

# BUILDING A WORLD OF DIFFERENCE

## LONG-TERM ASSESSMENT OF NATURAL GAS INFRASTRUCTURE TO SERVE ELECTRIC GENERATION NEEDS WITHIN ERCOT

### SUMMARY PRESENTATION

PREPARED FOR ERCOT

September 13, 2013



**BLACK & VEATCH**  
Building a world of difference.®

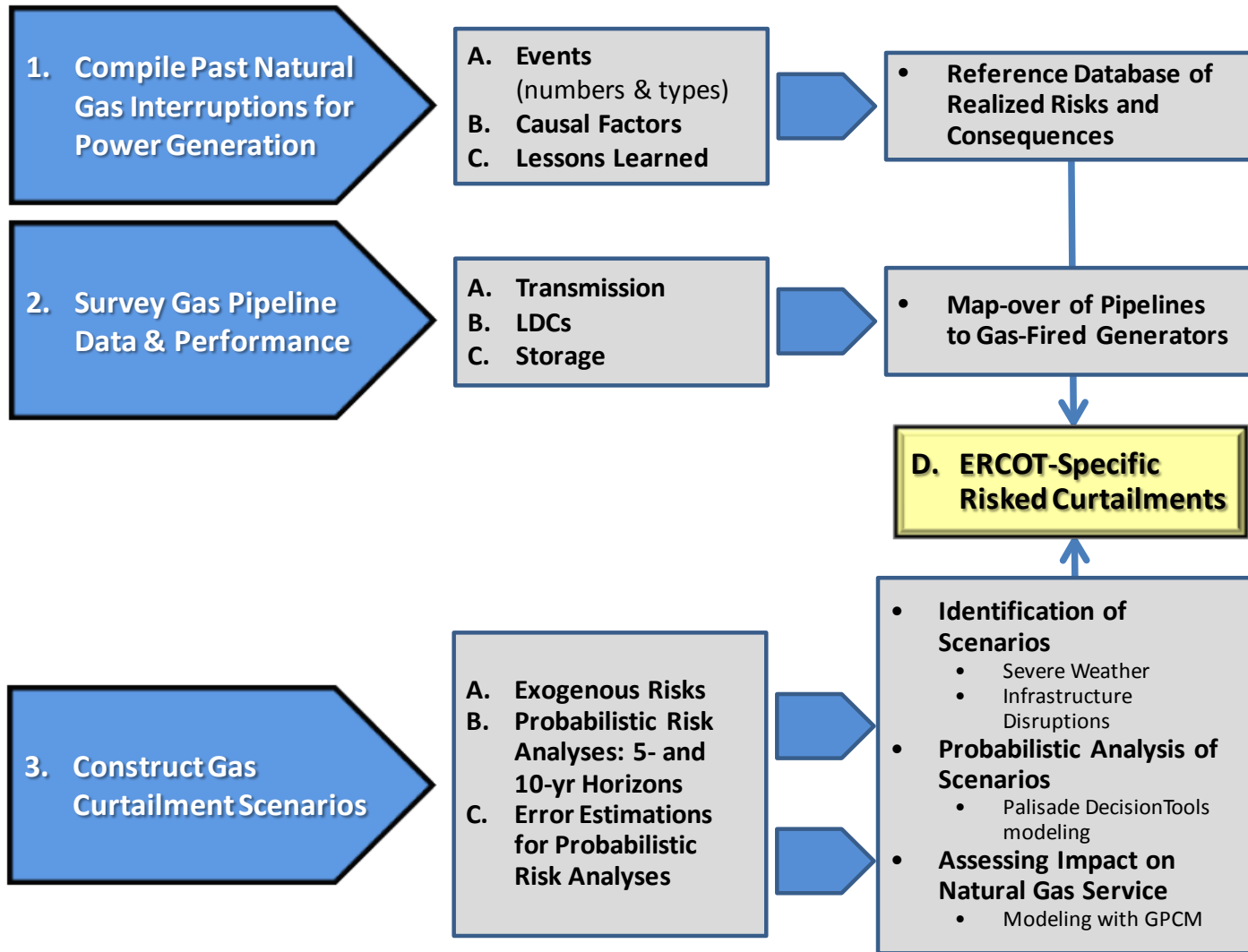
# BACKGROUND OF STUDY

- ERCOT commissioned Black & Veatch to perform a Gas Curtailment Risk Study in 2012<sup>1</sup>
- Study intended to increase ERCOT's understanding risks of generation loss from gas supply curtailment over 1, 5 and 10 years and potential ways to mitigate risks arising from curtailments
- Current study assesses the long-term ability of the natural gas infrastructure to serve electric generation needs within the ERCOT service region between 2020 and 2030
- Both studies are part of a larger long-term transmission planning effort undertaken by ERCOT and funded by the Department of Energy<sup>2</sup>

<sup>1</sup>*Gas Curtailment Risk Study*, Prepared for ERCOT by Black & Veatch, March 2012.

<sup>2</sup>*ERCOT Interconnection Long-Term Transmission Analysis, 2012-2032*, ERCOT, Summer 2013.

# OVERVIEW OF 2012 GAS CURTAILMENT RISK STUDY



# PROJECT SCOPE – OVERVIEW

- Reviewed current and projected natural gas fired generation and sufficiency of natural gas infrastructure to support power generation needs in ERCOT
- Analysis of extreme supply and demand scenarios to stress test the ability of the natural gas infrastructure to serve electric generation
- Black & Veatch also reviewed potential regional constraints in adding natural gas infrastructure needed to support electric generation needs

# PROJECT SCOPE BY TASK

## Task A

- Review of Current Natural Gas-Fired Generation and Infrastructure supporting Power Generation Needs Within ERCOT

## Task B

- Review of Projected Natural Gas Demand for Electric Generation in 2020-2030

## Task C

- Assessment of Sufficiency of Natural Gas Infrastructure to Serve Electric Generation Demand

## Task D

- Identification of Regional Constraints in Adding Natural Gas Infrastructure Needed to Support Electric Generation Needs

# STUDY COMBINED ERCOT AND BLACK & VEATCH MARKET VIEWS

Key Assumption	Source
Electric Projections Within ERCOT	ERCOT's Long-term Transmission Analysis – Business as Usual with All Tech Scenario
Current Electric Capacity within ERCOT	ERCOT CDR Report – May 2012
North American Electric Assumptions (Non- ERCOT)	Black & Veatch's 2013 Energy Market Perspective
North American Natural Gas Demand and Supply	Black & Veatch's 2013 Energy Market Perspective
Interstate and Intrastate Pipeline Infrastructure	Black & Veatch's 2013 Energy Market Perspective

# KEY OBSERVATIONS & CONCLUSIONS – SUMMARY

- Natural gas infrastructure serving ERCOT is expected to be adequate from 2020 to 2030
- Texas enjoys well developed natural gas infrastructure & robust production growth forecasts
- Natural gas infrastructure expected to be adequate under baseline or stress scenarios examined
- Commercial arrangements and market inefficiencies could create challenges in the short-term

# KEY OBSERVATIONS & CONCLUSIONS – TASK A

- Sufficient natural gas infrastructure exists to meet ERCOT's current power generation needs within ERCOT
- Natural gas production growth in Texas from unconventional shale production is expected to more than offset declines in conventional onshore and offshore supplies
- Projected natural gas pipeline and midstream infrastructure development in Texas follows emerging Eagle Ford Shale production and the need to access processing capacity to reach intra-state and Mexican export markets
- Sufficient existing natural gas storage capacity exists to meet the seasonal fluctuations of gas demand in Texas



## KEY OBSERVATIONS & CONCLUSIONS – TASK B

- Robust demand growth in the power sector expected in ERCOT and Lower 48

Key Electric Component	ERCOT	Lower 48
Power Generation Capacity	75 GW in 2012 to 92 GW by 2030	966 GW in 2012 to 1,164 GW by 2030
Cumulative Natural Gas Capacity Additions 2017-2030	10,800 MW of CC and 6,800 CT	143,000 MW of CC and 27,000 MW of CT
Natural Gas Demand	3.1% CAGR	2.6% CAGR

- Natural gas demand from the residential, commercial and industrial sectors is expected to experience a moderate growth of 0.3% CAGR

# KEY OBSERVATIONS & CONCLUSIONS – TASK C

- Black & Veatch analyzed the sufficiency of natural gas infrastructure to serve ERCOT's electric generation needs under Base Case & different supply-demand stress scenarios

Scenario	Key Observations
Base Case	Sufficient natural gas infrastructure exists to meet the needs of power generation in each ERCOT transmission zone
Cold Texas	Even with additional gas demand in each ERCOT Zone, sufficient natural gas supply and available pipeline capacity exist
Cold Texas & Outside Markets	Sufficient natural gas supply and available pipeline capacity exist, albeit at higher prices to meet the additional gas demand from outside markets
Tropical Cyclone Supply Disruption	Limited impact on regional Texas market prices/basis Sufficient supply and pipeline infrastructure exists to meet the peak summer power generation gas demand
Pipeline Disruption	Limited impact on regional Texas market prices/basis

# KEY OBSERVATIONS & CONCLUSIONS – TASK D

- Several government agencies make authoritative decisions that affect development permits for natural gas infrastructure
- Texas agencies can influence permit decisions affecting water or land use
- Air quality related to natural gas development is an issue for the Dallas, Houston and San Antonio regions
- Water availability has been recognized as an issue in the Dallas and San Antonio regions (Odessa not yet studied) and drought remains a concern

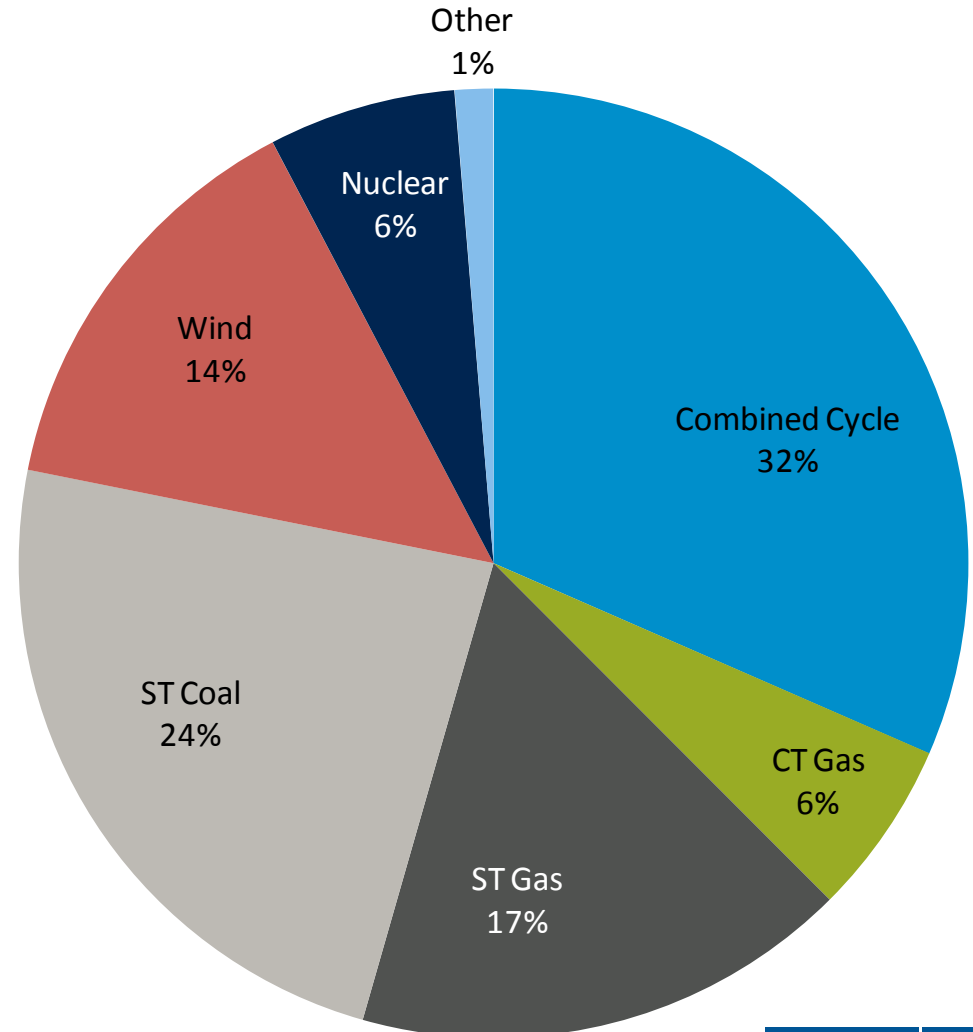
# DISCUSSION OUTLINE

- A. **Review of Current Natural Gas-Fired Generation and Infrastructure supporting Power Generation Needs**
- B. Review of Projected Natural Gas Demand for Electric Generation (2020-2030)
- C. Assessment of sufficiency of Natural Gas Infrastructure to serve electric generation needs
- D. Identification of Regional Constraints in adding Natural Gas Infrastructure

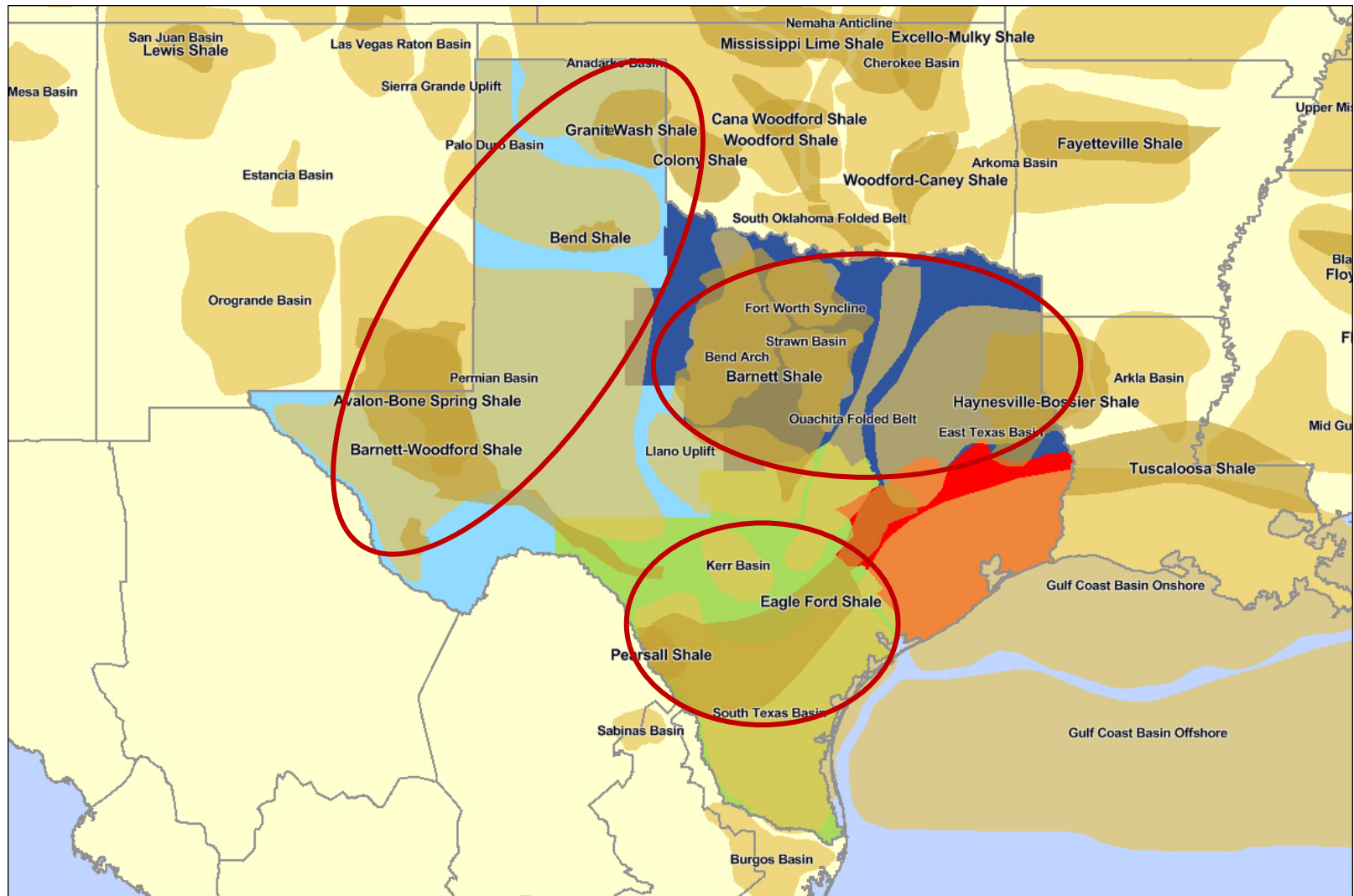
# KEY OBSERVATIONS – ERCOT GENERATION CAPACITY

- Gas fired generation capacity makes up close to 50% of firm capacity across all ERCOT subregions
- Recent wind generation capacity additions have occurred in the South and West Zones
- The share of combustion turbine and combined cycle capacity expected to grow with additional steam turbine retirements

ERCOT - Summer Capacity (MW)

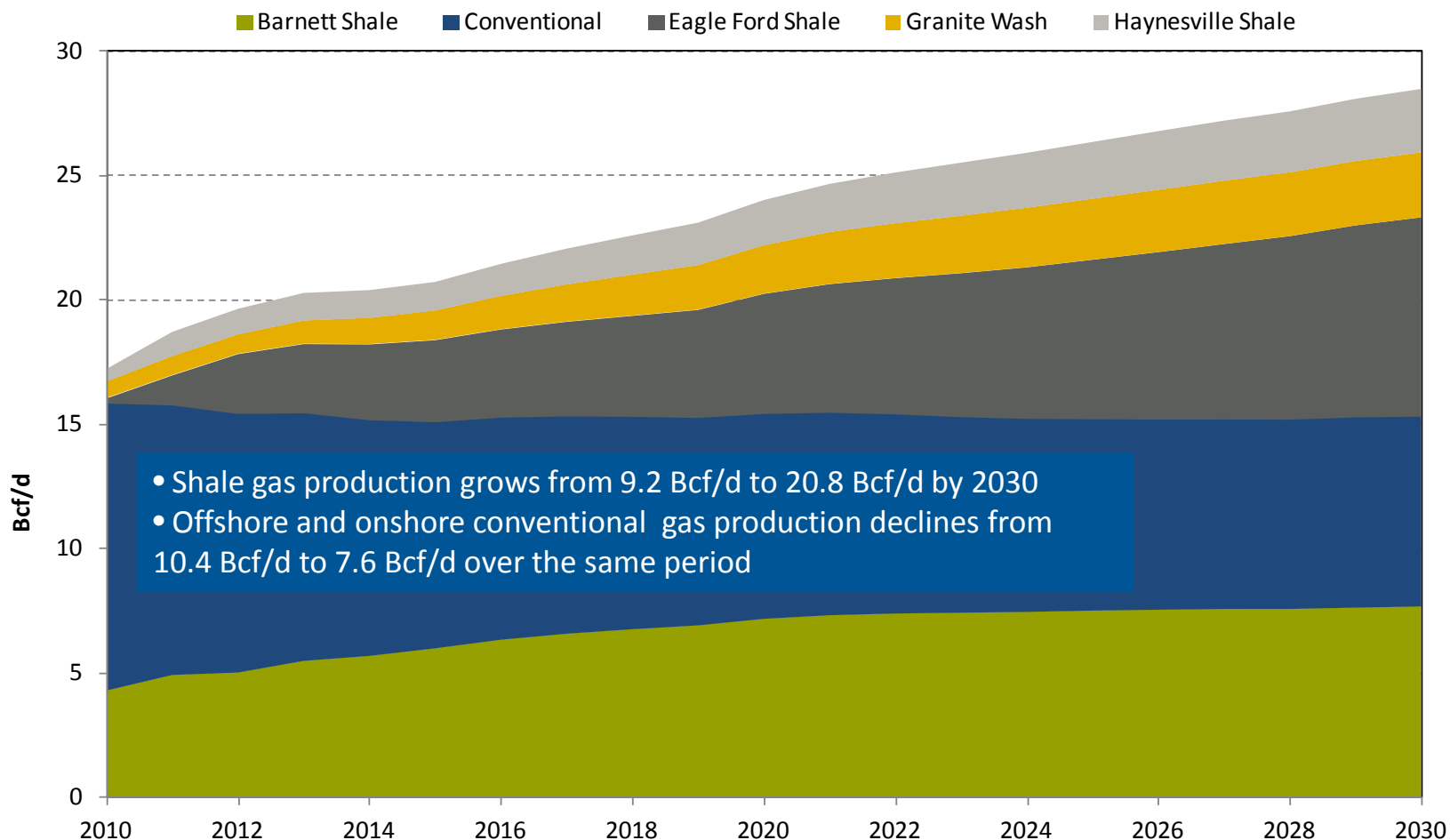


# TEXAS BENEFITS FROM MULTIPLE NATURAL GAS PRODUCTION AREAS SPREAD ACROSS THE STATE



# TEXAS PRODUCTION IS EXPECTED TO GROW BY 8.5 BCF/D BY 2030

## Historical and Projected Texas Production by Region 2010-2030





# EMERGING SHALES OFFER ABUNDANT SUPPLY AND REDEFINE TRADITIONAL MARKET DYNAMICS

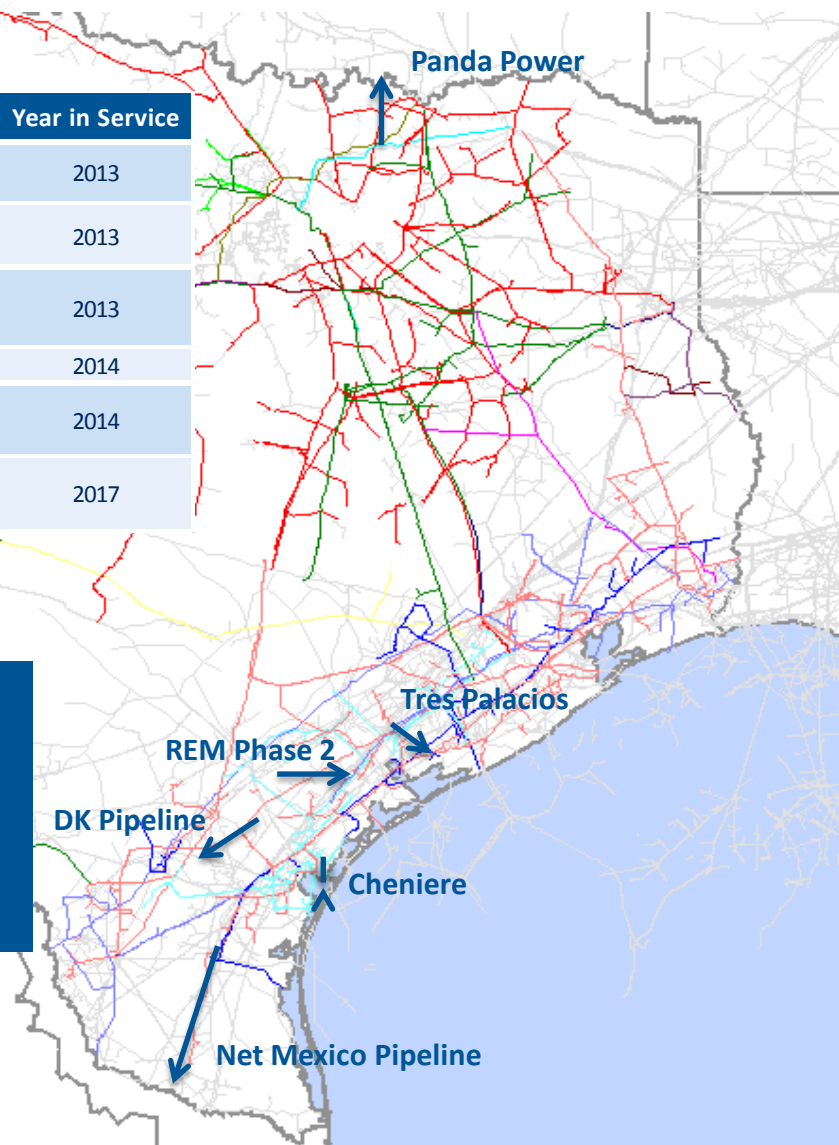




# EAGLE FORD SHALE PRODUCTION STIMULATES SHORT-HAUL MIDSTREAM PIPELINE CAPACITY

Project Name	Owner	Capacity (Dth)	Development Status	Year in Service
DK Pipeline Extension	Copano Energy LLC	350,000	Announced	2013
Rich Eagle Ford Mainline Expansion (REM) Phase 2	Energy Transfer Partners LP	194,742	Announced	2013
Tres Palacios Copano Interconnect	Tres Palacios Gas Storage LLC	292,113	Construction Begun	2013
NET Mexico Pipeline	NET Midstream	2,044,791	Announced	2014
Panda Power Lateral Project	Gulf Crossing Pipeline Co.	125,000	Early Development	2014
Cheniere Corpus Christi Pipeline Project	Cheniere Energy Inc.	2,190,847	Early Development	2017

- Incremental Intrastate capacity focused on moving Eagle Ford Shale production to Gulf Coast processing or downstream markets
- No large, long-haul pipeline projects expected
- LNG and Mexican pipeline exports will compete with regional power generators for supplies



# DISCUSSION OUTLINE

- A. Review of Current Natural Gas-Fired Generation and Infrastructure supporting Power Generation Needs
- B. **Review of Projected Natural Gas Demand for Electric Generation (2020-2030)**
- C. Assessment of sufficiency of Natural Gas Infrastructure to serve electric generation needs
- D. Identification of Regional Constraints in adding Natural Gas Infrastructure

# ELECTRIC GENERATION ASSUMPTIONS

- **Black & Veatch utilized ERCOT's Long-Term Transmission Analysis\* (ERCOT 2013 Long-Term Transmission Analysis) to establish electric generation assumptions within ERCOT**
  - At ERCOT's request, Black & Veatch utilized assumptions and outputs of the Business as Usual with All Tech Scenario, developed to be consistent with EIA's Annual Energy Outlook, and designed to simulate today's market conditions, extended 20 years into the future
- **For all other remaining North American markets, Black & Veatch utilized its 2013 Energy Market Perspective to derive assumptions on electric generation**
  - Our Energy Market Perspective is a proprietary view of electric generation load, power generation technology and fuel costs, and environmental regulations
  - Utilizes an integrated model approach to analyze the impact of various power generation fuels, policy drivers, and technologies on regional dispatch decisions and projected capacity retirements

*\*ERCOT Interconnection Long-Term Transmission Analysis, 2012-2032, ERCOT, Summer 2013.*

# ELECTRIC GENERATION ASSUMPTIONS AND TRENDS

- **ERCOT – Business as Usual with All Tech**

- Additional 17,600 MW of natural gas fired generation capacity from 2017 through 2030
  - 10,800 MW of Combined Cycle, 6,800 MW of Combustion Turbine selected from a set of resource technologies
- No capacity retirements; expiration of the production tax credit results in no renewable capacity additions
- Residential demand response of 2,200 MW and industrial demand response of 500 MW each year

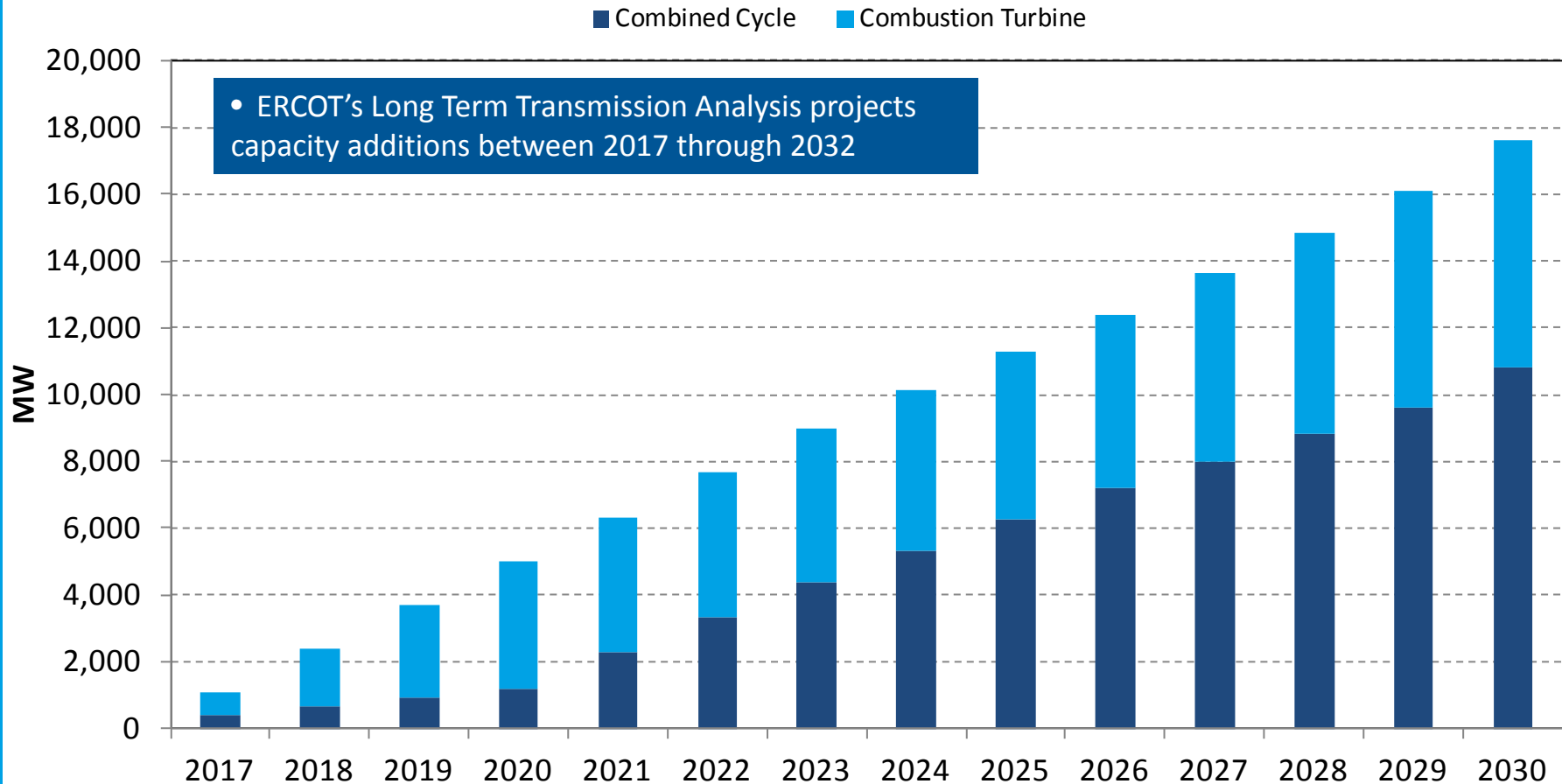
- **Lower 48 – Black & Veatch's Energy Market Perspective**

- Additional 170,000 MW of natural gas fired generation capacity by 2030
  - 143,000 MW of combined cycle, 27,000 MW of combustion turbine capacity
- 77,000 MW of coal retirements and 90,000 MW of renewable capacity additions by 2030

- **Overall, the retirement of coal generation capacity leads to the addition of G/H class base load gas fired combined cycle capacity, supplemented by renewables and combustion turbine capacity**

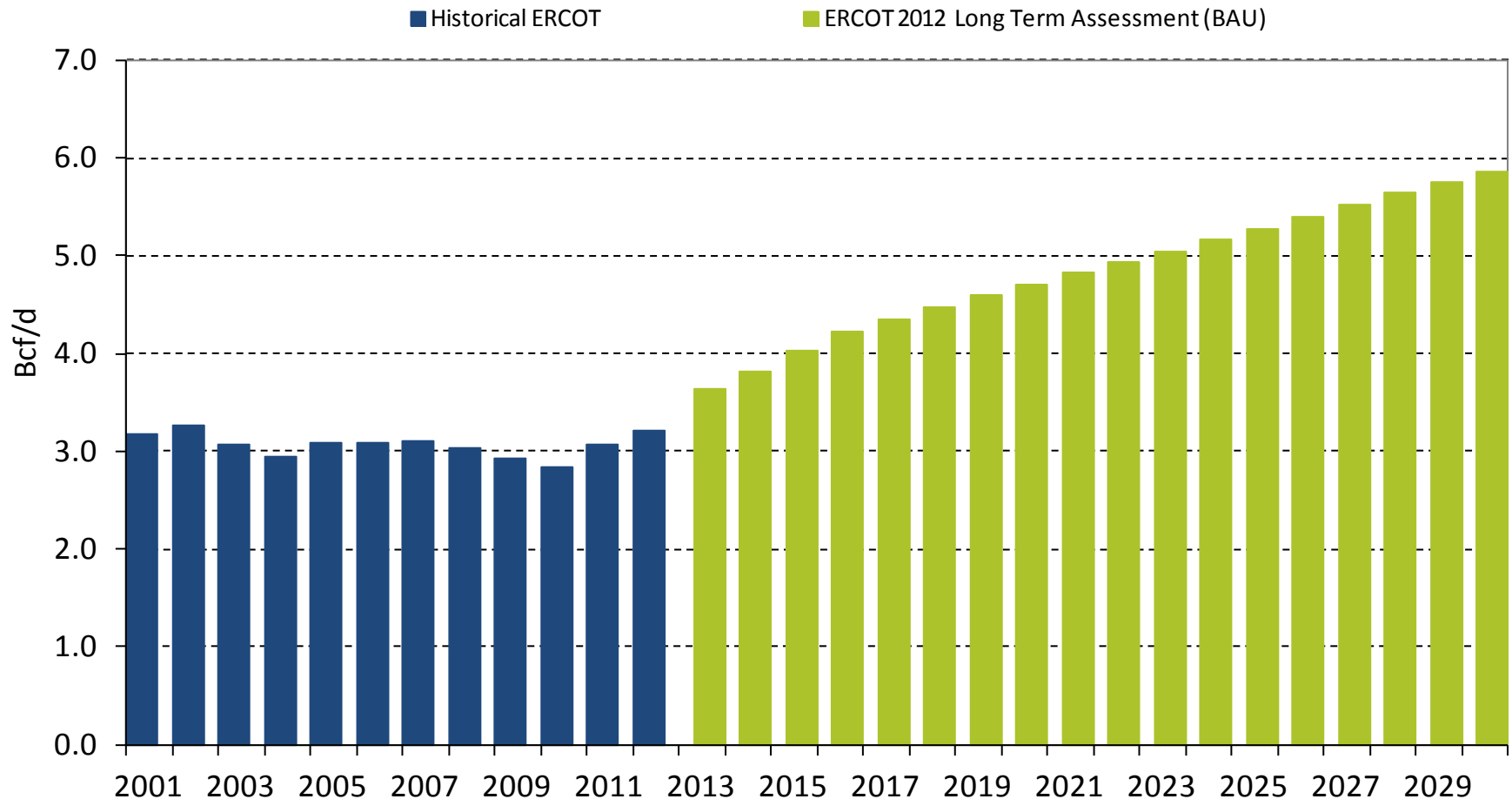
# PROJECTED ERCOT GAS-FIRED GENERATION CAPACITY ADDITIONS EXCEED 17,000 MW BY 2030

## Projected Cumulative ERCOT Generation Capacity Additions



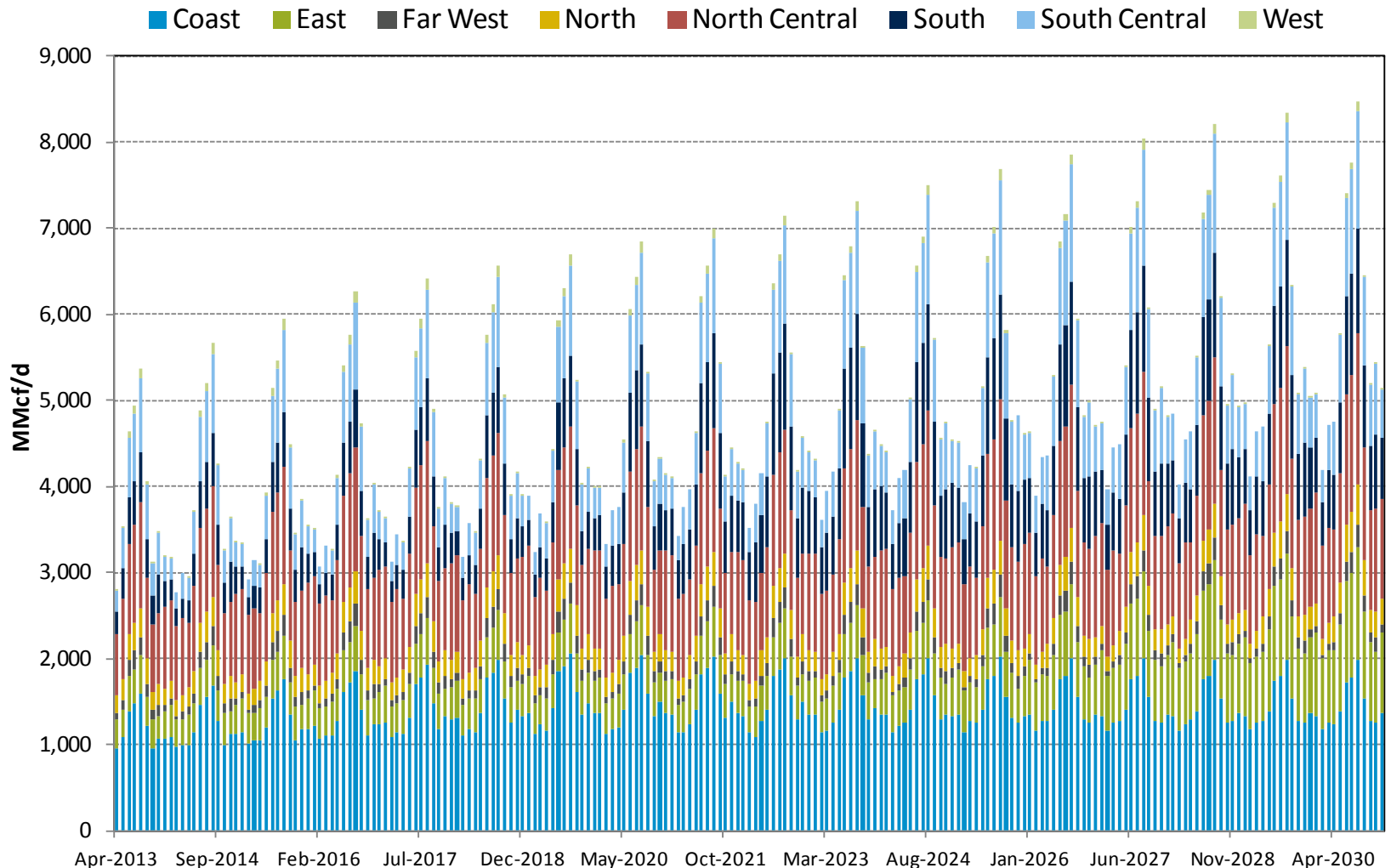
# ERCOT PROJECTS GAS DEMAND GROWTH FOR ELECTRIC GENERATION TO NEARLY DOUBLE BY 2030

ERCOT Natural Gas Demand for Power Generation

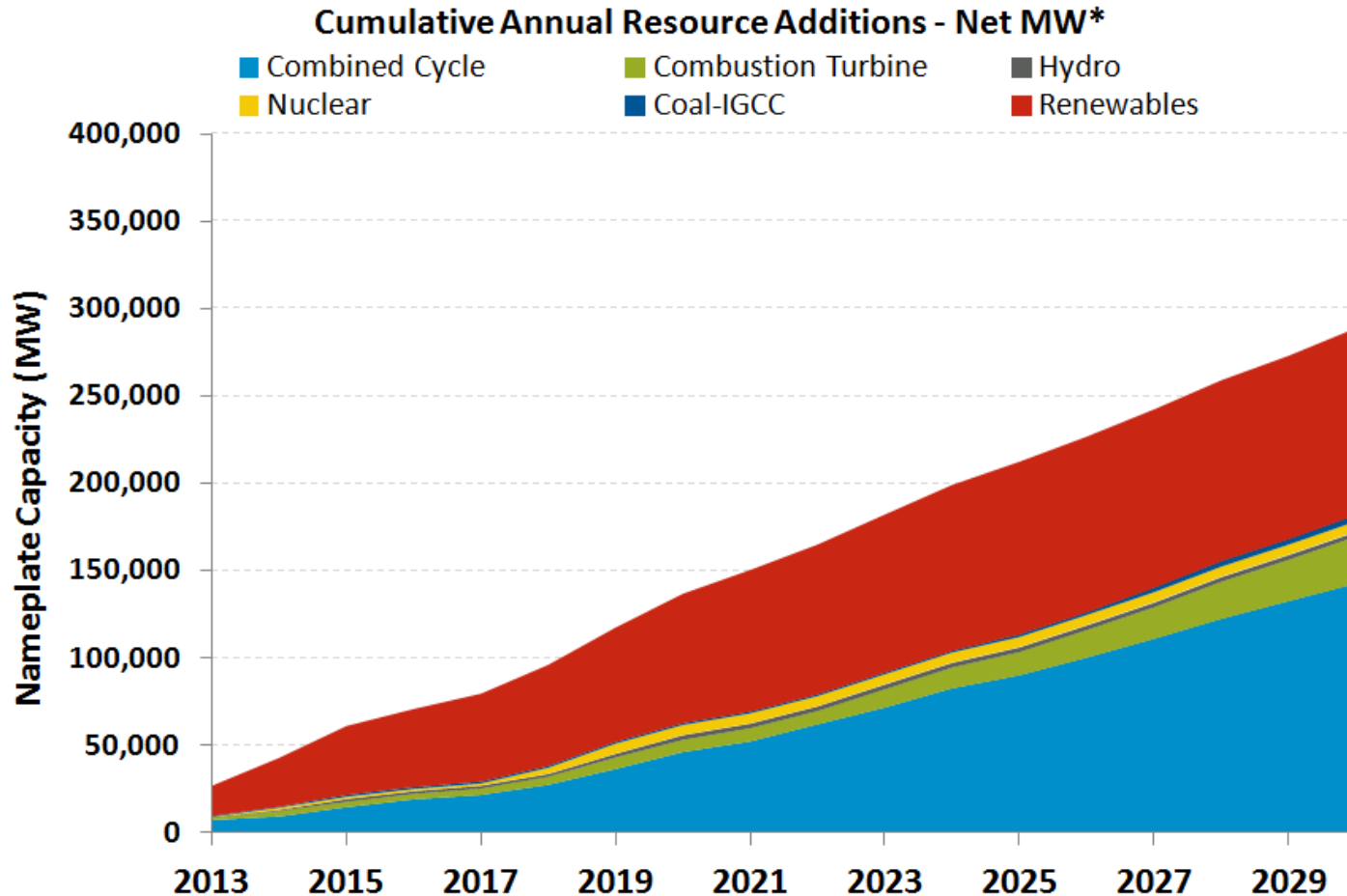


# SIGNIFICANT SEASONAL VARIATION IN ERCOT GAS DEMAND FOR POWER GENERATION

## Projected ERCOT Power Generation Demand by Weather Zone



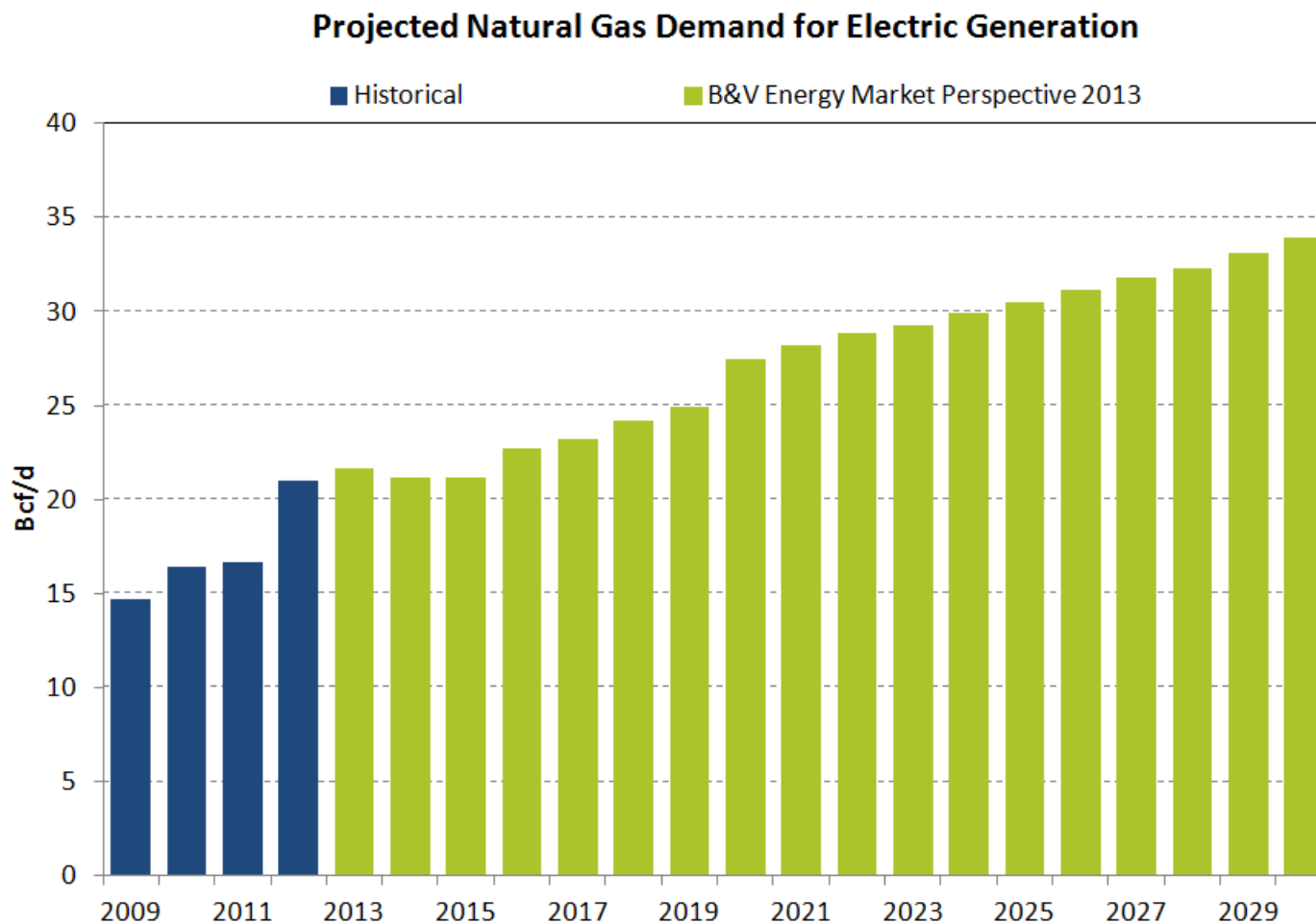
# PROJECTED LOWER 48, NON-ERCOT CUMULATIVE CAPACITY ADDITIONS, NEARLY 300,000 MW BY 2030



\*Net capacity takes into account both additions and retirements



# LOWER 48, NON-ERCOT NATURAL GAS DEMAND FOR ELECTRIC GENERATION NEARLY 35 BCF/D BY 2030



# DISCUSSION OUTLINE

- A. Review of Current Natural Gas-Fired Generation and Infrastructure supporting Power Generation Needs
- B. Review of Projected Natural Gas Demand for Electric Generation (2020-2030)
- C. **Assessment of Sufficiency of Natural Gas Infrastructure to Serve Electric Generation Needs**
- D. Identification of Regional Constraints in Adding Natural Gas Infrastructure

# SUMMARY FINDINGS – BASE CASE

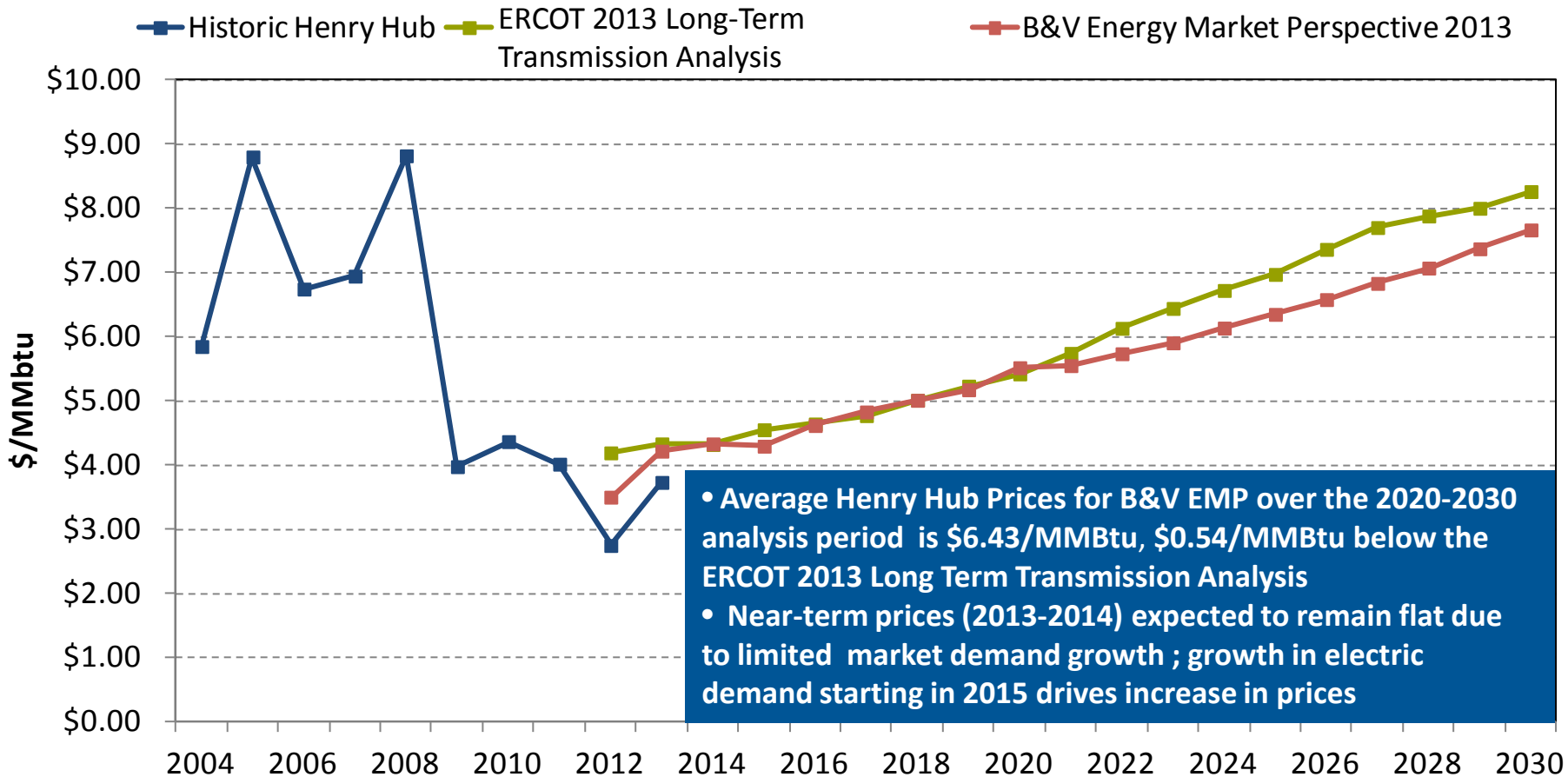
- Under the Base Case, sufficient pipeline infrastructure exists to meet the needs of power generation in each ERCOT transmission zone
- Growth in Texas production is expected to support regional demand growth and maintain pipeline exports to Lower 48 markets
- Throughout the analysis period, close to 50% of Texas production will be consumed by markets outside of ERCOT
- Sufficient natural gas supply and capacity exist to serve gas demand for power generation in ERCOT

# STUDY APPROACH

- The assessment examined the supply-demand balance for each ERCOT zone and entire ERCOT under the designed scenarios
  - The supply-demand balance indicates whether the projected supply in Texas exceeds regional demand for natural gas throughout the study period under the scenarios examined
- Market price responses offer another indicator of tightness in the natural gas market.
  - An increase in overall price level or regional basis is an indicator that additional higher cost supply is needed to meet the level of demand experienced in the market
  - The market price and basis response reflects the integrated nature of the North America natural gas market

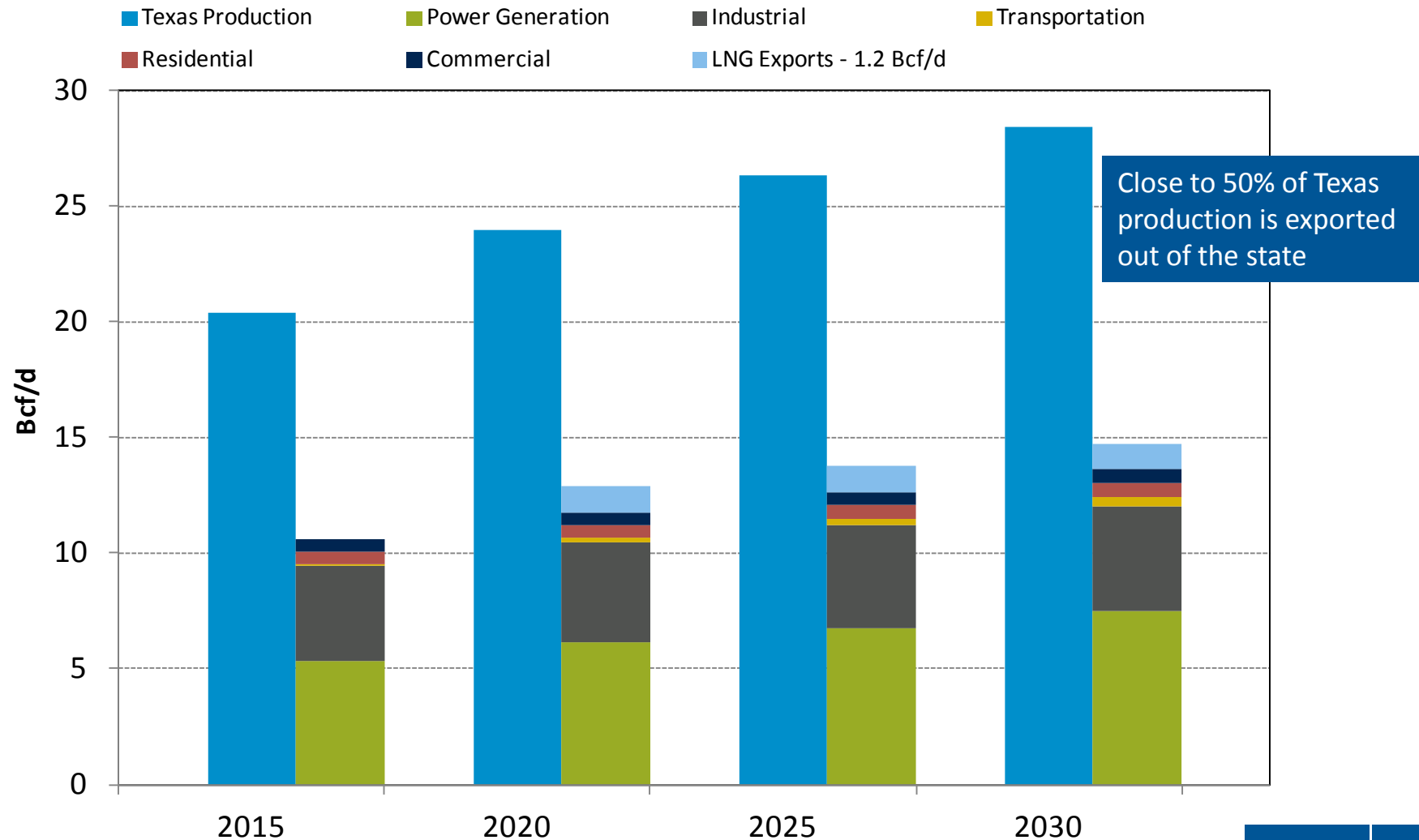
# B&V'S PROJECTED HENRY HUB PRICE RISES FROM \$5.00 TO \$8.00/MMBTU OVER THE ANALYSIS PERIOD

## Comparison of Henry Hub Natural Gas Prices

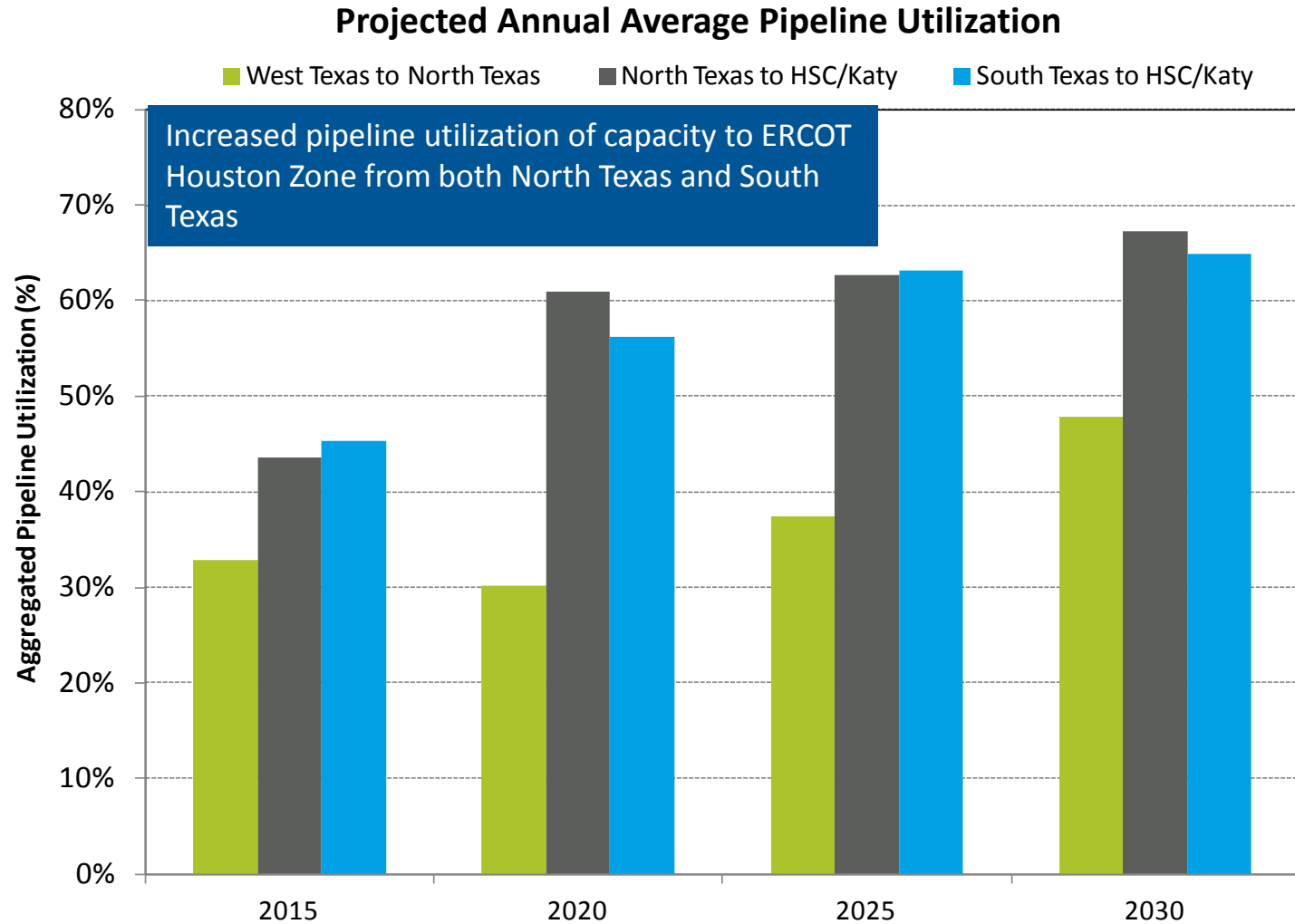


# PROJECTED TEXAS PRODUCTION GROWTH SUPPORTS REGIONAL DEMAND AND EXPORTS

## Projected Texas Supply and Demand Balance

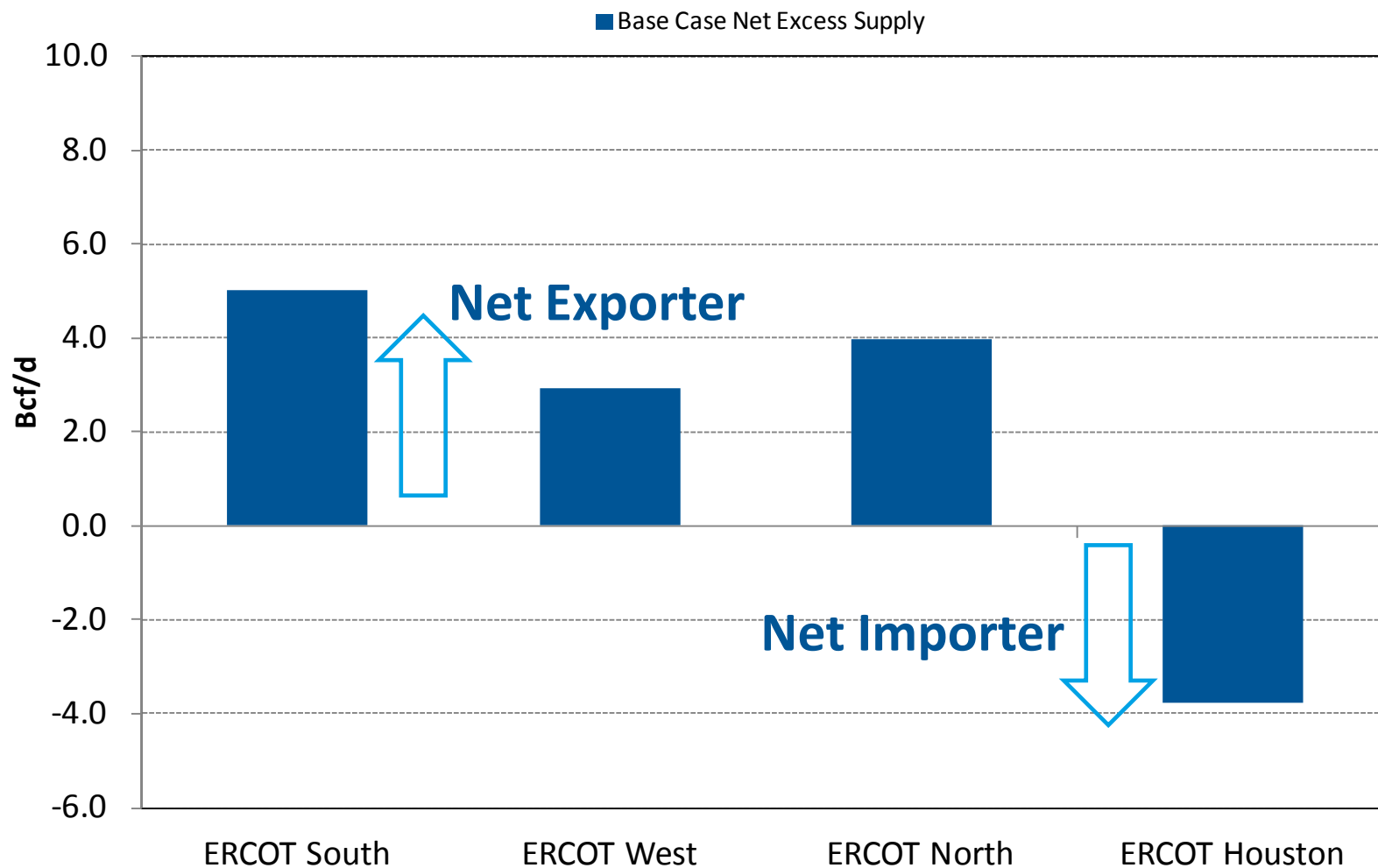


# PIPELINE UTILIZATION INCREASES TO SUPPORT TEXAS DEMAND GROWTH AND EXPORTS



# ERCOT HOUSTON IS THE ONLY ZONE WITH NET IMPORT NEEDS

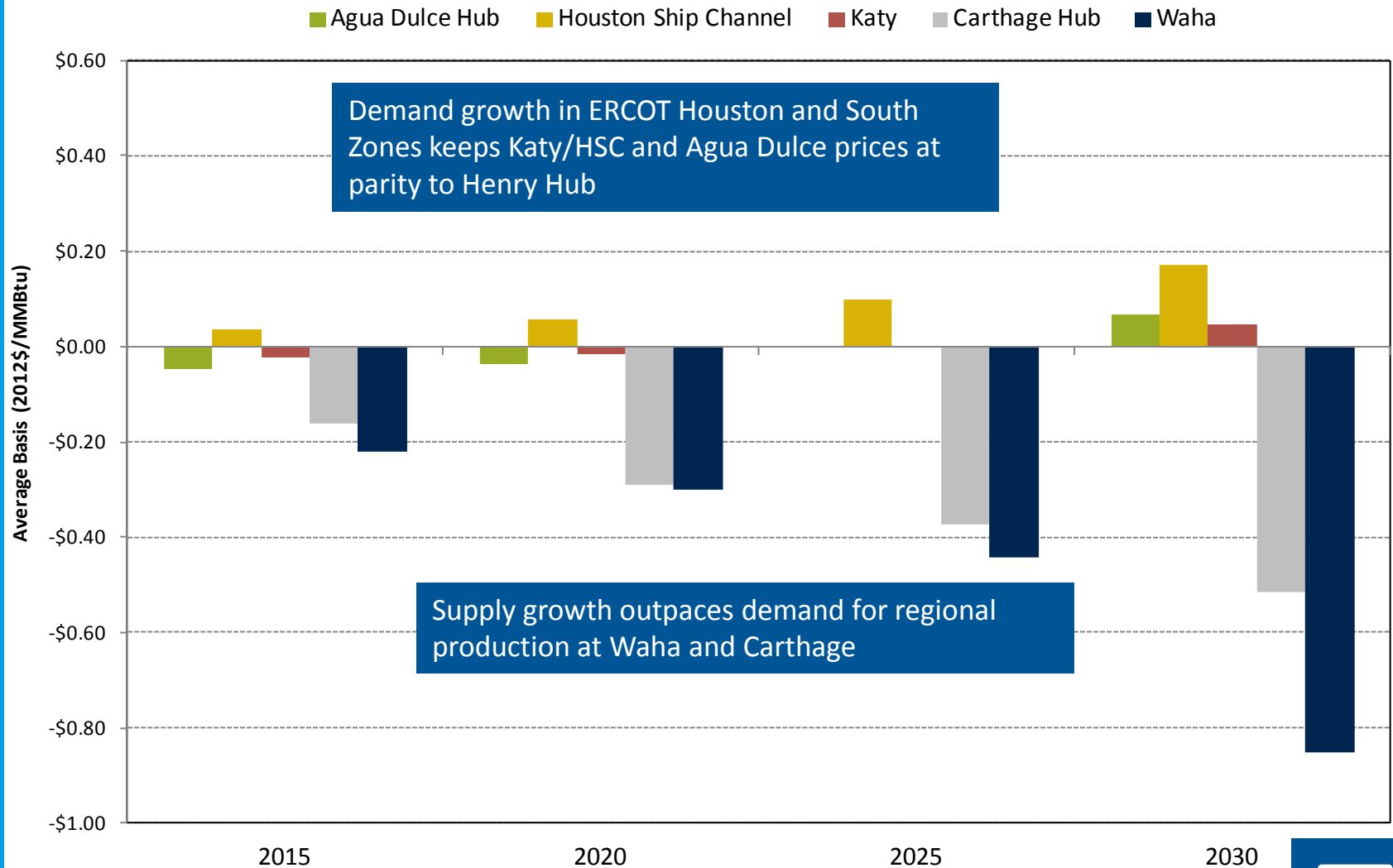
Projected Supply and Demand Balance Across Scenarios- 2030





# TEXAS MARKET AREA PRICES EXPECTED TO REMAIN LOW, TIED WITH HENRY HUB

## Projected Annual Average Basis - Texas Markets



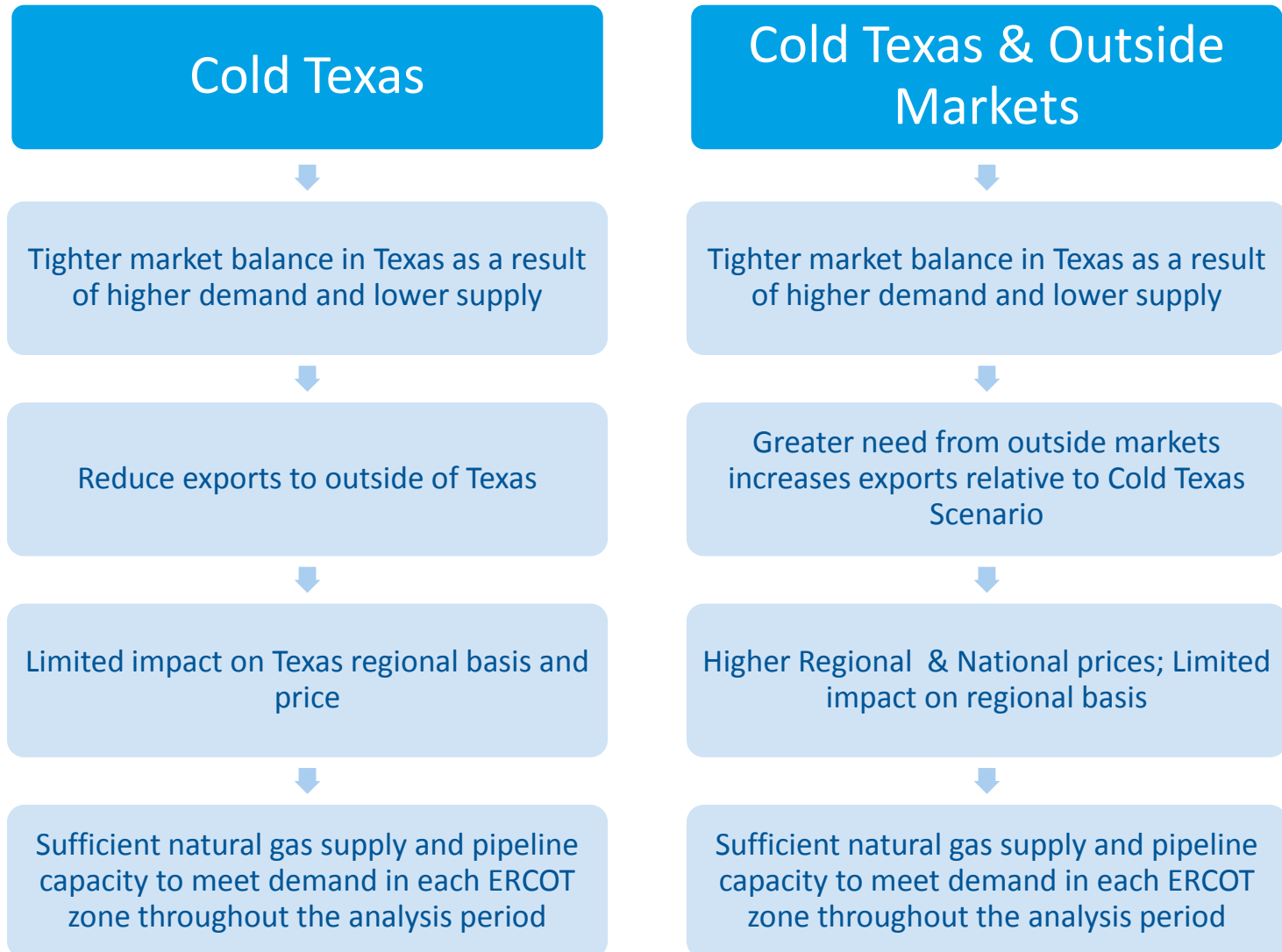
# SUPPLY AND DEMAND STRESS TEST SCENARIOS DRIVEN BY GAS CURTAILMENT RISK STUDY

- Black & Veatch's Gas Curtailment Risk Study in 2012 reviewed various data sources to identify generation loss due to natural gas curtailments
- Historical records show that leading causes of historical gas supply curtailment incidents in ERCOT were due to:
  - Winter storms/Freezes
  - Tropical cyclones
  - Pipeline failures
- This study examines the ability of the natural gas infrastructure to serve electric generation needs within ERCOT under extreme scenarios driven by these identified causes

# SCENARIO DESCRIPTIONS

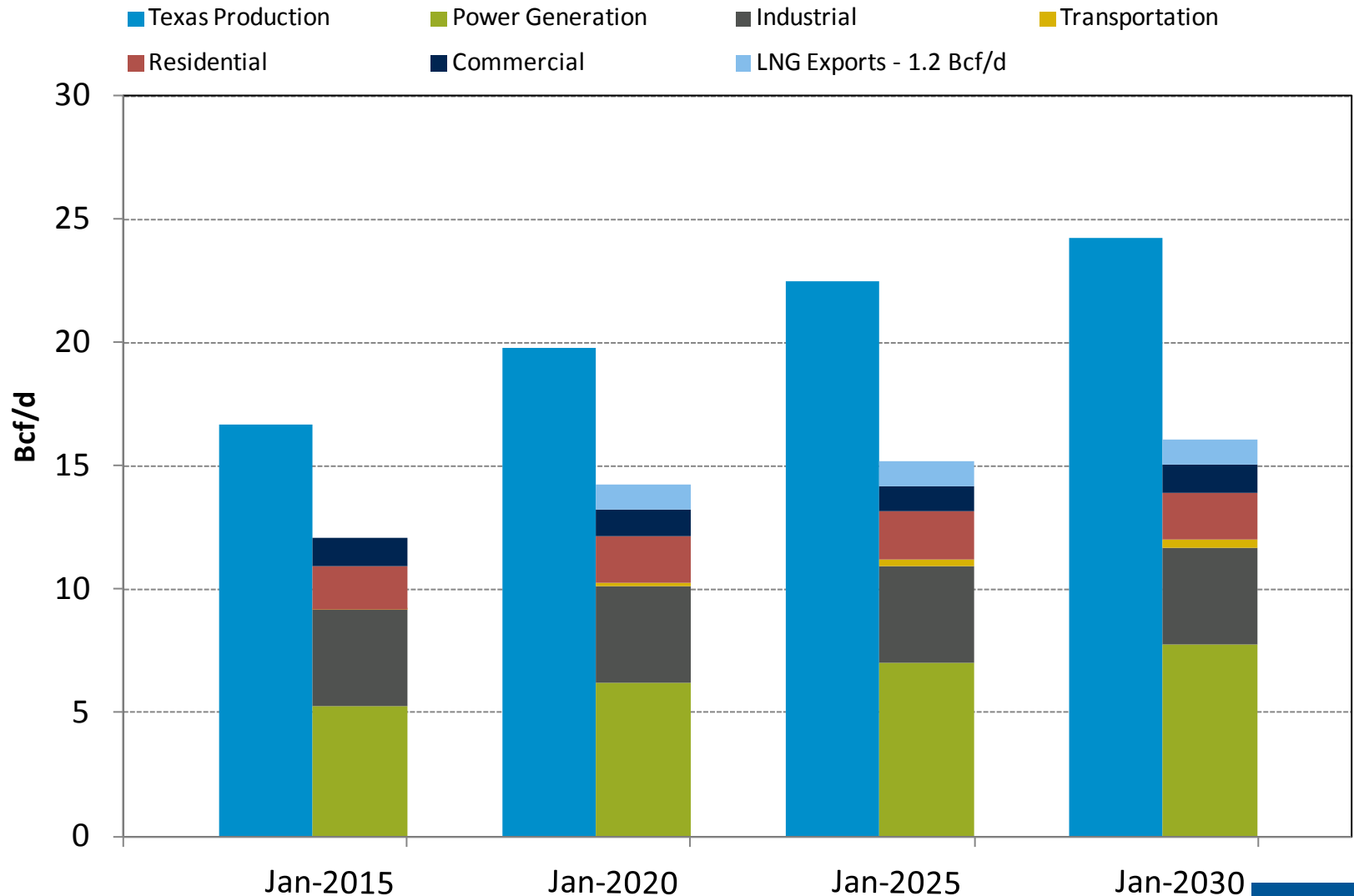
Scenario	Description
Cold Texas	Higher residential, commercial and power generation demand with some onshore production loss due to well freeze-offs
Cold Texas & Outside Markets	Same as Cold Texas, with higher residential and commercial demand in key export markets in Midwest, Northeast and Southeast markets
Tropical Cyclone Supply Disruption	A 46% reduction of offshore GOM production during peak summer month
Pipeline Disruption	A 40% reduction of pipeline capacity in a pipeline segment in the ERCOT Houston zone

# SUMMARY FINDINGS – COLD TEXAS AND COLD TEXAS & OUTSIDE MARKETS



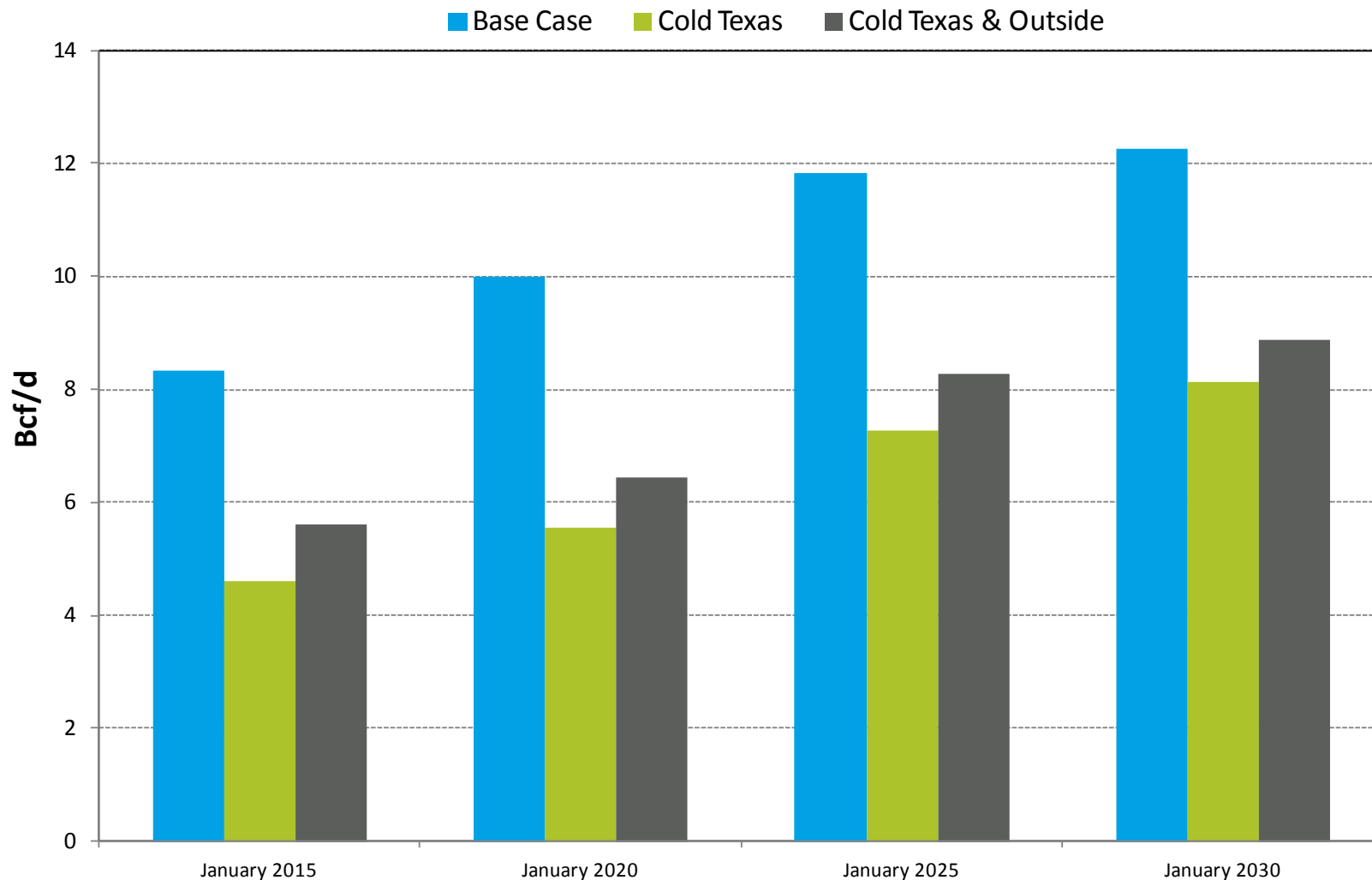
# COLD TEXAS SCENARIO – REDUCES AVAILABLE TEXAS EXPORTS BY 6 BCF/D BY 2030

## Projected Texas Supply and Demand Balance - Cold Texas



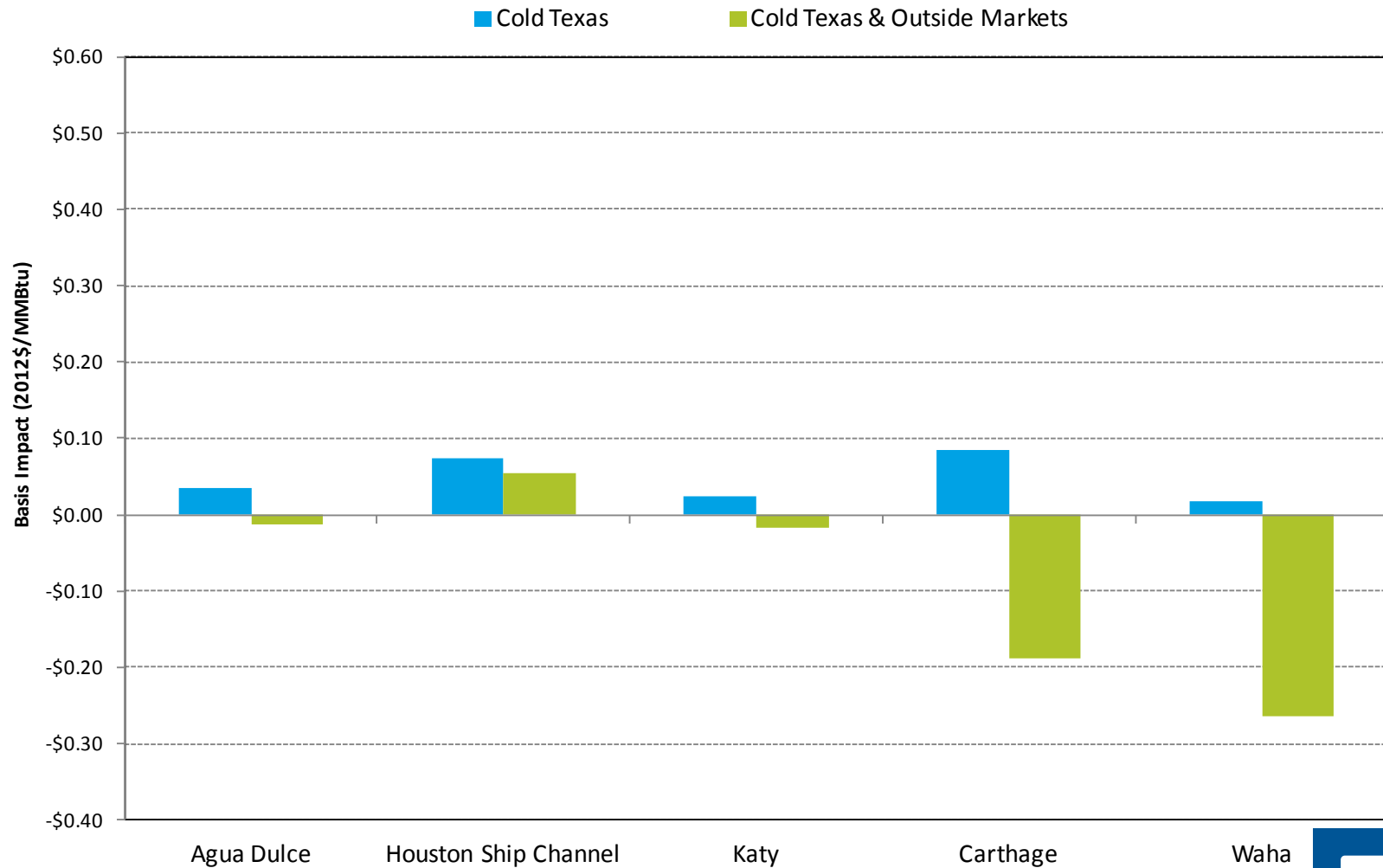
# NET PIPELINE EXPORTS FROM TEXAS ARE REDUCED UNDER THE TWO EXTREME WEATHER SCENARIO

Projected NET Pipeline Exports from Texas



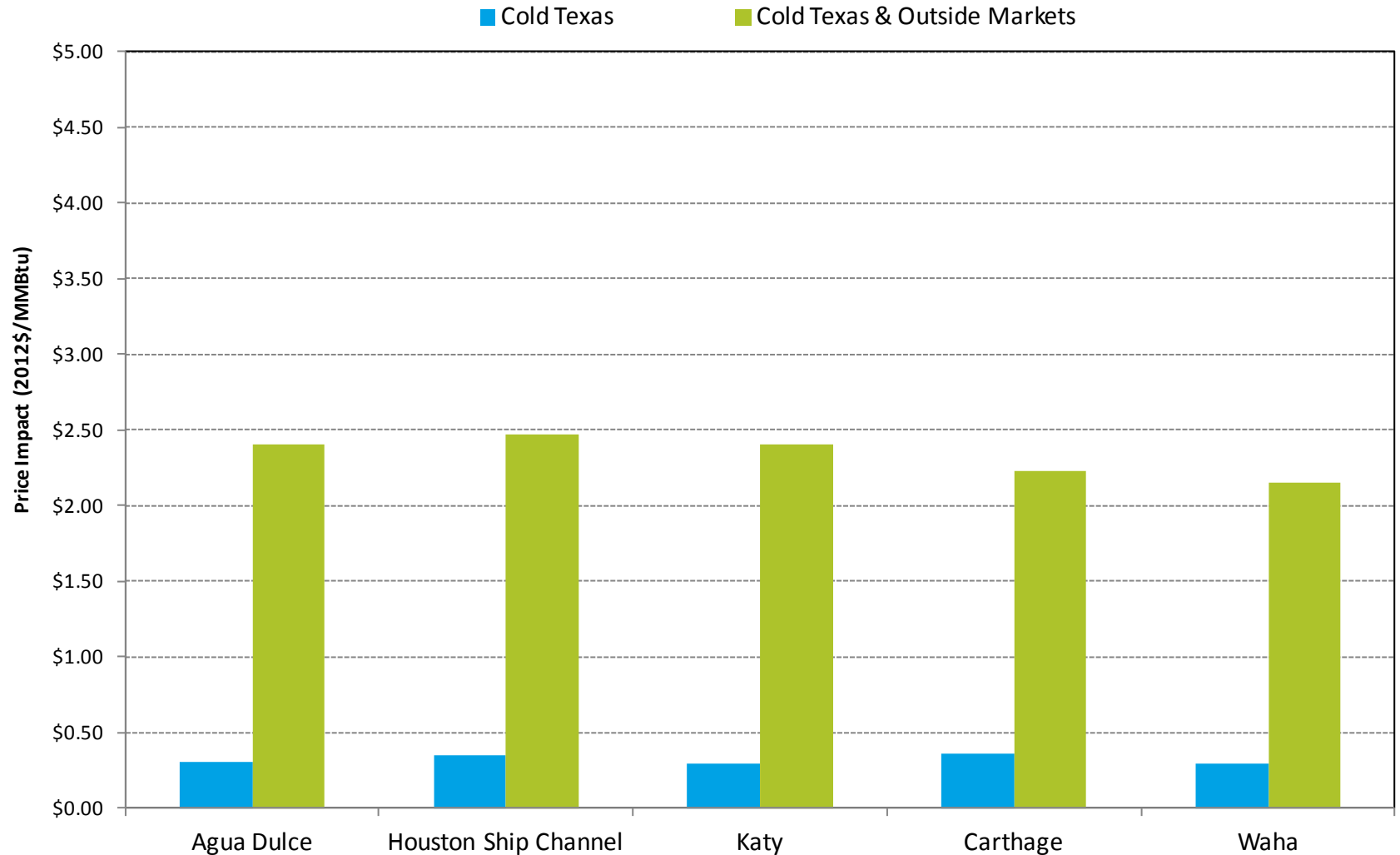
# COLD TEXAS AND COLD TEXAS & OUTSIDE MARKETS HAVE LIMITED IMPACT ON REGIONAL BASIS

Average Basis Impacts Across Scenarios - Texas Markets



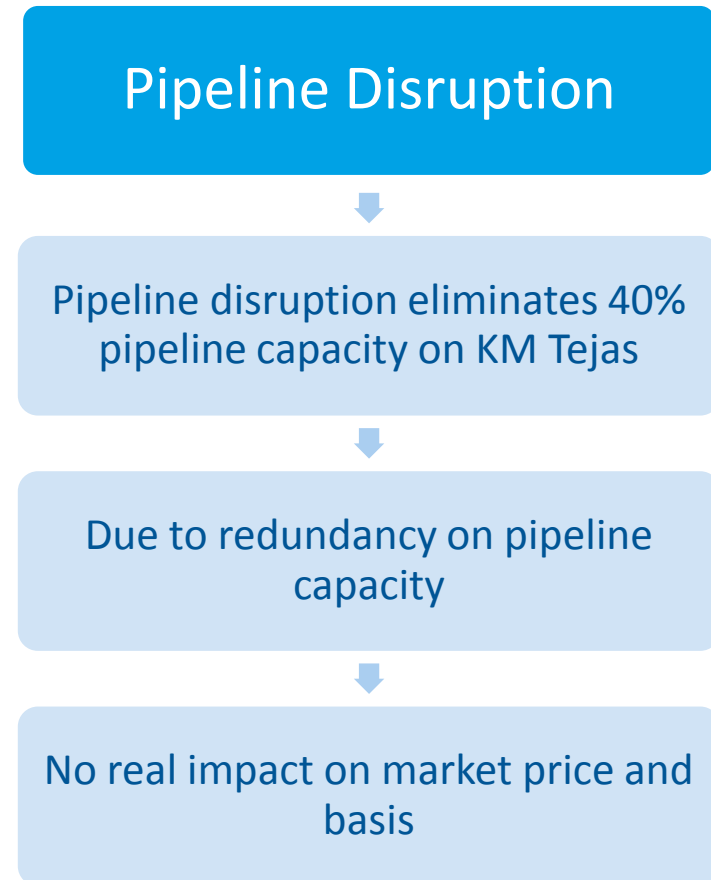
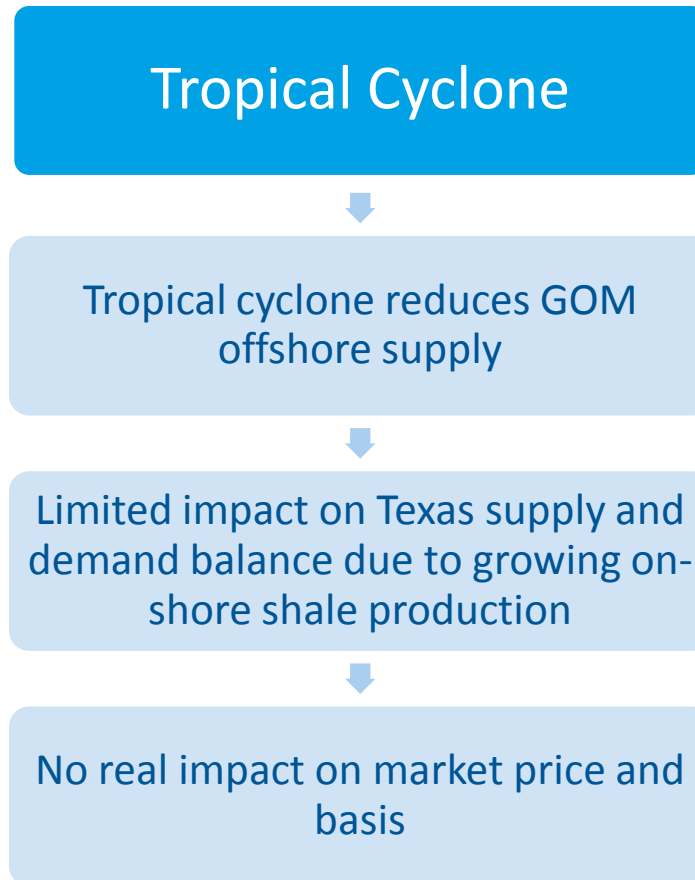
# EXTREME WEATHER ACROSS TEXAS AND OTHER MARKETS RAISES NATIONAL AND REGIONAL PRICES

## Average Price Impacts Across Scenarios - Texas Markets





# TROPICAL CYCLONE & PIPELINE DISRUPTION HAVE LIMITED IMPACTS ON THE ERCOT MARKET



# DISCUSSION OUTLINE

- A. Review of Current Natural Gas-Fired Generation and Infrastructure supporting Power Generation Needs
- B. Review of Projected Natural Gas Demand for Electric Generation (2020-2030)
- C. Assessment of sufficiency of Natural Gas Infrastructure to serve electric generation needs
- D. **Identification of Regional Constraints in adding Natural Gas Infrastructure**

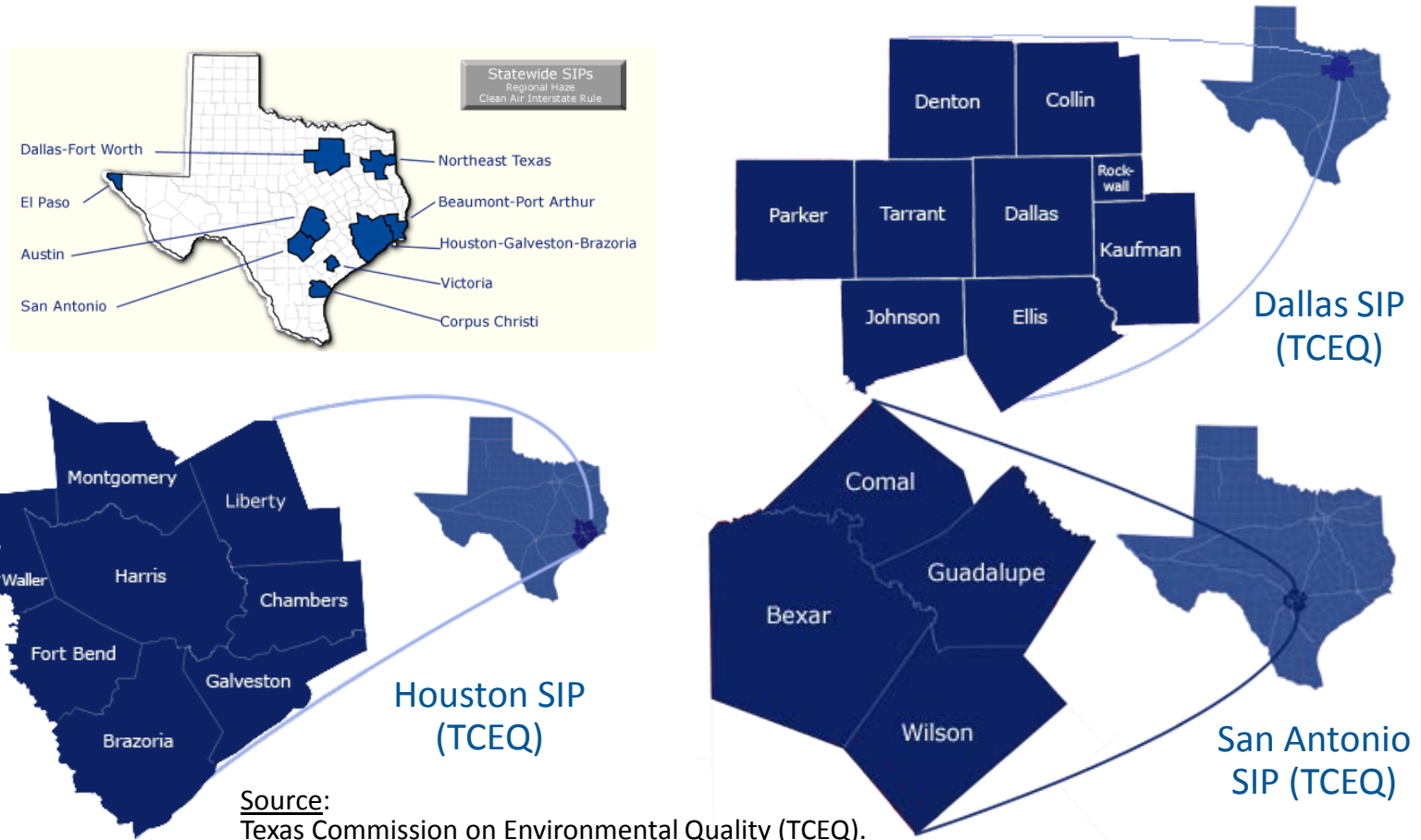
# SUMMARY OBSERVATIONS – TASK D

- **At least three government agencies make authoritative decisions that affect development permits for natural gas infrastructure**
  - Railroad Commission of Texas (TXRRC)
  - Texas Commission on Environmental Quality (TCEQ)
  - US Environmental Protection Agency (EPA)
- **At least two other government agencies can influence permit decisions affecting water or land use**
  - Texas Water Development Board (TWDB)
  - Texas Parks and Wildlife Department (TPWD)
- **Air quality related to natural gas development is an issue for the Dallas, Houston and San Antonio regions**
  - Gas flaring is an emerging issue in the Eagle Ford region
- **Water availability has been recognized as an issue in the Dallas and San Antonio regions (Odessa not yet studied) and drought remains a concern**
  - TXRRC has concluded there is no problem (reliance on groundwater) although the issue remains debated for Eagle Ford region
  - TWDB and TCEQ remain more cautious (issues of drought and aquifer recharge)
- **Endangered species (both plants and animals) are recognized by EPA/TPWD in all highlighted development areas**

**Development issues have evolved rapidly since 2008 and consensus has not been reached regarding go-forward plans**

# ENVIRONMENTAL CONCERNS: AIR QUALITY

- Dallas, Houston and San Antonio all are under TCEQ State Implementation Plan (SIP) supervision to improve air quality per EPA
- For now, Odessa and Brownsville are not under SIPs



**Air quality issues involve traffic and facilities needed to build and operate natural gas infrastructure**

## INFRASTRUCTURE ISSUES IN THE EAGLE FORD SHALE AREA\*: ROADS, PIPELINES, WATER AND FLARING (1 OF 3)

- Roads are inadequate and cannot be properly maintained under the load growth of development traffic
  - Loaded trucks needed per gas well:
    - 1,184 to bring well into production
    - 353 per year to maintain production
    - 997 for refracturing (every 5 years)
  - Road costs are \$80K/mi/year O&M upward to \$1.9MM/mi if new build
- Pipeline construction would help reduce at least some truck traffic but some legal issues have slowed pipeline development
  - 20-inch crude oil pipeline running 50 miles would displace 1,250 tank truck trips per day
  - The presumed access to eminent domain for obtaining right of way was made uncertain by *Texas Rice Land Partners, Ltd. v. Denbury Green Pipeline-Texas, L.L.C.*, 363 S.W.3d 192 (Tex. 2012)
  - TXRRC has no authority to intervene on behalf of pipeline developers and some projects have slowed their plans

\*Source: Railroad Commission of Texas(TXRRC).

[http://www.rrc.state.tx.us/commissioners/porter/reports/Eagle\\_Ford\\_Task\\_Force\\_Report-0313.pdf](http://www.rrc.state.tx.us/commissioners/porter/reports/Eagle_Ford_Task_Force_Report-0313.pdf)

**Heavy wear on overloaded roads has become a somewhat unexpected bottleneck for other development objectives**



## INFRASTRUCTURE ISSUES IN THE EAGLE FORD SHALE AREA\*: ROADS, PIPELINES, WATER AND FLARING (2 OF 3)

- Pipeline routing also is expected to address local concerns (even with eminent domain) – requiring more time to negotiate
  - Use road corridors wherever possible to minimize off-road impacts
  - Maximize distance from homes and minimize damage to natural landscape, including vegetation
- **Water availability is not totally resolved but oil & gas-related water demands are argued to be less impactful than other uses**
  - “Mining water use” (as classified by the TWDB) is 1.6% of state’s water use compared with 26.9% municipal and 55.9% irrigation
  - Actual “mining water” percentages are higher in the affected counties - and skewed toward groundwater for which opinions differ regarding the resource adequacy
  - Considers viable solutions to include a “water market” (i.e., sell water rights to the highest bidder) and a dilution of impacts by spreading groundwater demands across multiple GCDs
  - Assumes readily available injection wells for wastewater handling
  - Assumes future droughts can be handled by reassigning water rights

\*Source: Railroad Commission of Texas(TXRRC).

[http://www.rrc.state.tx.us/commissioners/porter/reports/Eagle\\_Ford\\_Task\\_Force\\_Report-0313.pdf](http://www.rrc.state.tx.us/commissioners/porter/reports/Eagle_Ford_Task_Force_Report-0313.pdf)

**A consensus has not been reached on water issues and possible upsets from future severe droughts are recognized**



## INFRASTRUCTURE ISSUES IN THE EAGLE FORD SHALE AREA\*: ROADS, PIPELINES, WATER AND FLARING (3 OF 3)

- **Gas flaring is used increasingly as gas takeaway infrastructure is lagging well construction**
  - TXRRC issues flaring permits but TCEQ issues air-emissions permits so the two agencies require close coordination to balance different criteria
  - TCEQ prefers flaring to venting
  - Some industry advocates prefer venting as more cost-effective
- **TXRRC has some internal disagreements about flaring vs. venting policies going forward**
  - Tightening requirements (less venting and more restrictive flaring) could slow development
- **There is no funding plan in place to address the roads, pipelines and water issues - although they are beyond the capabilities of the affected counties**
  - Either State of Texas will need to address or additional burden will be transferred to developers

\*Source: Railroad Commission of Texas(TXRRC).

[http://www.rrc.state.tx.us/commissioners/porter/reports/Eagle\\_Ford\\_Task\\_Force\\_Report-0313.pdf](http://www.rrc.state.tx.us/commissioners/porter/reports/Eagle_Ford_Task_Force_Report-0313.pdf)

**A consensus has not been reached on gas flaring and how related air emissions might impact future oil & gas permits**



# APPENDIX

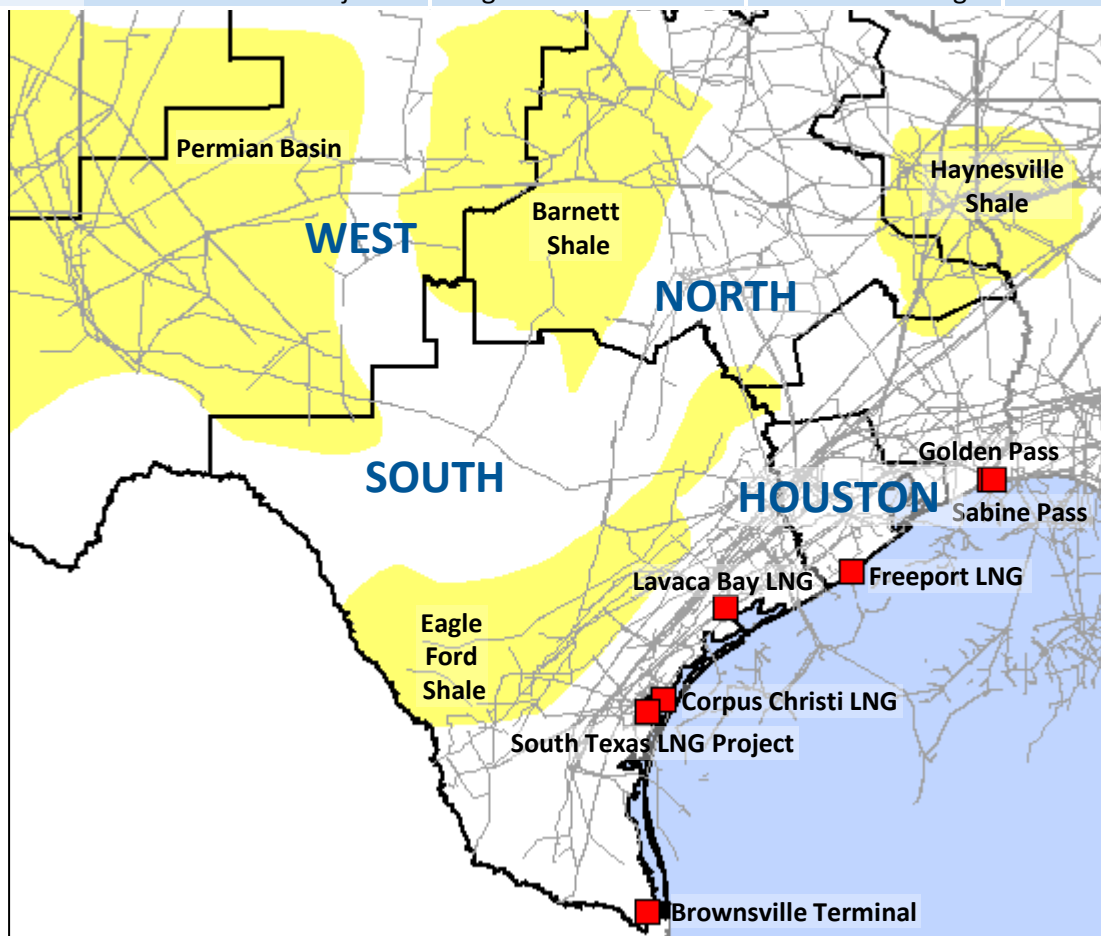


# SUMMARY FINDINGS – HIGH LNG EXPORTS AND HIGH MEXICAN PIPELINE EXPORTS

- In the High LNG Export Scenario, additional LNG exports from Freeport will have a moderate impact on regional Texas market prices/basis.
  - Sufficient pipeline infrastructure exists to meet additional LNG Export demand and peak summer power generation gas demand in the Houston region
  - Higher pipeline utilization expected from North/West Texas and South Texas to Houston to meet additional demand needs
- In the High Mexican Pipeline Export Scenario – additional 2.0 Bcf/d of incremental pipeline capacity from South Texas to Northeast Mexico will have a moderate impact on regional Texas market prices/basis
  - Northeast Mexican power generation growth coupled with reduced LNG imports will increase the utilization of existing and incremental pipelines serving the market
  - Diminished South to Houston flows will be replaced by North and West Texas imports

# LNG EXPORT TERMINAL DEVELOPMENT COULD POTENTIALLY ADD 10 BCF/D OF INCREMENTAL DEMAND

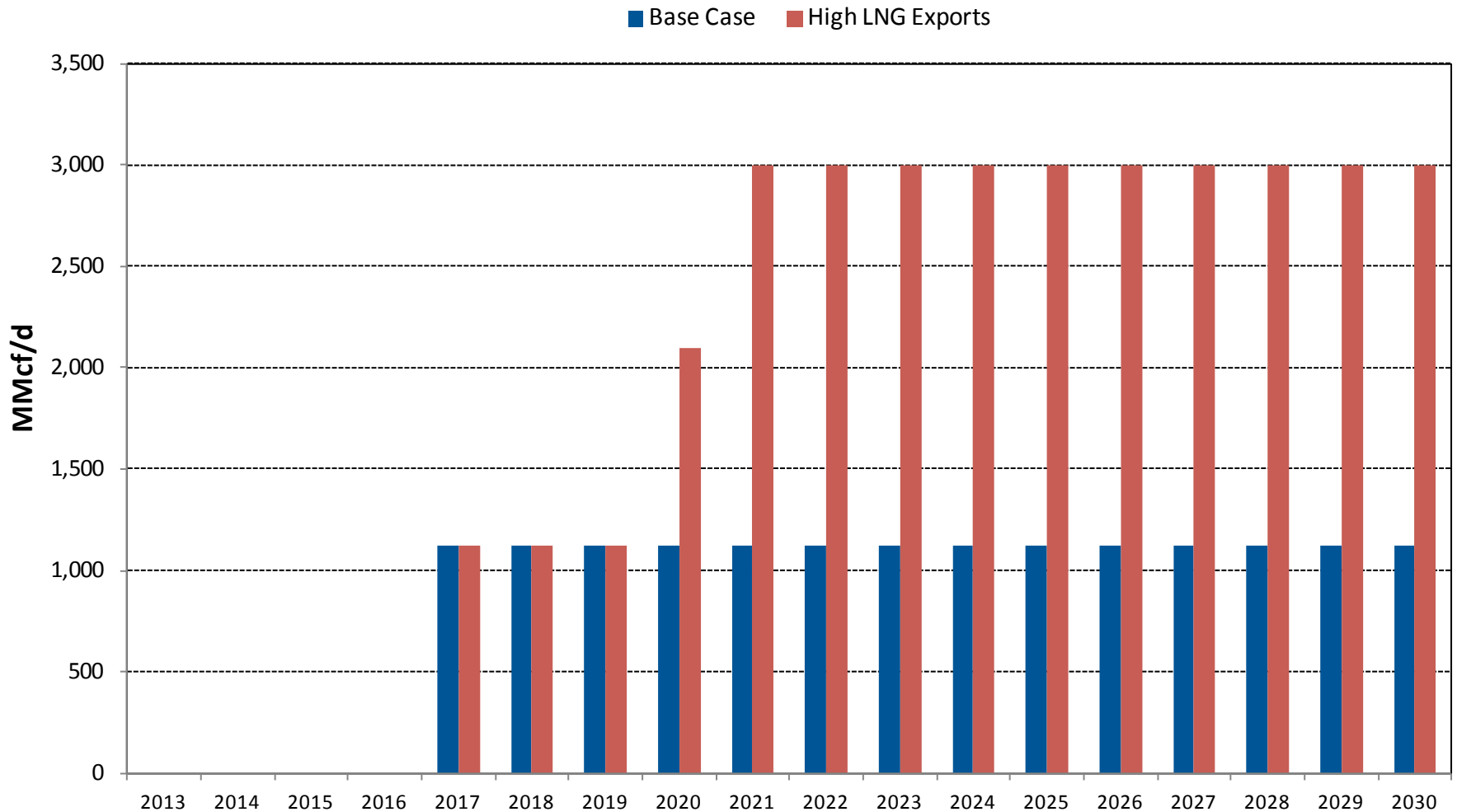
Region	Terminal Name	Sponsors	Status	Capacity (bcf/d)	Proposed Online Date
TX	Freeport LNG	Freeport LNG	Non-FTA Approved	2.8	2017
	Brownsville Terminal	Gulf Coast LNG Export	Non-FTA Pending	2.8	2018
	Lavaca Bay LNG Project	Excelerate Energy	Non-FTA Pending	1.38	4Q 2017
	Corpus Christi LNG	Cheniere Marketing	Non-FTA Pending	2.1	2017
	South Texas LNG Project	Pangea LNG B.V.	Non-FTA Pending	1.09	Apr 2018



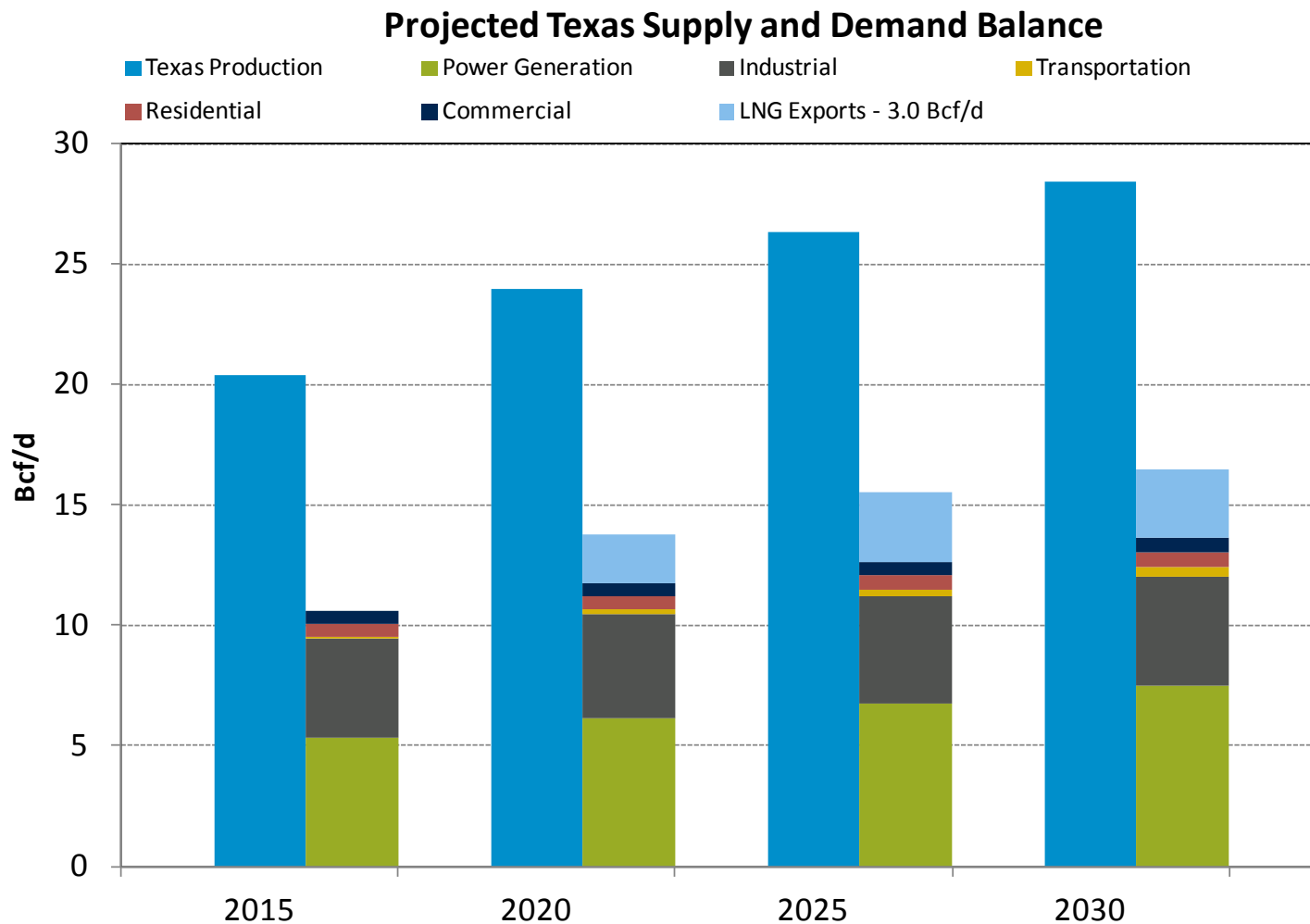
- Proposed LNG Export Facilities
- Natural Gas Pipelines
- Natural Gas Basins

# HIGHER LNG EXPORT SCENARIO – AN ADDITIONAL 2 BCF/D OF LNG EXPORTS FROM FREEPORT BY 2021

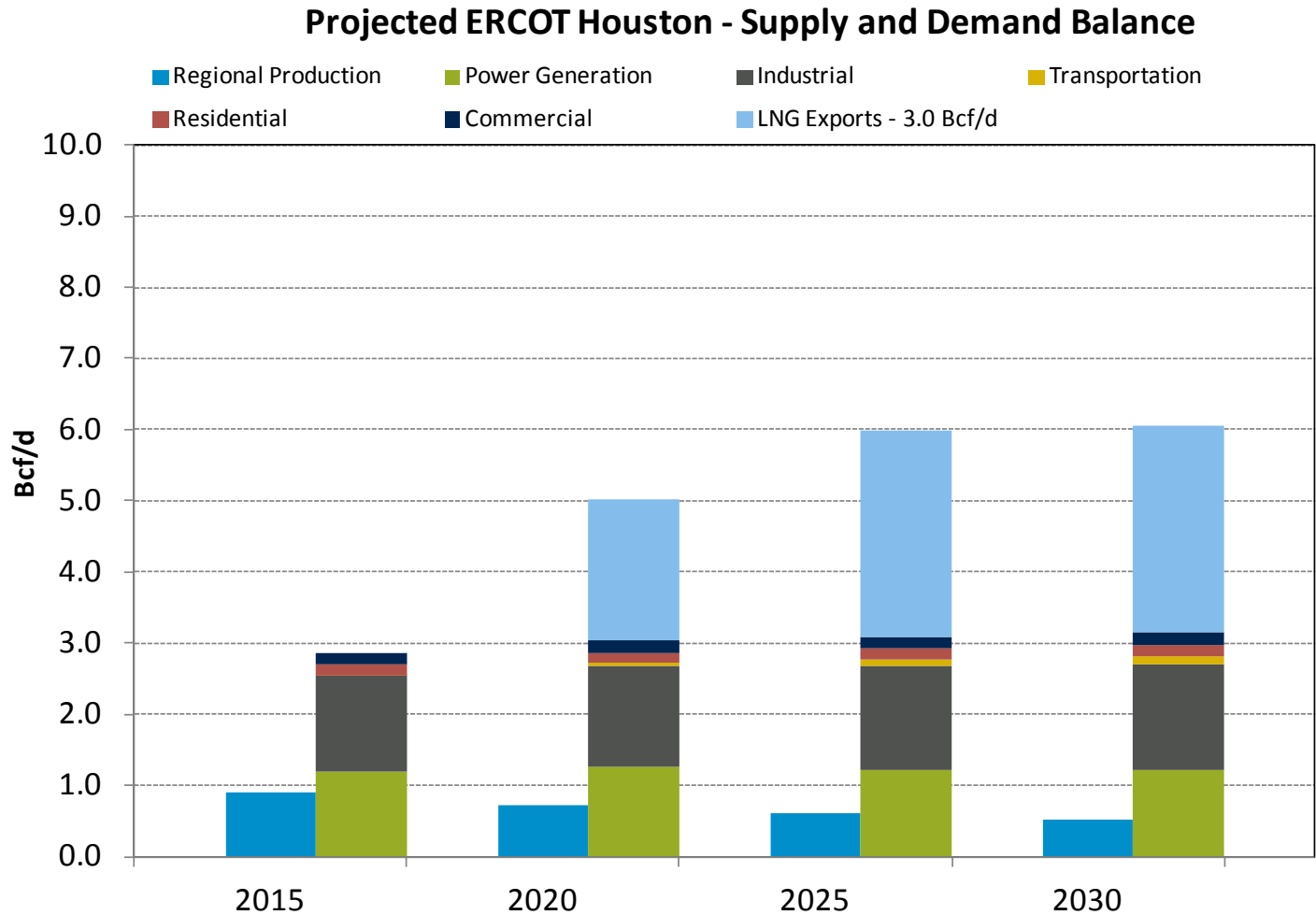
## LNG Export Assumptions - High LNG Export Scenario



# HIGHER LNG EXPORTS REDUCE TEXAS PIPELINE EXPORTS BY 2 BCF/D



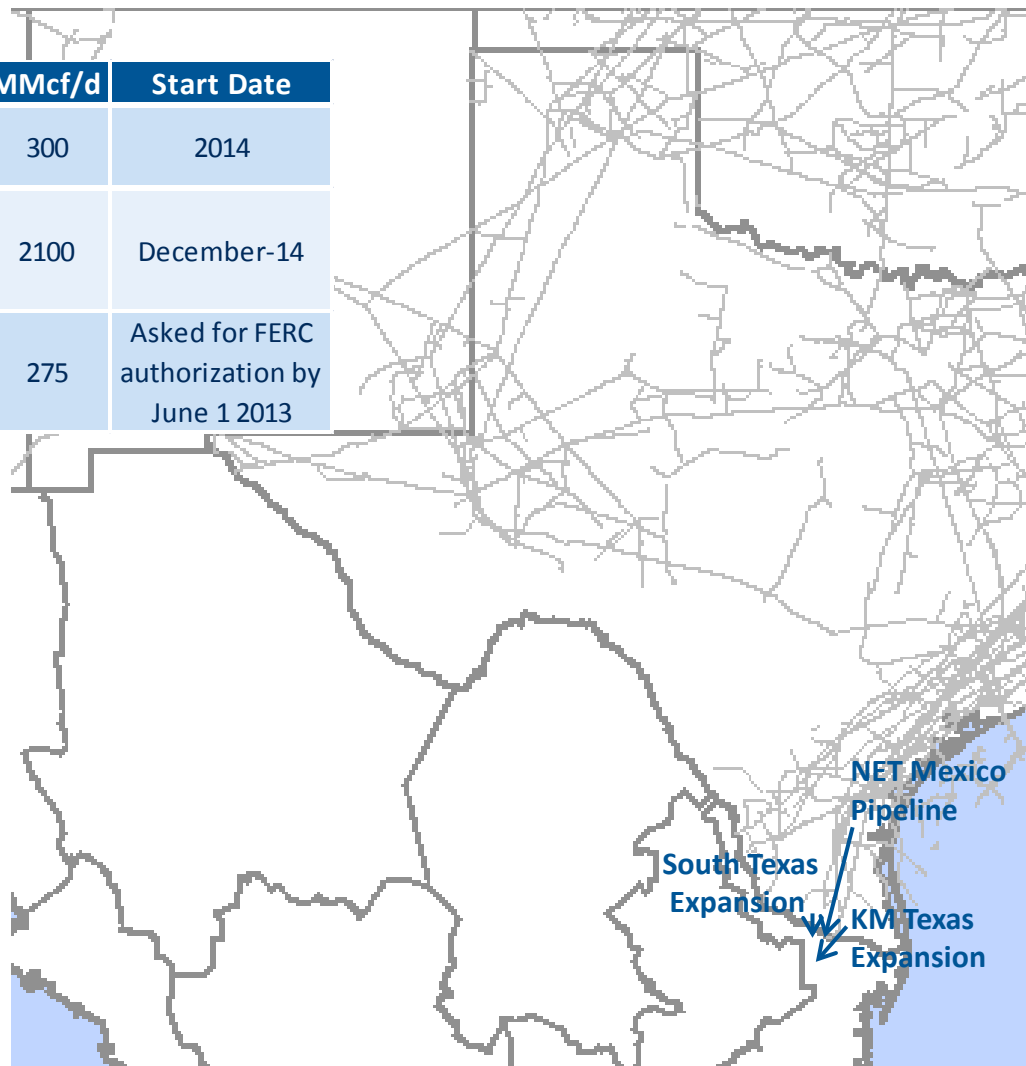
# ADDITIONAL FREEPORT LNG EXPORTS INCREASE PIPELINE IMPORTS TO ERCOT HOUSTON



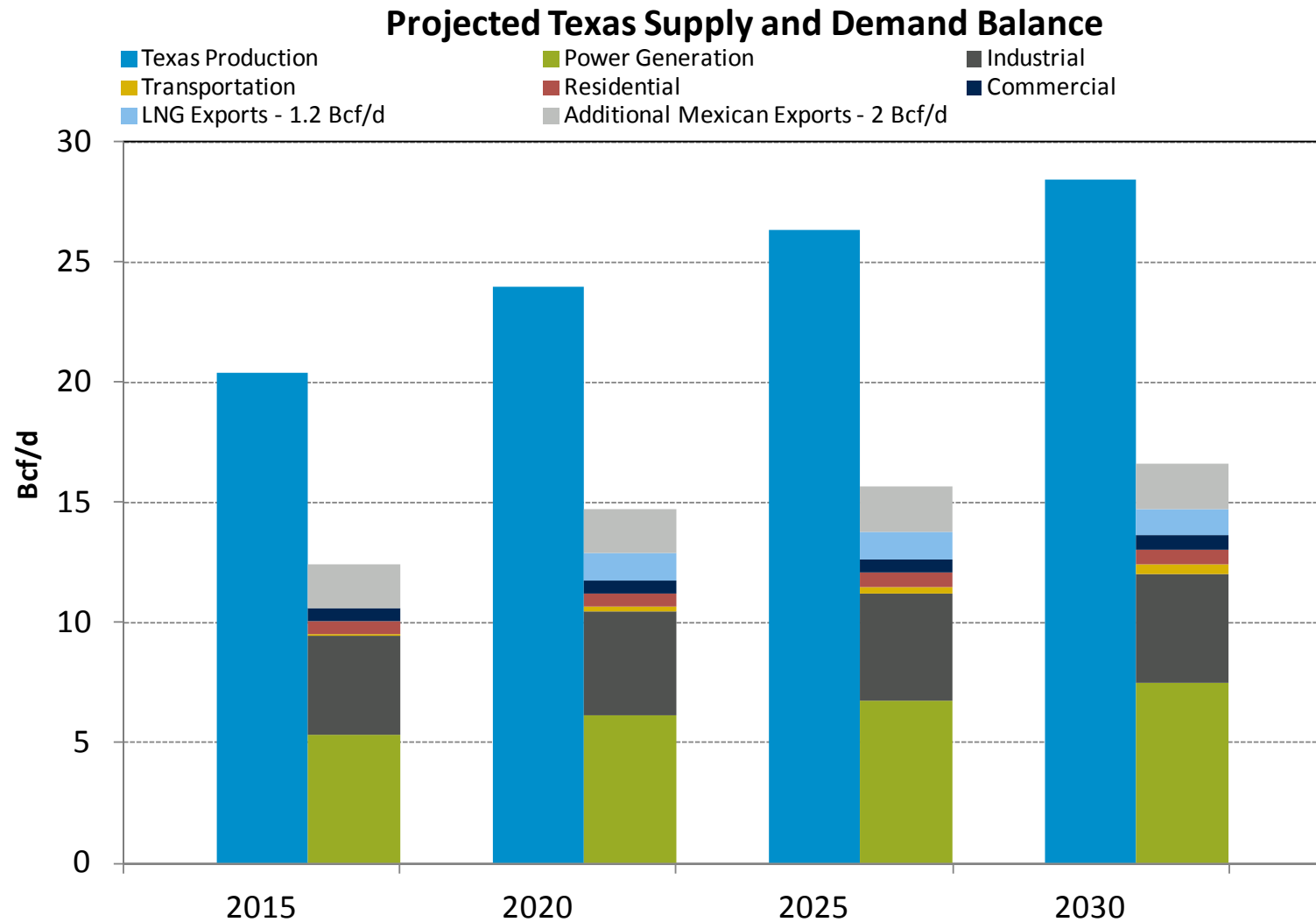
# PROPOSED EXPORT PIPELINES TO MEXICO FROM SOUTH TEXAS EXCEED 2.7 BCF/D

Project Name	Sponsor	MMcf/d	Start Date
South Texas Expansion Project	Texas Eastern Transmission	300	2014
Eagle Ford Shale Pipeline System Expansion	NET Mexico Pipeline	2100	December-14
Kinder Morgan Texas Pipeline Expansion	Kinder Morgan	275	Asked for FERC authorization by June 1 2013

- Current Existing South Texas Export Capacity to Mexico: 2.3 Bcf/d
- Average Utilization 2012-2013: 46% or 1.1 Bcf/d
- Analysis considered the impact of incremental export demand of 2 Bcf/d from Mexico

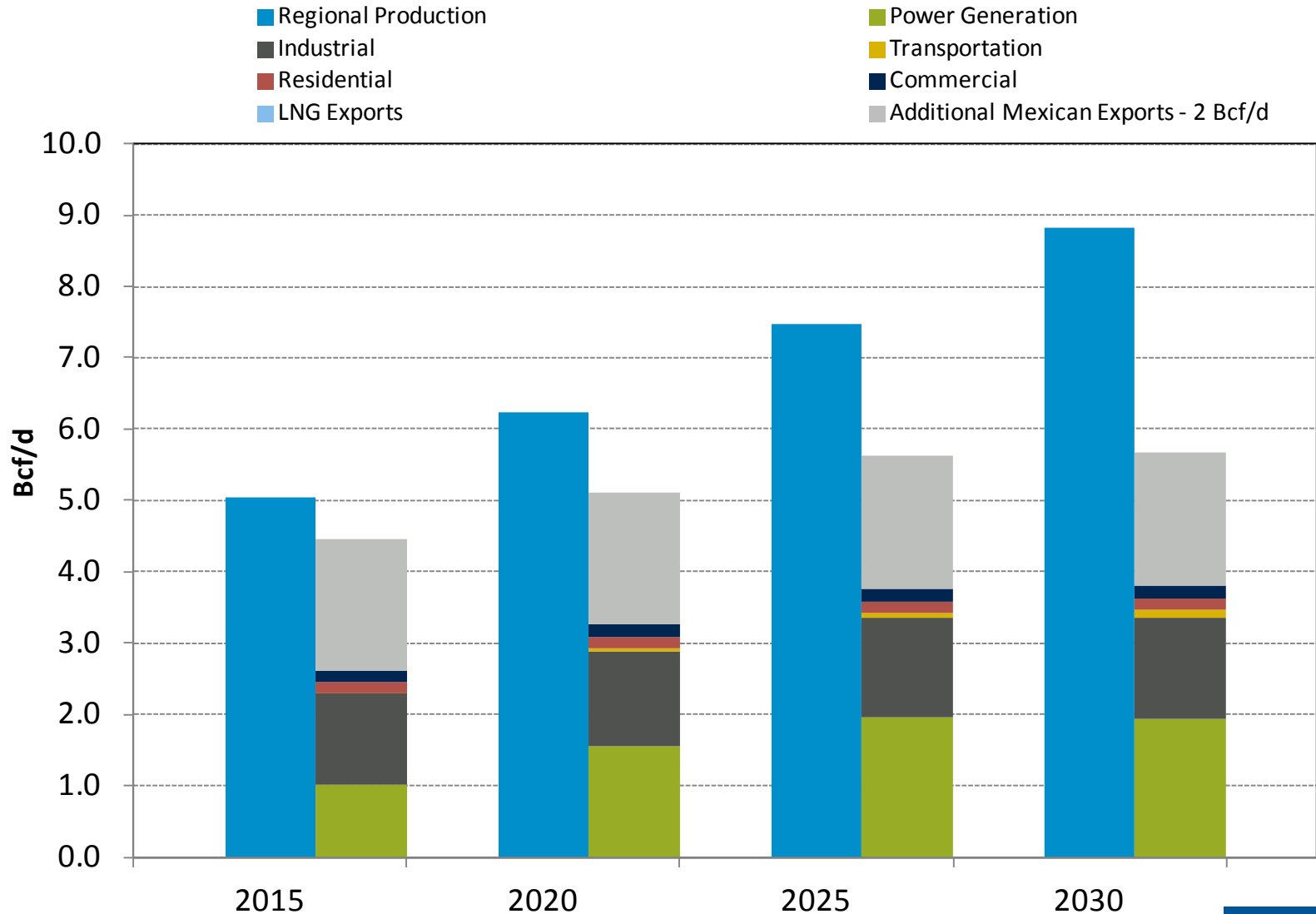


# HIGH EXPORTS TO MEXICO REDUCE GAS AVAILABLE FOR INTERSTATE EXPORTS BY 2 BCF/D



# HIGH MEXICAN PIPELINE EXPORTS NARROW AVAILABLE EXPORTS FROM ERCOT SOUTH TO HOUSTON

## Projected ERCOT South - Supply and Demand Balance





# HIGH MEXICAN PIPELINE EXPORTS REDUCE FLOWS TO ERCOT HOUSTON FROM SOUTH TEXAS

