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Long-Range Planning

Comments Regarding ERCOT's
Long-Term Transmission Analysis 2010 - 2030

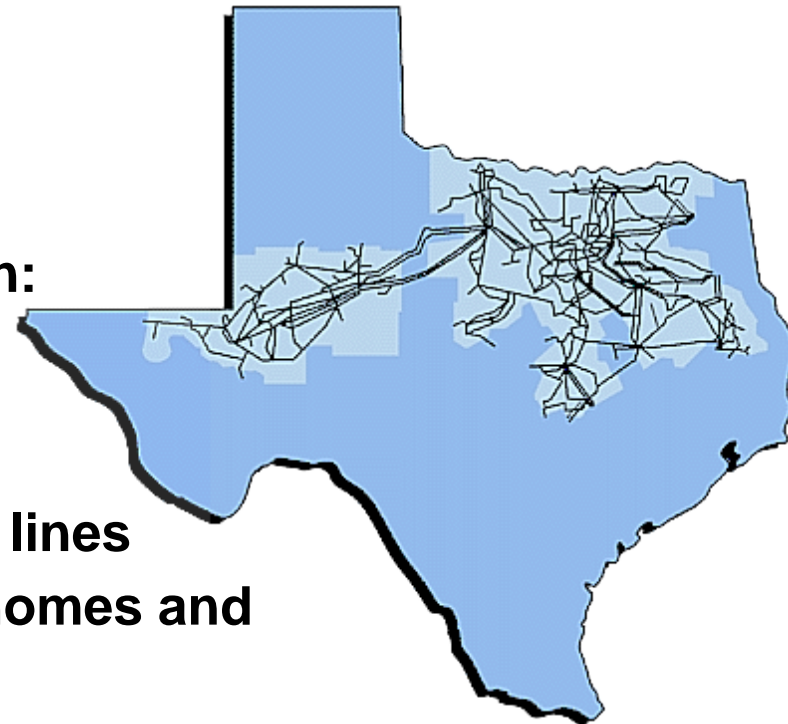
April Pinkston, PE

ERCOT Regional Planning Group Meeting
Austin, Texas
July 15, 2011

Oncor Electric Delivery Company LLC

Our System

- § **“Wires Only” Company formerly known as TXU Electric Delivery (DPL, TESCO & TPL)**
- § **Largest transmission and distribution system operator in Texas**
- § **More than 6,300 Transmission Circuit Breakers**
- § **More than 983 Stations**
- § **More than 1,588 Power Transformers**
- § **More than 172 Autotransformers**
- § **More than 15,300 miles of Transmission:**
 - § 5,325 circuit miles of 345 kV
 - § 7,080 circuit miles of 138 kV
 - § 2,899 circuit miles of 69 kV
- § **More than 103,000 miles of distribution lines**
- § **Delivers power to more than 3 million homes and businesses**
- § **Employs ~3,800 people**
- § **Keeps the lights on for more than 7 million Texans**



Enhance the Long-Term Study Task Force (LTSTF) through Transmission Service Provider (TSP) input

Provide input that will enhance the quality and feasibility of the long-term study

Propose projects that can be used to resolve transmission limitations experienced while performing transmission analysis

Transmission Service Providers (TSPs) help the long-term study

- Knowledge of the system
- Individual voltage criteria
- Identified future projects
- Information regarding developmental restrictions
- Information on standard equipment and installations
- Information on available expansion capability
- Increase feasibility

Lines

- 345 kV Circuit Capacity of 5000 Amps (suggest modeling as bundled 1926.9 kcmil ACSS TW conductor)
- Double Circuit Capable Structures
- Maximize use of existing Right of Way
- Provide full capacity for new Right of Way
- 138 kV system will need new lines, new stations and many upgrades to meet load projections
- Voltage adversely affected by exceeding circuit surge impedance

Line Impedances and Cost Estimates

- 30% adder due to variations in line route and length
- 50% to 100% increase may be needed in highly urban areas
- Cost adder for change to monopole

345/138 kV Autotransformers

- 600 MVA rating (standard size and configuration)

Non-standard Equipment Proposals

- Autotransformer size
- Increased cost
- Complicates replacement & maintenance

Developmental Restrictions

- Lack of available space within existing substations
- Lack of available ROW/Easement
- 345 kV switching stations proposed where there are no 345 kV lines
- Fully developed areas

Non-standard Installation Proposals

- Size of proposed switched shunt devices to be installed in a station

Taking lines out of service creates a short-term adverse impact on reliability and the market

Construction timeline very constraining

Multiple clearances at the same time may not be possible

Consideration of Environmental Restrictions and Land Owner Rights

Environmental Agencies

- U.S. Army Corp of Engineers
- Texas Commission of Environmental Quality
- Texas Parks and Wildlife
- U.S. Fish and Wildlife

Political Acceptance

Land Owner Acceptance

Local Zoning Ordinances

Number of habitable structures affected



West Plano Proposed Project in a Highly Developed Area

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Google Earth

Underground Consideration

**Significantly Higher Cost Above
Traditional Transmission
1500% to 3000% Increase**

Design Limitations

- Size and number of cables limited
- Capacity limited due to heat
- 3,200 Amps or less

**Repairs Are Very Complex
Longer Time Out**

Installation

- Significant Right of Way Impact



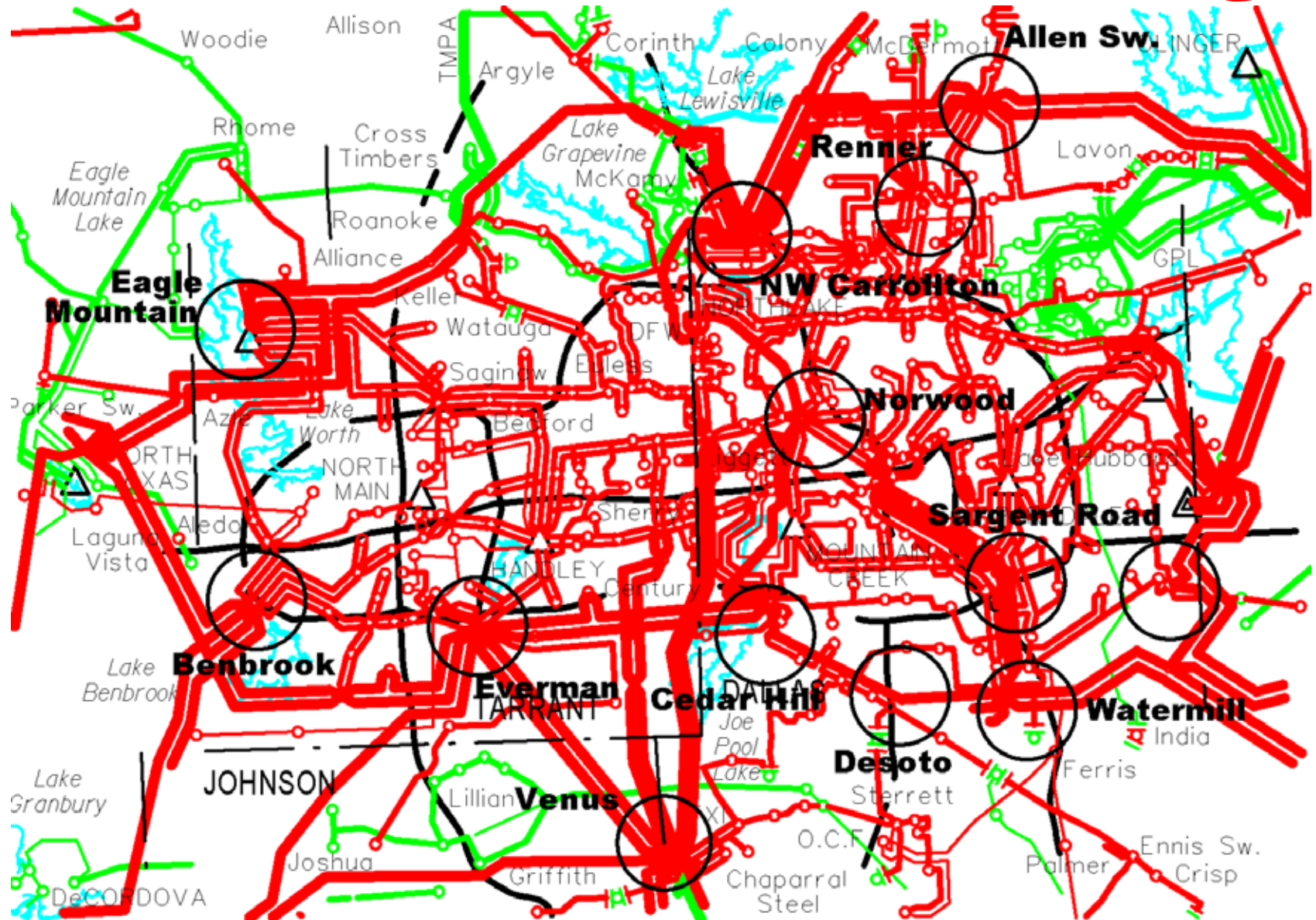


Autotransformer Replacements
Eagle Mountain #1
Eagle Mountain #2
Benbrook
Everman #1
Everman #2
Norwood #1
Venus Switch
Renner Switch #1
NW Carrollton
Allen Switch #1

Autotransformer Installations at Existing Stations
Cedar Hill Switch #2
DeSoto Switch #2
Seagoville Switch #2
Watermill #2
Hutto #2
Sargent Road #2

Future 345/138 kV Autotransformers

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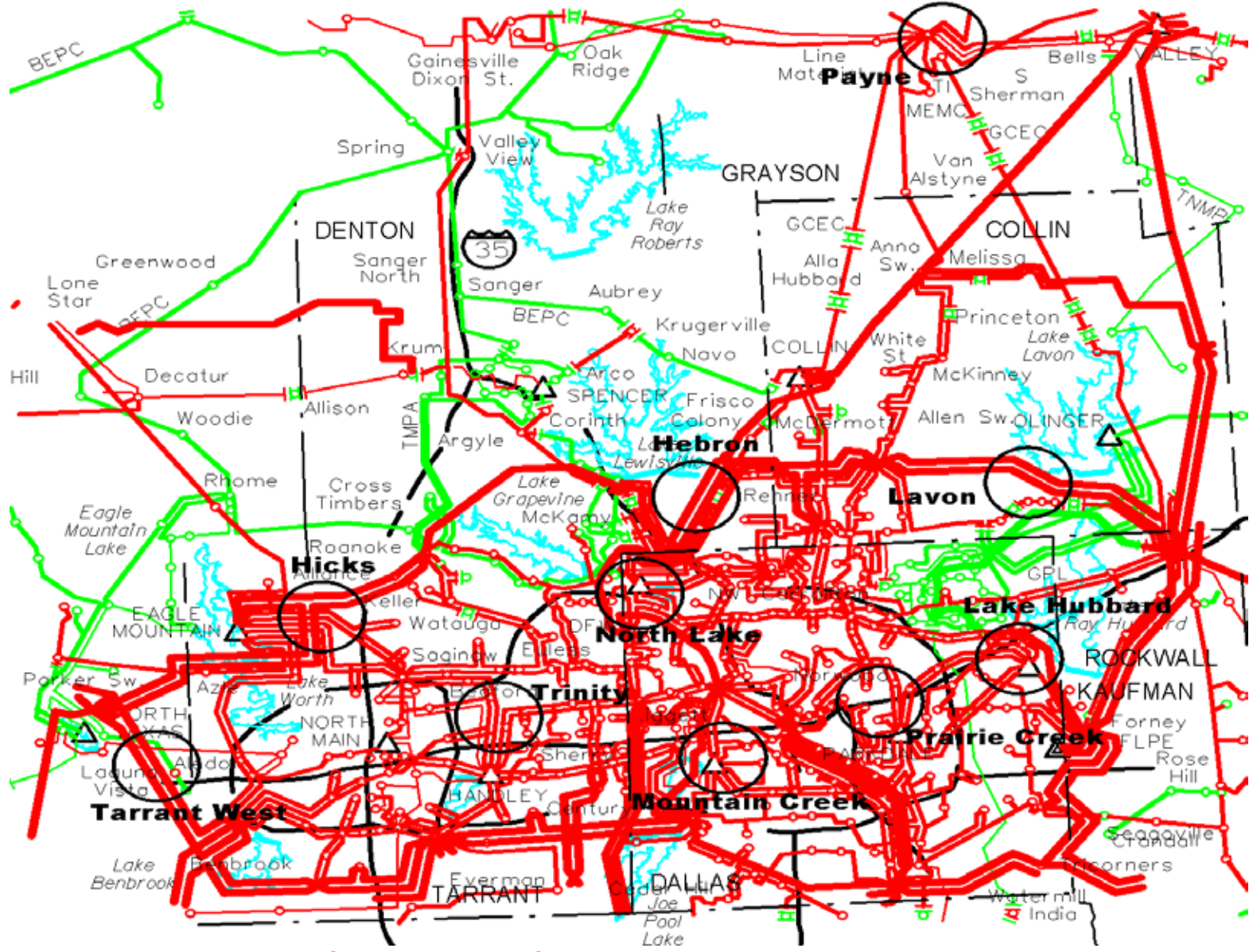




New 345 kV Switching Stations with Autotransformer Installations	
Hicks	2 Autotransformers
Tarrant West	2 Autotransformers
Trinity	2 Autotransformers
Mountain Creek	2 Autotransformers
North Lake	2 Autotransformers
Lavon	2 Autotransformers
Hebron	2 Autotransformers
Lake Hubbard	2 Autotransformers
Payne	2 Autotransformers
Prairie Creek	2 Autotransformers

Future New Stations with Autos

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Line Additions

Benbrook – Decordova 345 kV 2nd circuit

Jacksboro Switch – Krum West 2nd circuit

Benbrook – Tarrant West – Parker 345 kV line

Tarrant West – Eagle Mountain/Calmont double-circuit (DCKT) 138 kV line

Forney – Sargent Road 345 kV line

West Levee – NW Carrollton 345 kV line

Watermill – Navarro DCKT 345 kV line

Navarro – Lake Creek DCKT 345 kV line

Whitney – Johnson Switch DCKT 345 kV line

Hicks – Elizabeth Creek DCKT 138 kV line

Liggett – Trinity 345 kV line

Sadow Switch – Temple Switch DCKT 345 kV line

Payne – Valley South 345 kV line

Future Line Additions

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345 kV Line Upgrades

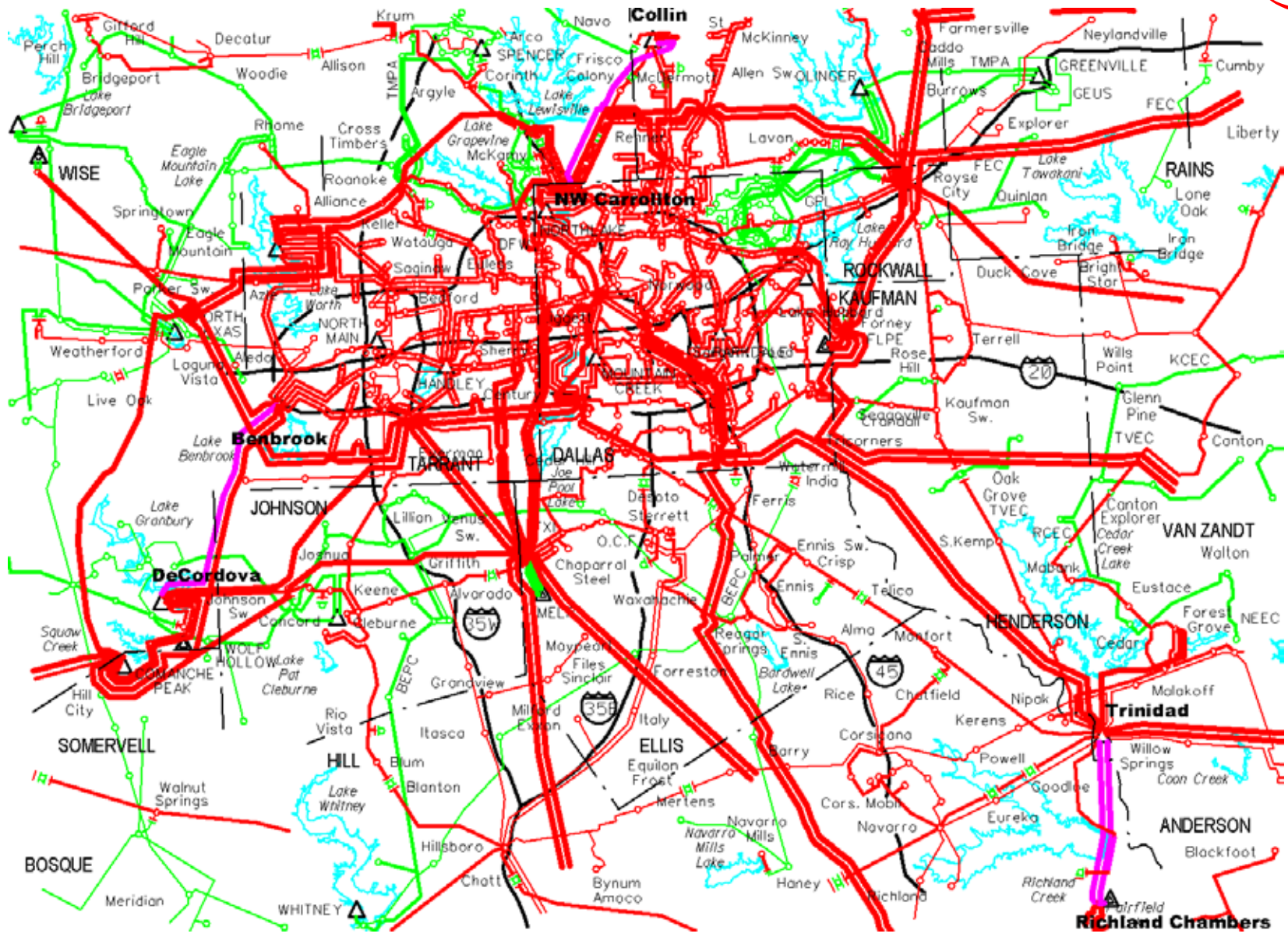
Benbrook – Decordova 345 kV line

Collin Switch – NW Carrollton 345 kV line

Trinidad – Richland Chambers DCKT 345 kV line

345 kV Line Upgrades

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Transmit large amounts of power into Dallas/Fort Worth

Maximize flow control

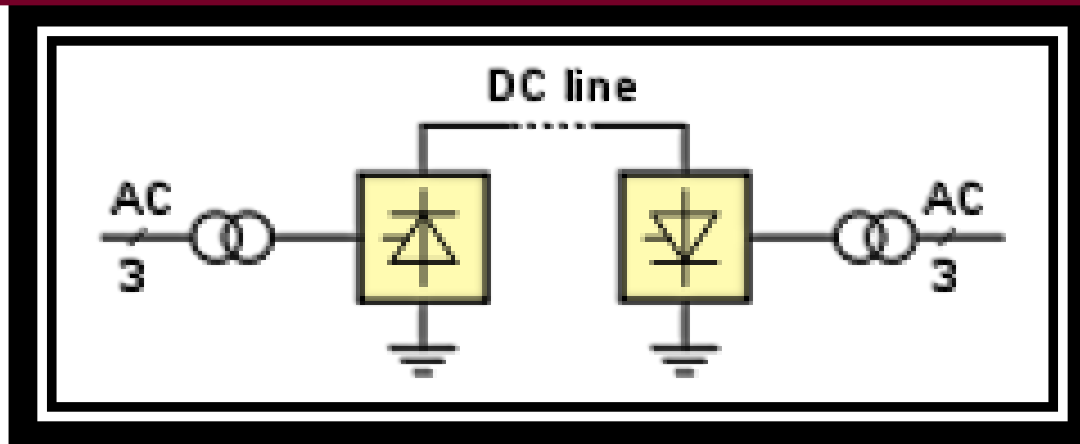
Provides voltage control, damps oscillations and increases stability

HVDC Light IGBT Technology

Replace autotransformers by connecting from 345 kV to 138 kV

Not sensitive to line route/length (does not affect capability or flow)

Consider Three to Six 500 MW to 800 MW HVDC lines injecting into DFW



Dynamic simulation analysis should be performed

- System stability
- Angular stability
- Voltage control and response
- Fault Induced Delayed Voltage Recovery (FIDVR) Blackout
- Added significant fixed shunt capacitors (~8,000 Mvar)
- Need Dynamic Reactive Devices (16 - 300 Mvar SVC's)
- High reactive losses due to exceeding circuit surge impedance
- HVDC may provide possible solution
- Significant cost adders for reactive power facilities, dynamic reactive devices, series capacitor compensation, FACTS and Smart Grid

Evaluate Generation Development North Side of DFW

- Near West Krum
- Near Anna
- Near Farmersville
- Existing retired or mothballed generation sites

In order to bolster the long term study process, Oncor urges:

- **Incorporation of TSP and other stakeholder comments in the long term study will enhance the quality and results to the benefit of ERCOT DOE and the market**
- **This involvement bridges theory and practice by recognizing differences in operating regions and specific plans; e.g. Oncor has (16) auto transformer projects, (20) new 345kV station projects, (13) new line projects, and (3) upgrades**
- **Only through TSP involvement can the feasibility be improved around local physical design limitations, land & right-of-way plans, standard equipment, and existing projects**

Questions?

Further Discussion