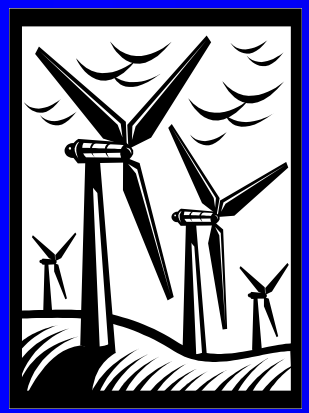
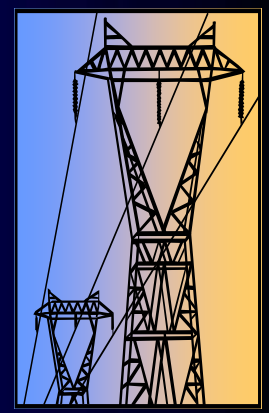
# Wind Energy & Transmission Planning in the ERCOT Region



**Background Information for**
**House Subcommittee on Renewables**
**March 16, 2005**



Kent Saathoff, Director of System Operations
Electric Reliability Council of Texas

# ERCOT Planning Process

- ERCOT supervises an open, non-discriminatory planning process that considers and balances the impact of transmission system additions on stakeholders
- Projects or studies can be proposed by any Market Participant, Transmission Owner or ERCOT Staff
- Stakeholders have opportunity to comment on proposals and offer alternative solutions
- ERCOT Staff performs independent review
- ERCOT Staff makes independent recommendation to the Board of Directors for major projects
- ERCOT Board endorsements are considered by the PUC for approval of Certificate of Convenience & Necessity

# Planning Process Results

## Facilities added and currently in service (since 1996)

- 26,500 MW of generation capacity interconnected (45% increase)
- Nearly $2 billion invested in transmission facilities
- 700 miles of new 345 kV transmission lines
- Several hundred miles of new or rebuilt 138 kV transmission lines
- Many 345/138 kV transformers
- Dynamic and static voltage control devices

## Underway

- 619 miles of 345 kV transmission lines
- Numerous 138 kV lines and upgrades
- Additional $1.8 billion will be invested in the transmission system over next few years, based on current projections

*ERCOT Region has seen much greater expansion of transmission infrastructure in recent years than any other North American region*

# Transmission Expansion Issues

- Time to build: due to permitting and right-of-way requirements, transmission projects can take years to complete
- Building ahead of need: Transmission Owners may not be willing to take the business risk for future generation interconnection projects
- Finite resources: ERCOT is experiencing record transmission expansion and new construction may be limited by available capital and resources

# Operational Issues Related to Wind Power

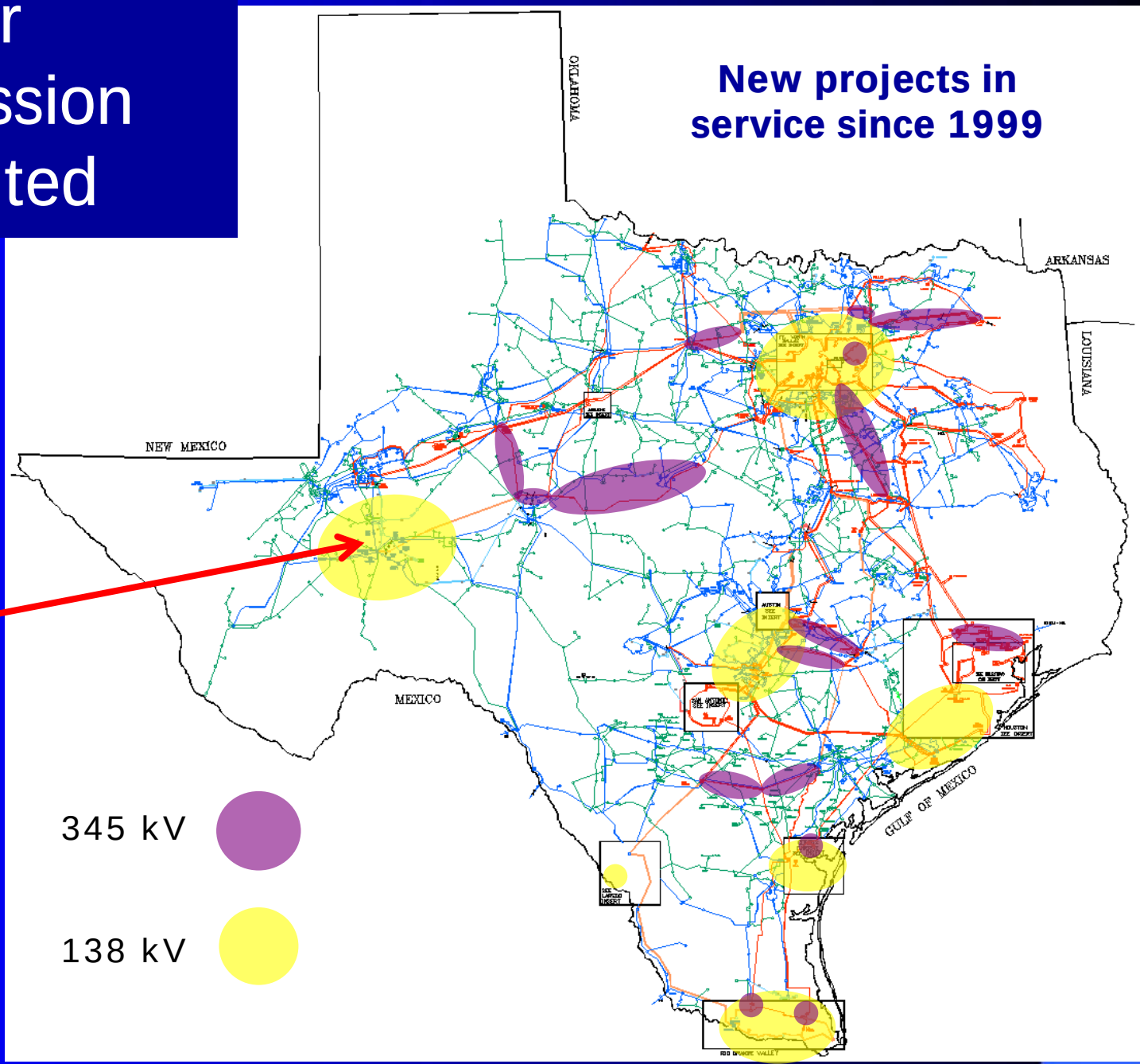
- Wind power is not as controllable or predictable as traditional sources of electricity
- Cannot be dispatched
- Works best in conjunction with controllable generation in same area
  - Controllable resources must be used to compensate for wind variability by providing ancillary services
- In West Texas, wind tends to produce more off-peak power than on-peak
  - Although overall capacity factor for wind is in the 35-40% range, only 10% of wind farms' total capacity is currently counted as operational for reserve margin planning
- Creates challenges in system design & operation

# Wind Interconnection Efforts

- Upgrades to transmission system currently underway could accommodate SB7 renewable mandate (based on current project siting), but not a significant increase above 2,000 MW from West Texas
- In 2003, ERCOT Board endorsed a plan to provide 345 kV lines to support a total of 1,500 to 2,000 MW of wind generation in McCamey area
  - Subject to subscription of new generation resources
  - 755 MW online in McCamey area today
  - Contingency plan currently under new review by ERCOT Staff based on input from AEP at West Regional Planning Group meeting Jan. 2005
- In 2004, ERCOT staff prepared an “order of magnitude” study for 5,000 MW of generation in West Texas
  - Additional studies will be required to optimize the design
  - ERCOT Region is breaking new ground in the U.S. on impact analysis for this level of wind generation
- ERCOT staff has also identified ideal locations for wind generation development along the gulf coast

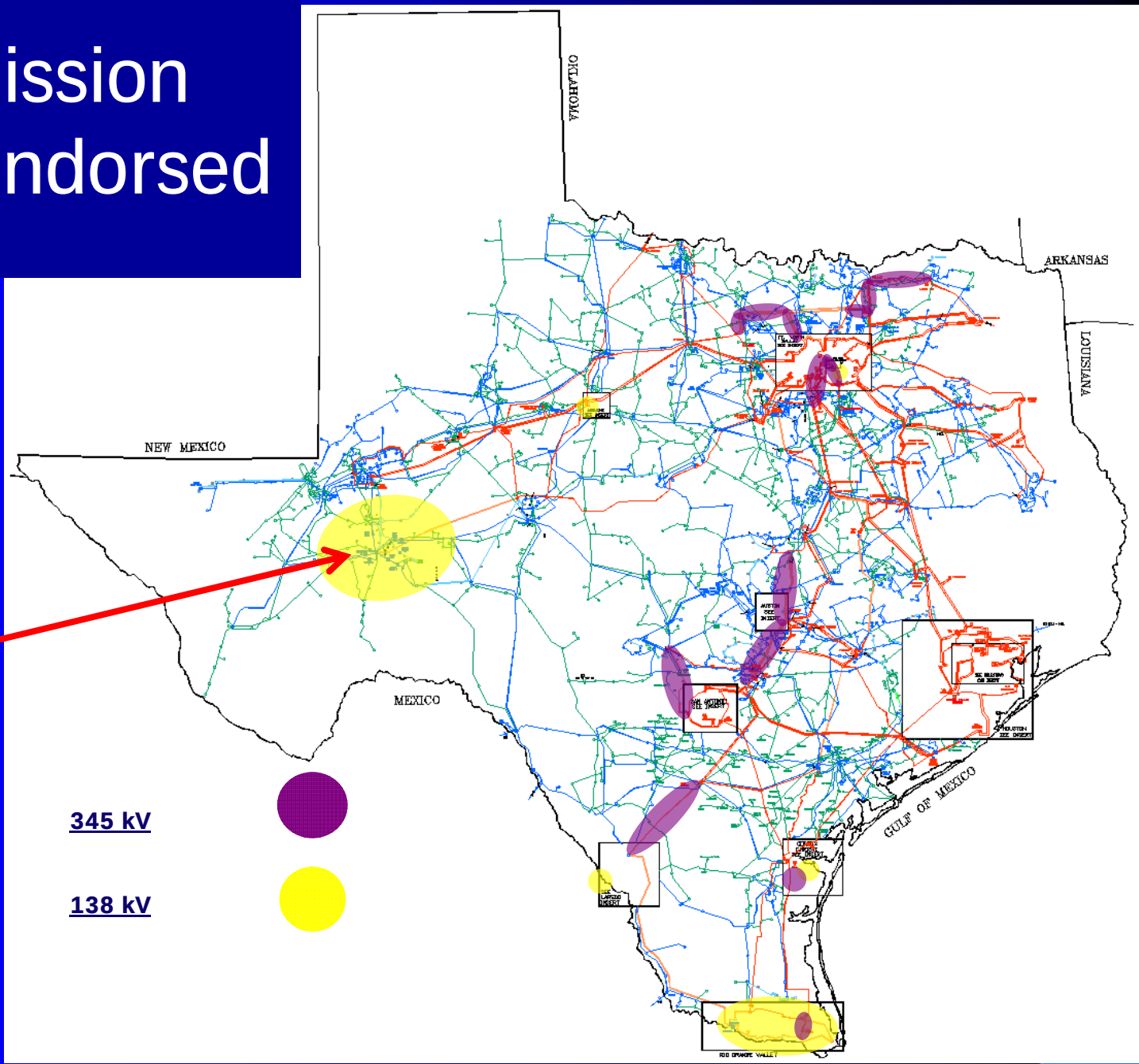
# Major Transmission Completed

Major improvements to 138kV network in the McCamey area have already been completed



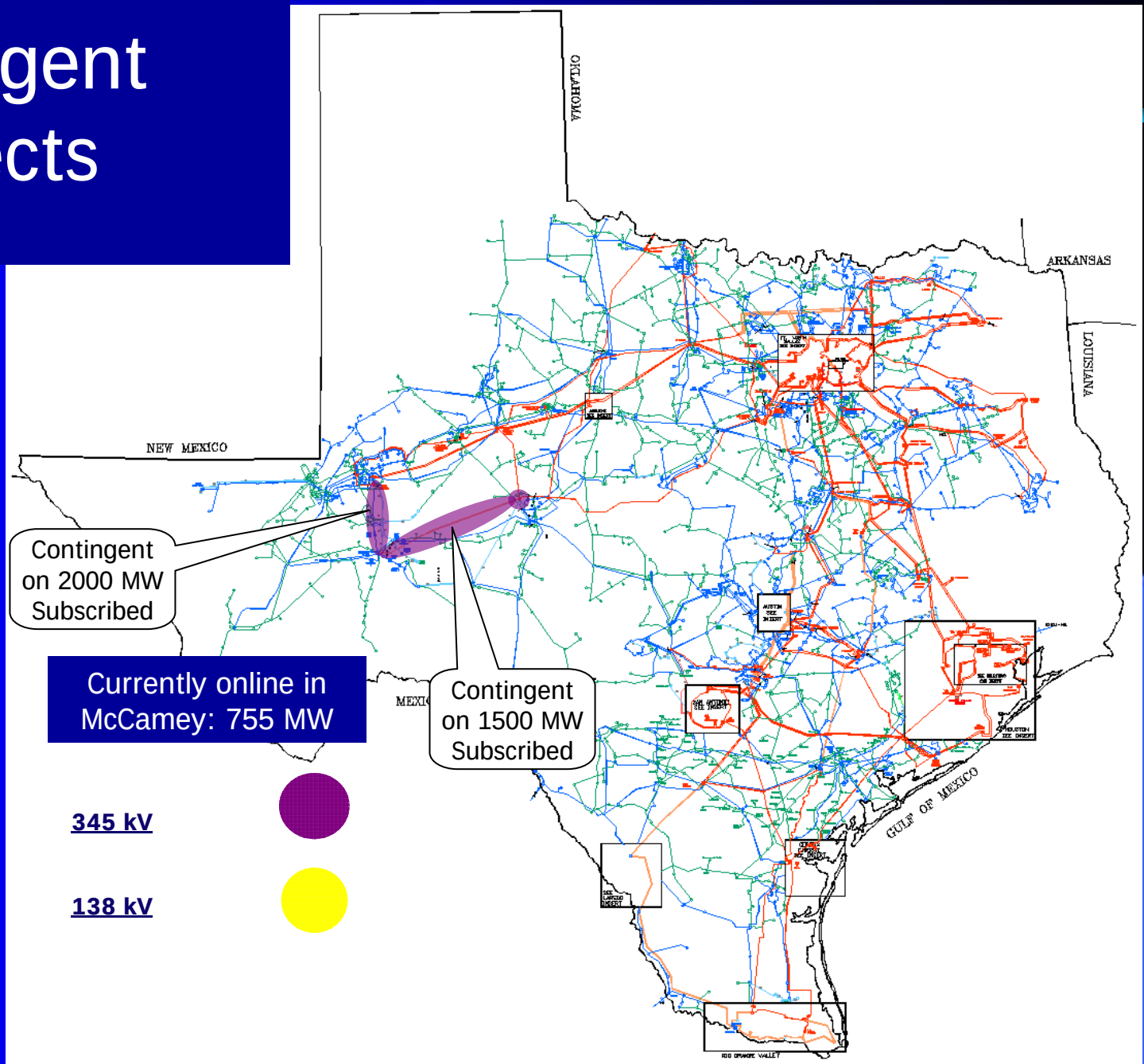
# Transmission Projects Endorsed

Remaining 138kV upgrades in the McCamey area will be completed by Oct. 2005



# Contingent Projects

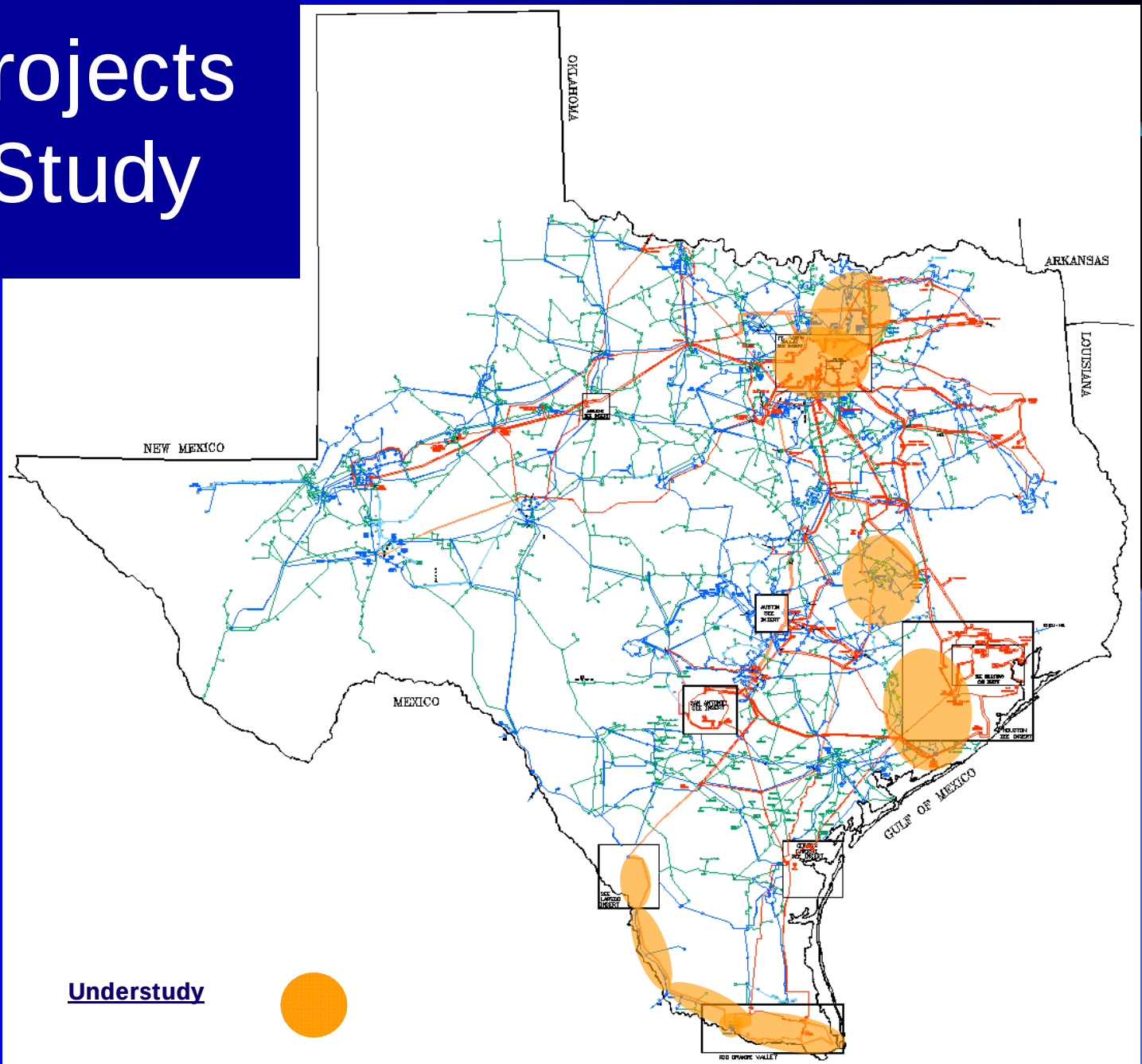
ERCOT Board in 2003 endorsed two major 345 kV projects from McCamey area contingent upon interconnection agreements



# Other Projects Under Study

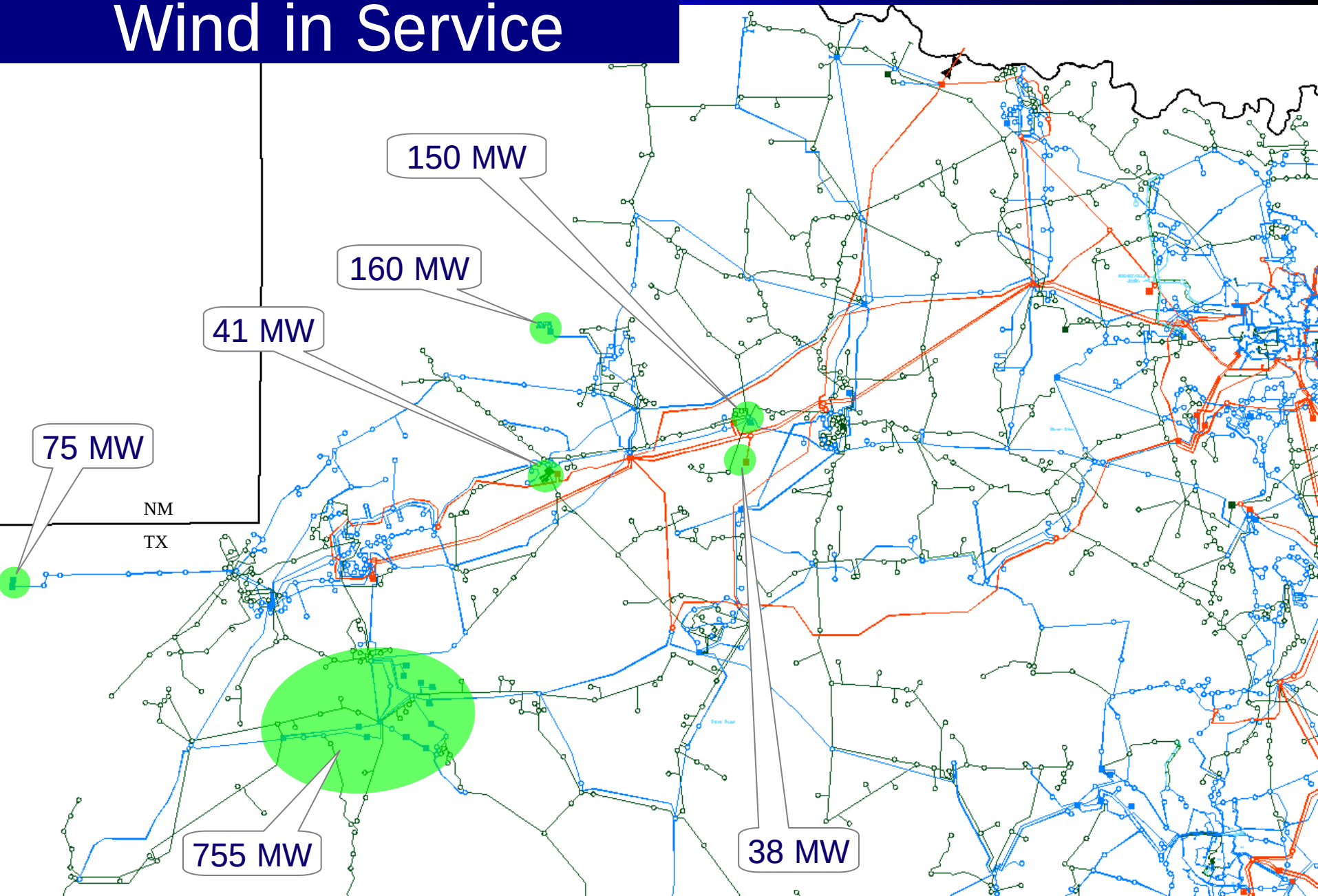
Areas where major transmission projects are under evaluation to reduce recurring local congestion:

- DFW
- College Station
- West Houston
- Rio Grande Valley



# ERCOT West Texas Wind in Service

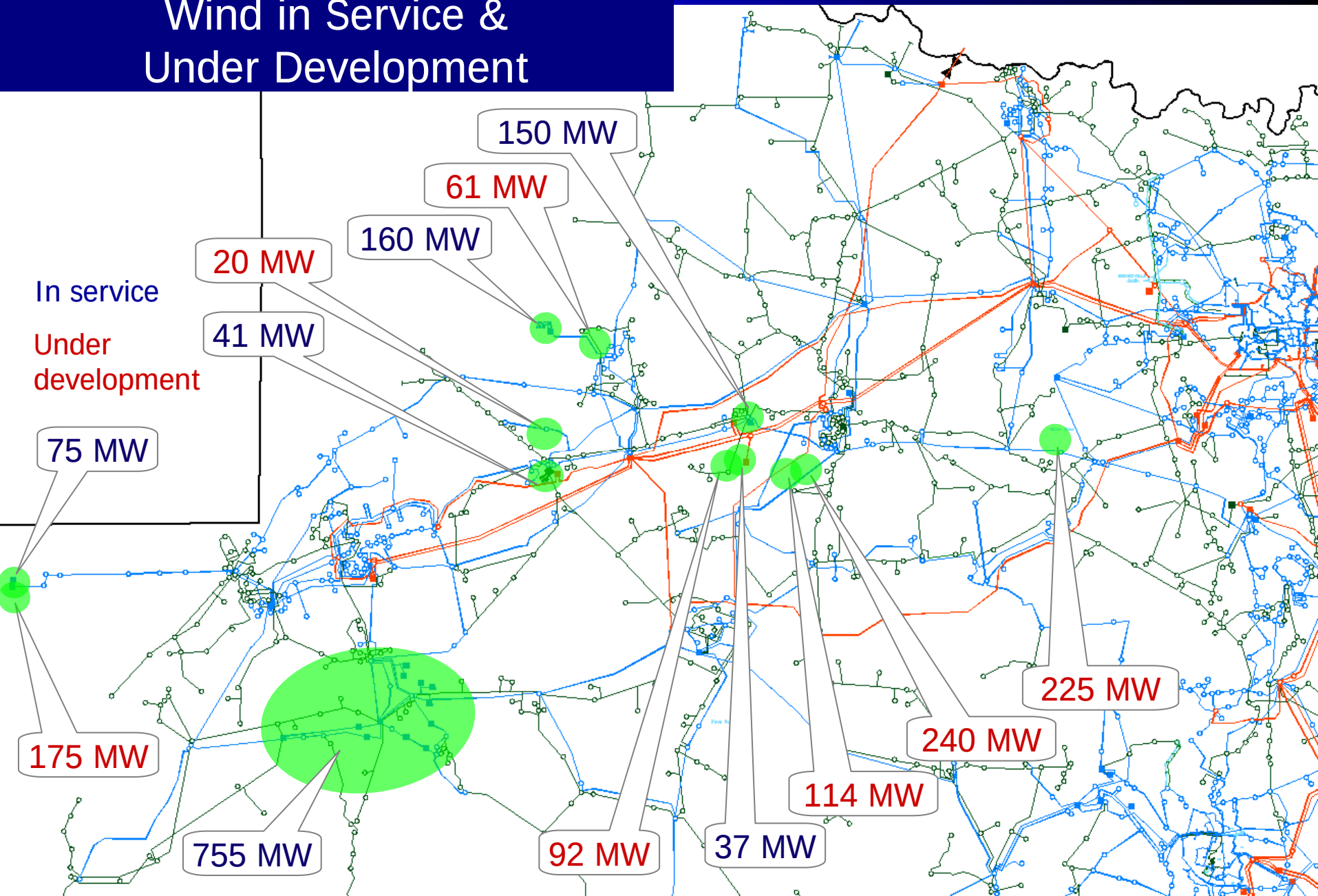
**Total 1,219 MW**



# ERCOT West Texas

## Wind in Service & Under Development

**Total 2127 MW**

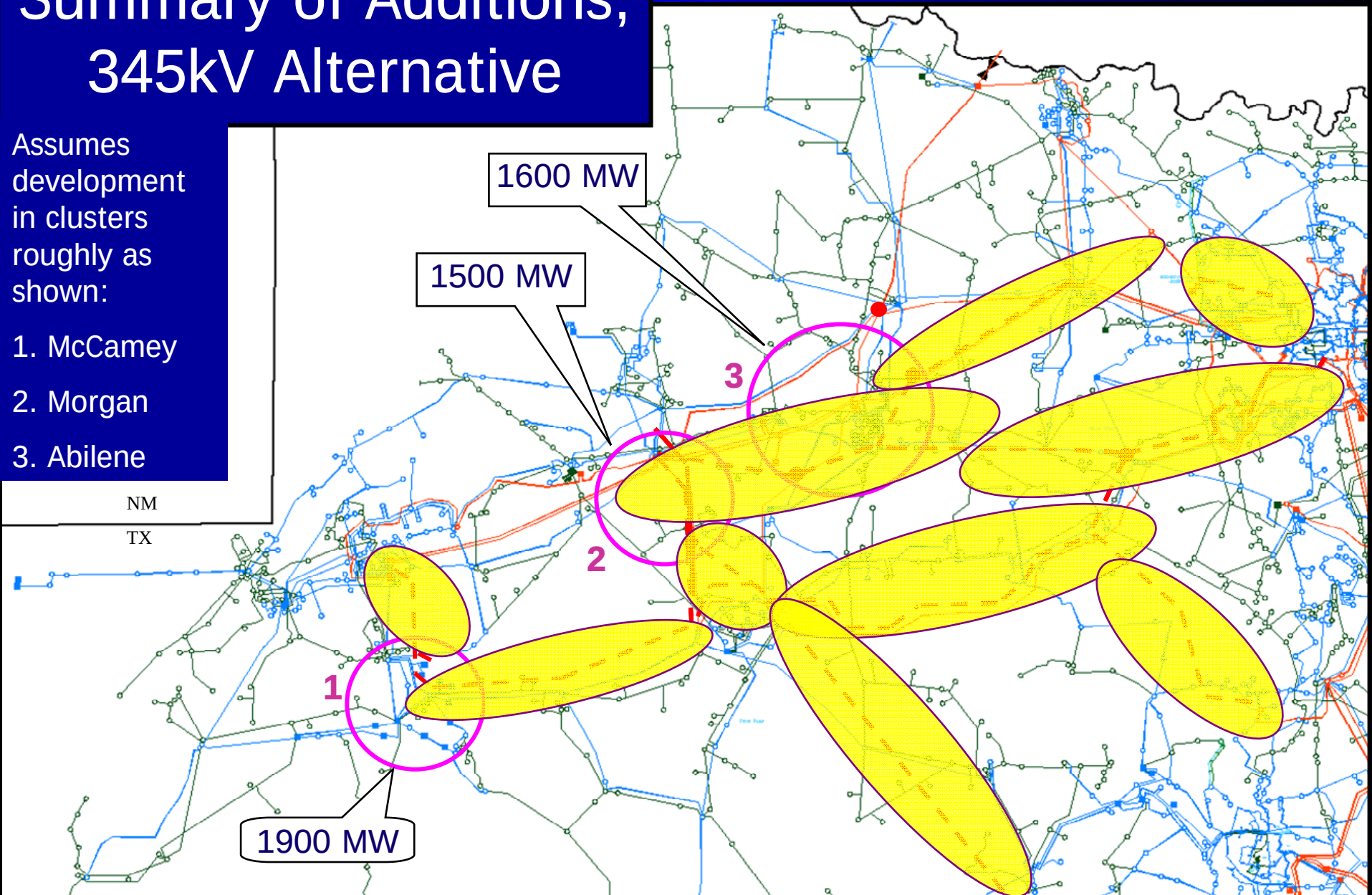


# ERCOT West Texas Summary of Additions, 345kV Alternative

These projects could support a total of 5,000 MW of West Texas wind power

Assumes development in clusters roughly as shown:

1. McCamey
2. Morgan
3. Abilene



# Estimated Cost to Support 5,000 MW of Wind Power from West Texas

| | McCamey | Morgan | Abilene | Total | Cost |
|---|---|---|---|---|---|
| Existing Gen | 750 MW | 250 | 200 | **1,200 MW** | **$320M** |
| New Gen | 1,150 MW | 1,250 MW | 1,400 MW | **3,800 MW** | **$1B** |
| Total | 1,900 MW | 1,500 MW | 1,600 MW | **5,000 MW** | **$1.3B** |

Total estimated cost of new transmission upgrades is approximately $1 Billion

- Based on 345kV development option
- 765kV is also an option to be considered
- Transmission plan optimization could reduce this estimate
- Does not include any cost for additional regulation or reserve services which may be required

*Sources: LCRA, ERCOT staff, American Wind Energy Assn.*

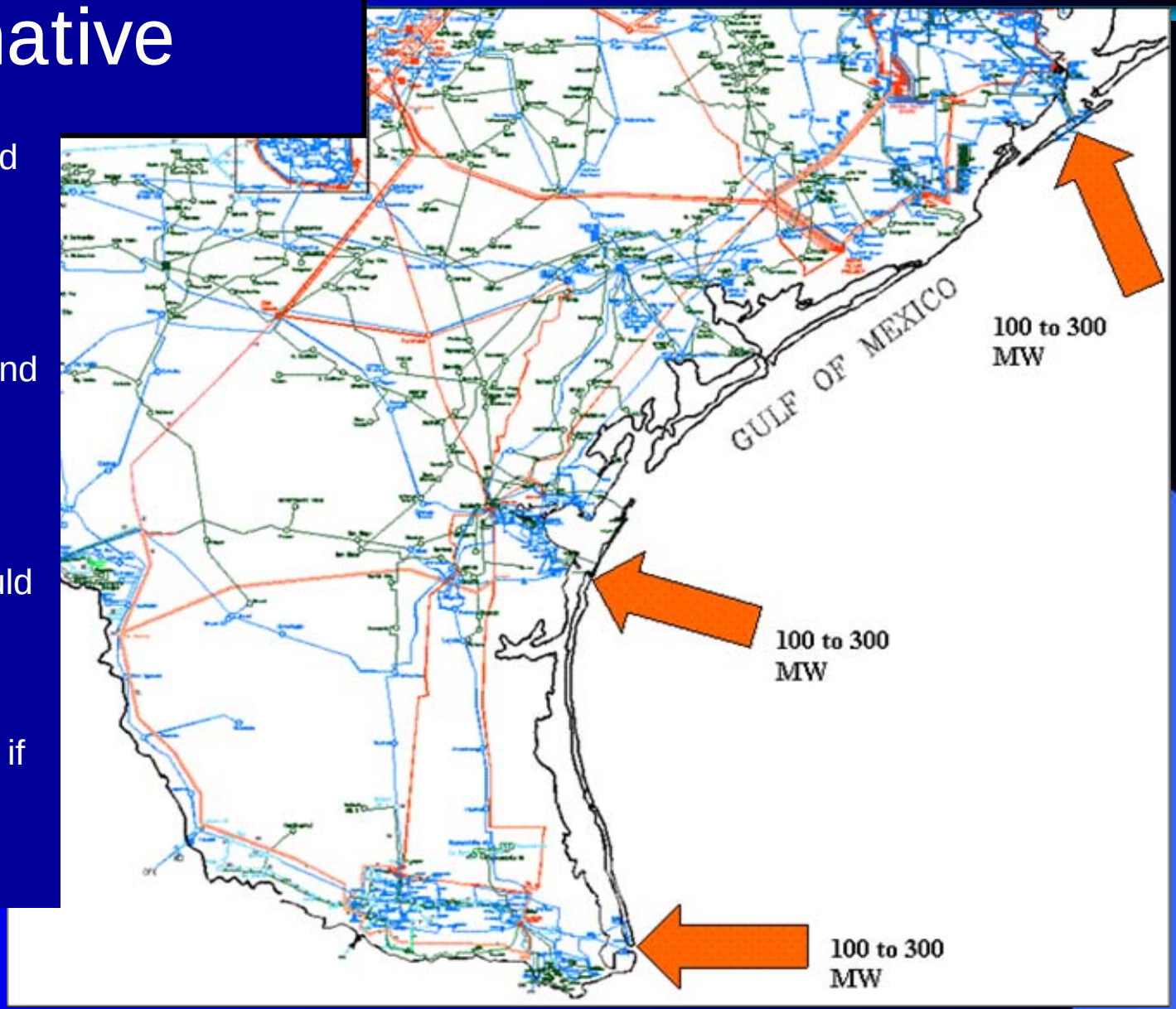
# 10,000 MW and Beyond

- ERCOT staff has not developed detailed engineering analyses for wind power additions in West Texas over 5,000 MW
- Informal group is now evaluating existing studies to produce "back of the envelope" cost estimates for consideration by the Legislature
  - Broad range of stakeholders are involved
  - Results targeted for release next week
- Diversification could help meet a larger renewable goal
  - Clustered development in multiple locations (i.e., "wind zones")
  - Other types of renewables
- Gradual phase-in schedule will be important to learn from actual operational experience and maintain system reliability
- ERCOT supports consideration of reactive (voltage) support devices to improve reliability issues associated with wind generation

# The Gulf Coast Alternative

Between 300 MW and 900 MW could be easily integrated

- 100 to 300 MW of wind generation could be integrated near each:
  - Galveston
  - South Corpus
  - South Padre Island
- Based upon direct connects without significant additional upgrades
- Generation levels would offset local load in the area
- Additional generation levels could be added if local high voltage transmission systems are upgraded



# The 765kV Option

- Highest-capacity transmission circuits currently in ERCOT are 345,000 volts
- 765,000 volt (765kV) lines are in use in other regions and nations
- 765kV option appears to accommodate voltage and output fluctuations (typical of wind) better than lower voltage options
  - "Shortens the distance between generation and load"
- However, more substations (injection points) = less efficiency & higher cost
- The larger the renewable target, the more attractive the 765kV option becomes
  - Cost per MW of generation is inversely proportional to the capacity needed
  - The higher the capacity required, the lower per MW cost

# Questions?