively remove large, over-mature trees within municipal right-of-way.**

**Plant only compact trees beneath over-head utilities. Use Trees for New Jersey Streets published by the New Jersey Shade Tree Federation as a guide.**

**[njshadetreefederation@att.net](mailto:njshadetreefederation@att.net) (732-246-3210)**

**All N.J. Electric Utilities are required by the N.J. Board of Public Utilities to conduct line clearance pruning of their respective distribution right-of-way once every 4 years. Use this as an opportunity to remove trees that are dead, diseased, dying, have been compromised by prior line clearance pruning and pose a threat to electric service.**

**Develop a procedure with your electric utility to establish whether downed wires are energized or not in order to determine when it is safe for the Department of Public Works or its contractors to enter an area to open up a blocked street and dispose of tree related debris.**

**Set up an information network where the public can be updated on road closures, escape routes, estimated utility restoration times, etc.**

**Set up mutual aid agreements with surrounding municipalities**

**Review past failures and successes in responding to prior tree related emergencies and adjust your response accordingly.**

**Develop a Community Forestry Management Plan in conformance with the New Jersey Shade Tree and Community Forestry Assistance Act, P.L. 1996, Chapter 135, to better prepare for the inevitable next storm.**

**Review ordinances that have tree removal limitations or require tree removal permits. Include a clause allowing waivers of these requirements in defined emergency situations.**

QUESTIONS??

# REVENGE OF THE TREES







