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THE VOICE OF FOOD RETAIL 

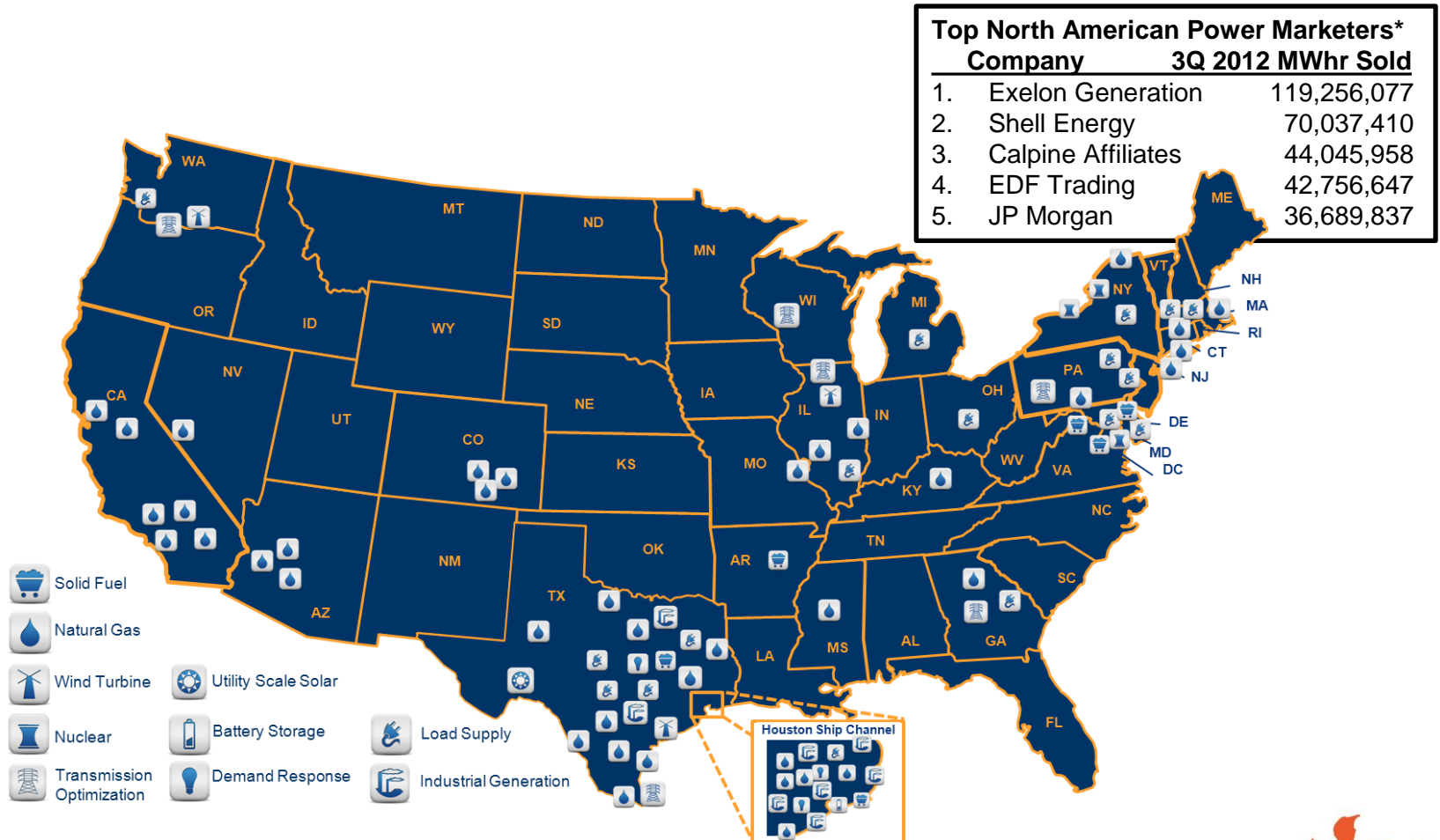
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**Energy Market Update:**  
**EDF Energy Services**

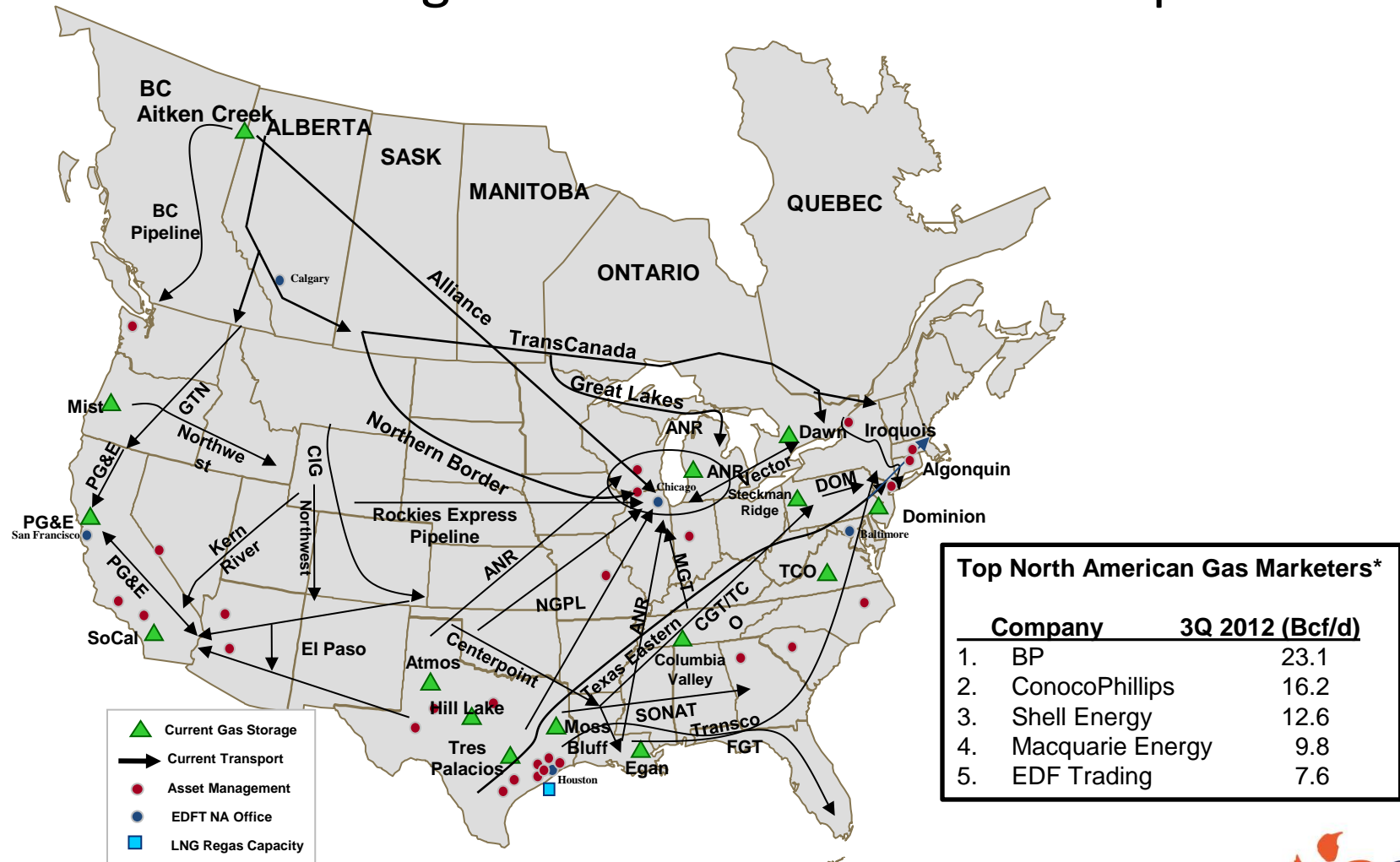
# EDF Trading's North American Power Footprint



## Top North American Power Marketers\*

Company	3Q 2012 MWhr Sold
1. Exelon Generation	119,256,077
2. Shell Energy	70,037,410
3. Calpine Affiliates	44,045,958
4. EDF Trading	42,756,647
5. JP Morgan	36,689,837

## EDF Trading's North American Gas Footprint



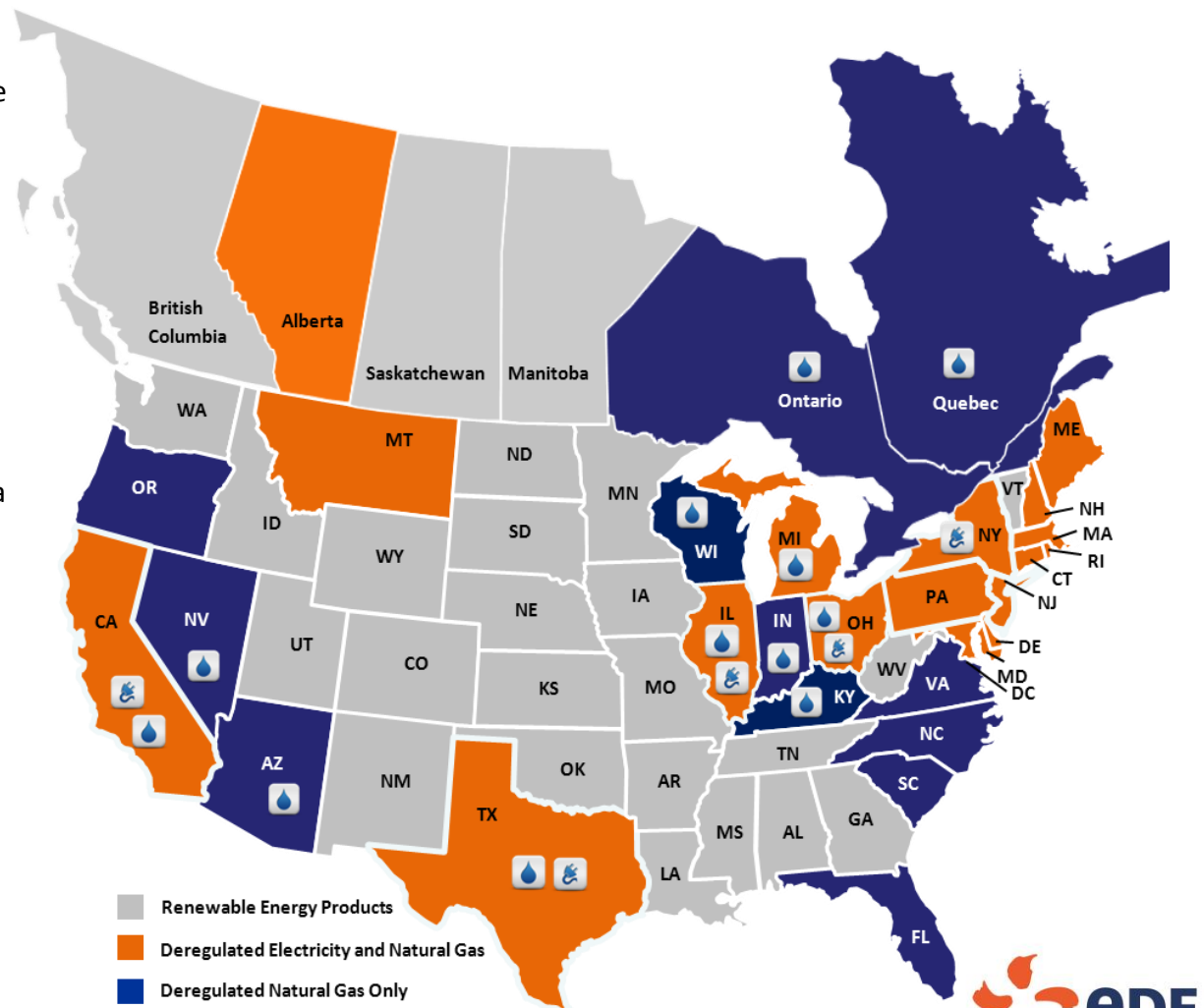
## EDF Energy Services

### Electricity:

- EDF currently serves 1,600 MWs of large C&I load in the following markets:
  - Texas (ERCOT)
  - Illinois (PJM and MISO)
  - New York (NYISO)
  - California (CAISO)
  - Ohio (PJM)

### Natural Gas:

- EDF currently serves clients in twelve states and provinces throughout Canada and the US
- Loads ~ 300,000 mmbtu/d





What are the primary variables affecting energy prices?

- **Shale gas/tight oil explosion**
- **Weak demand**
- **Coal-to-gas switching**
- **Renewables**
- **Demand Response and efficiency**
- **Resource adequacy and reserve margins**
- **CSAPR and other regulations**

What are the consequences?

- **Industrial renaissance in US**
- **LNG exports**
- **Low prices fix low prices**

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**Shale Gas & Tight Oil**

**Lower 48 states shale plays**

**Shale plays**

- Current plays
- Prospective plays

**Stacked plays**

- Shallowest/youngest
- Intermediate depth/age
- Deepest/oldest

**Basins**

- \* Mixed shale & chalk play
- \*\* Mixed shale & limestone play
- \*\*\* Mixed shale & tight dolomite-siltstone-sandstone

**Map Labels:** Niobrara\*, Heath\*\*, Bakken\*\*\*, Williston Basin, Cody, Big Horn Basin, Powder River Basin, Gammon, Hilliard, Bakkel, Mancos, Greater Green River Basin, Park Basin, Niobrara\*, Denver Basin, Excelsior, Mulky, Cherokee Platform, Forest City Basin, Michigan Basin, Antrim, Appalachian Basin, Devonian (Ohio), Marcellus, Utica, Illinois Basin, New Albany, Chattanooga, Black Warrior Basin, Conasauga, Valley & Ridge Province, Floyd, Neal, TX-LAWS Salt Basin, Tuscaloosa, Fayetteville, Woodford, Barnett, Permian Basin, Avalon-Bone Spring, Barnett-Woodford, Marla Basin, Eagle Ford, Haynesville-Bossier, Pearsall, Western Gulf, Monterey-Terrill, Monterey, Maria, Los Angeles, Mojave, San Joaquin Basin, Lewis, Raton Basin, Anadarko Basin, Ardmore Basin, Palo Duro Basin, Pierre, San Juan Basin, Paradox Basin, Hermosa, Mancos, Mahoning Canyon, Uinta Basin, Pinedale Basin, Denver Basin, Pierre, Raton Basin, Anadarko Basin, Ardmore Basin, Palo Duro Basin, Permian Basin, Avalon-Bone Spring, Barnett-Woodford, Marla Basin, Eagle Ford, Haynesville-Bossier, Pearsall, Western Gulf.

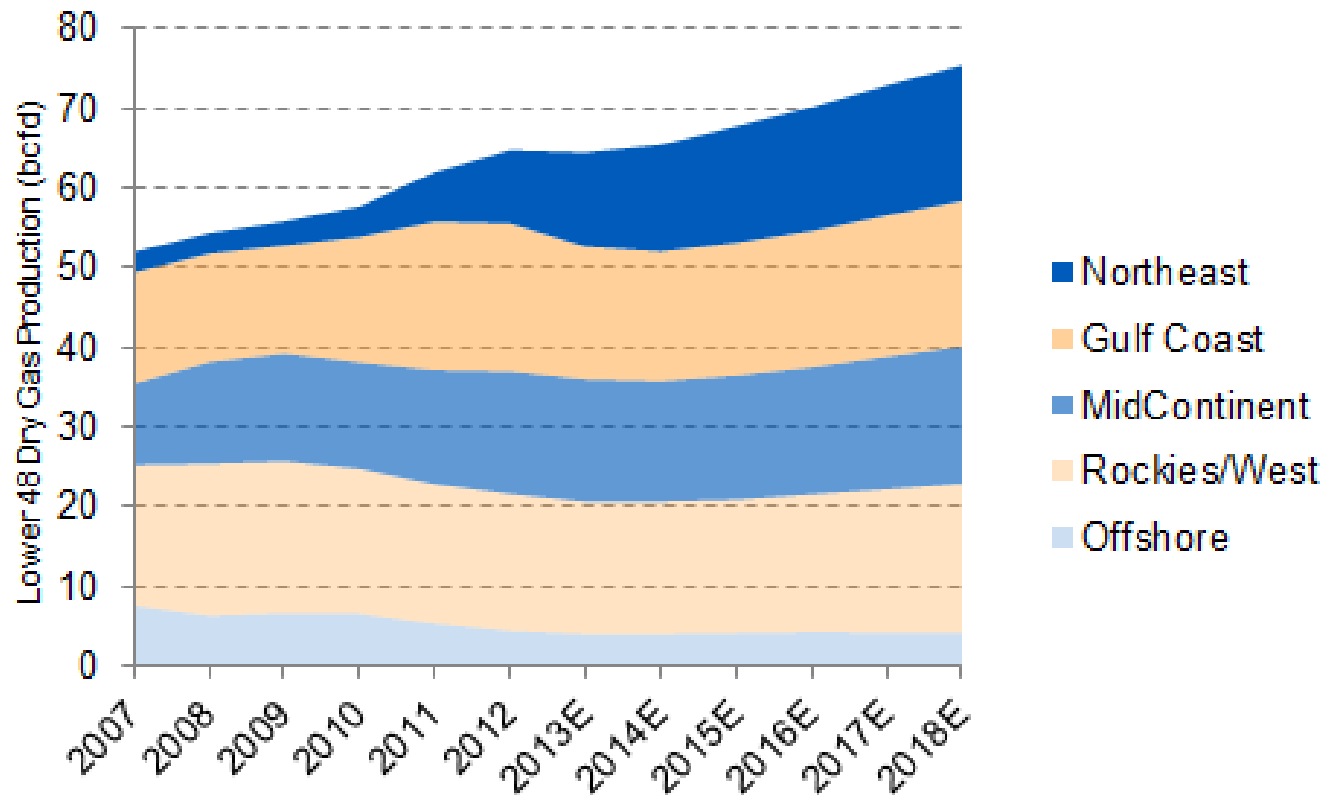
**Scale:** 0 100 200 300 400 Miles

**North Arrow:** N





## US Shale Gas Boom

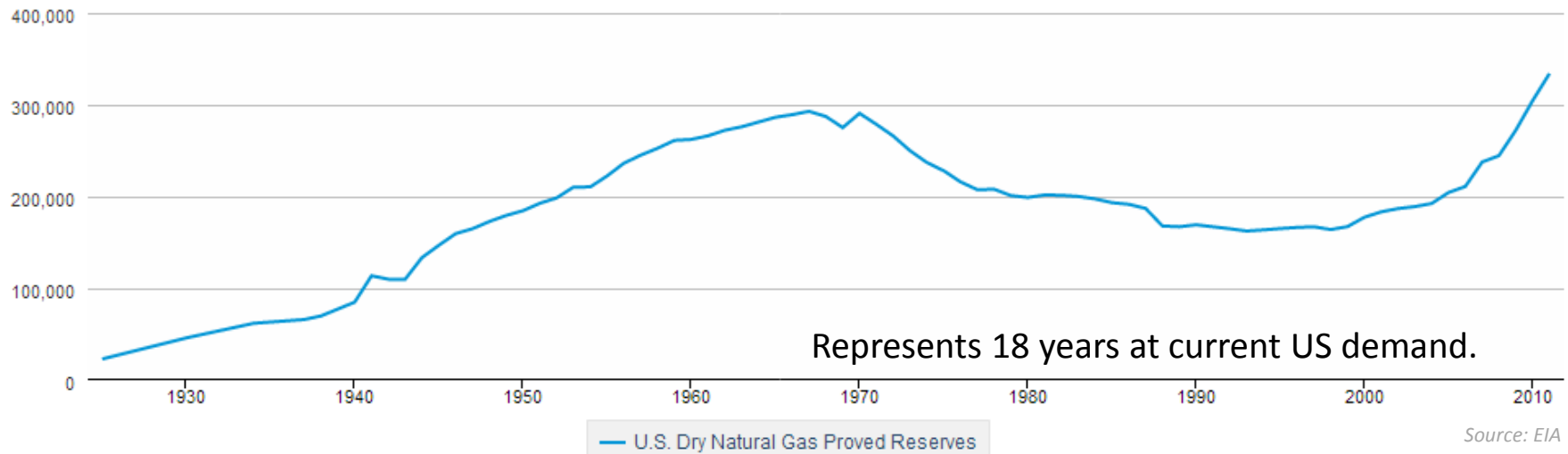


Source: EIA, Wood Mackenzie

## US Shale Gas Boom

### U.S. Dry Natural Gas Proved Reserves

Billion Cubic Feet



## Bearish Price Trend of Natural Gas

NYMEX Cal14 Forward Curve



**ERCOT North Hub Peak Forward Curve** — 2014 — 2015 — 2016

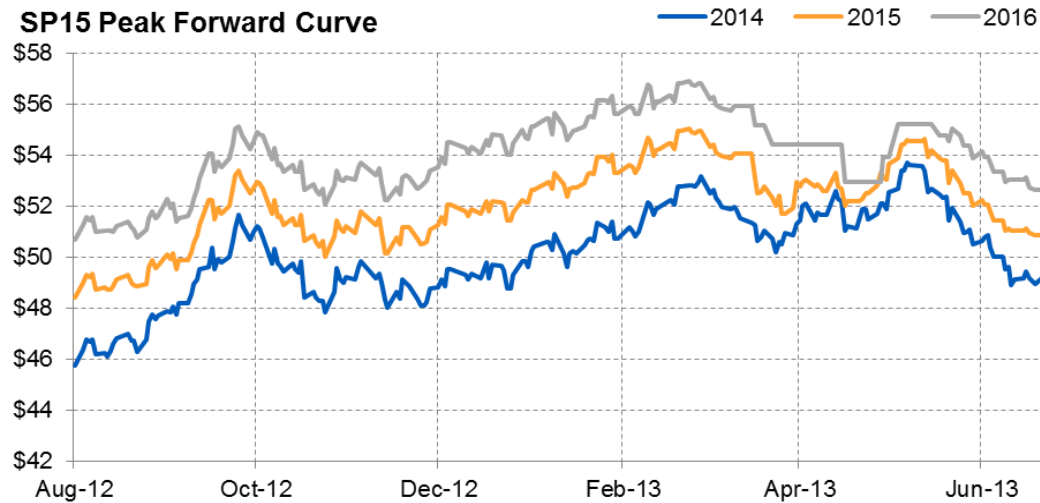


**PJM West Hub Peak Forward Curve** — 2014 — 2015 — 2016

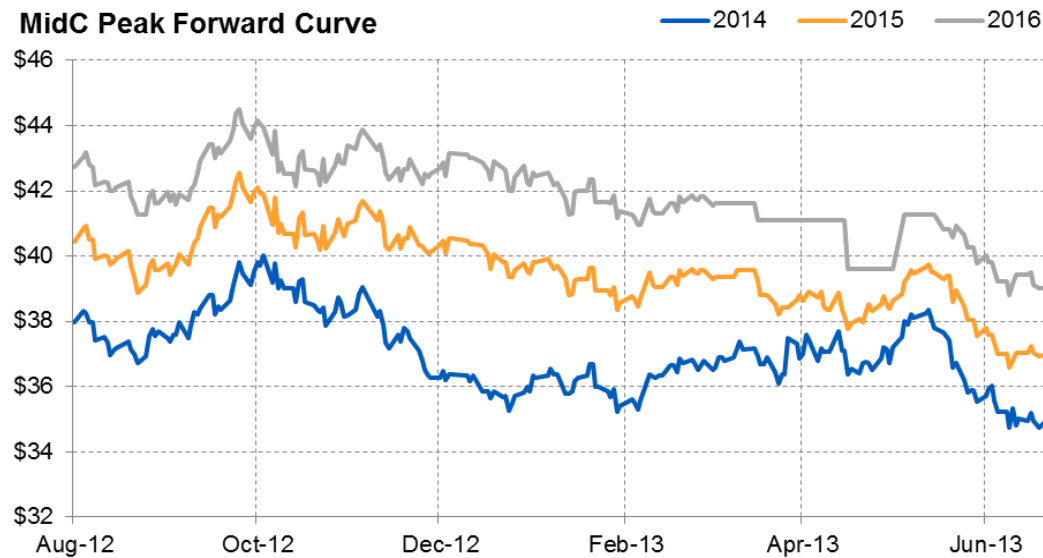




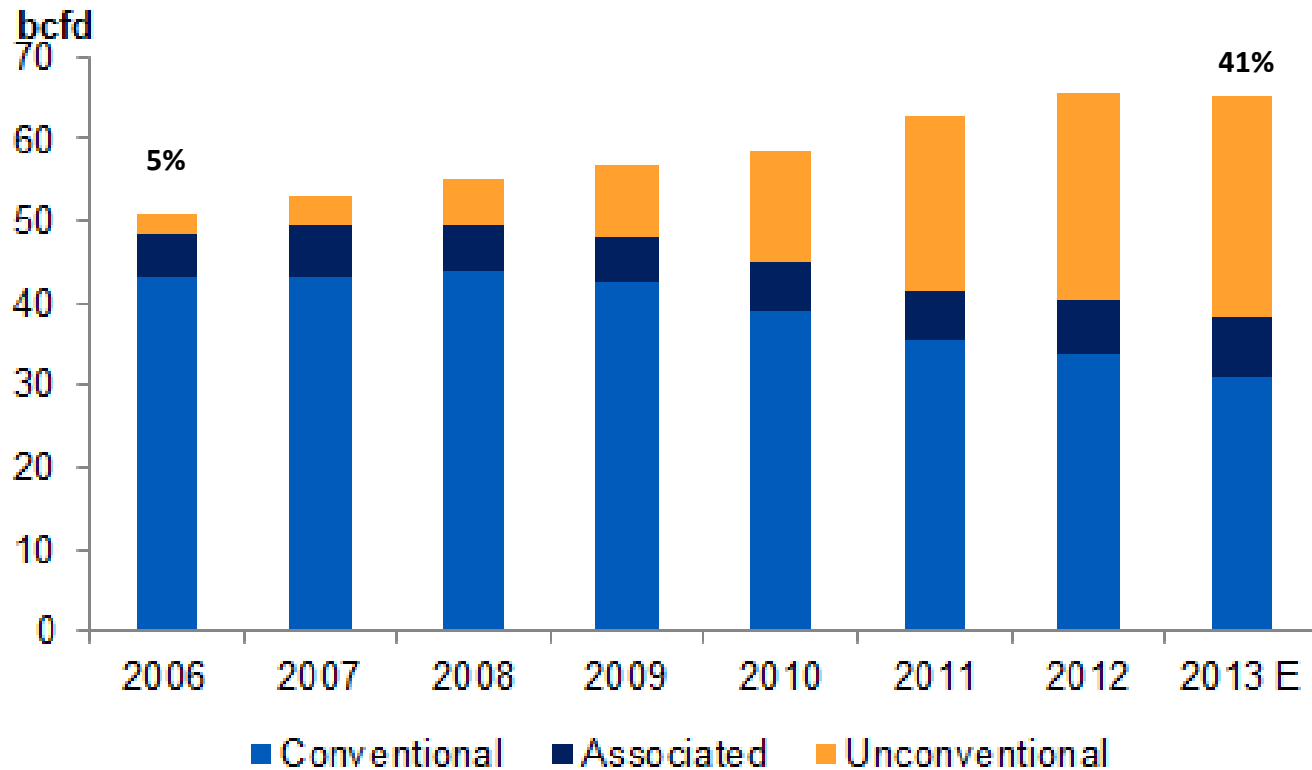
**SP15 Peak Forward Curve**



**MidC Peak Forward Curve**



## US Gas Production by Source

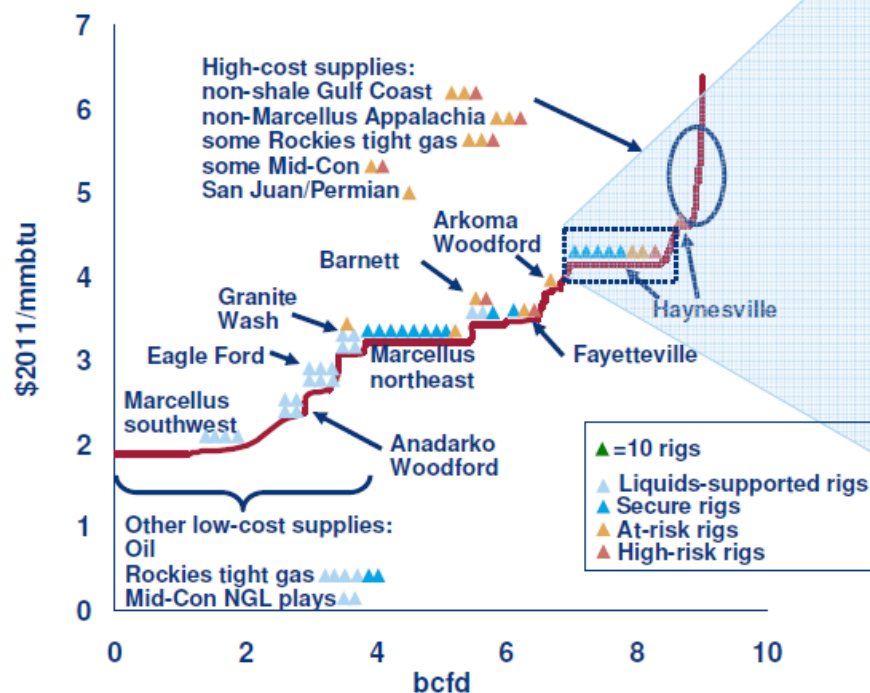


Source: EIA, Wood Mackenzie

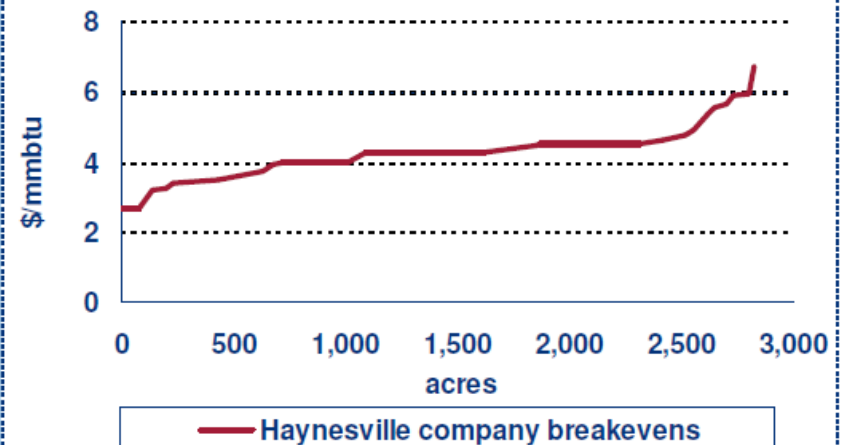
# Shale Play Break-evens Cap the Market

In 2012 low-cost gas supply is increasing from associated and rich-gas sources. But average play breakevens only tell part of the story for higher-cost plays

**2012 US new-drill supply and at risk rigs**



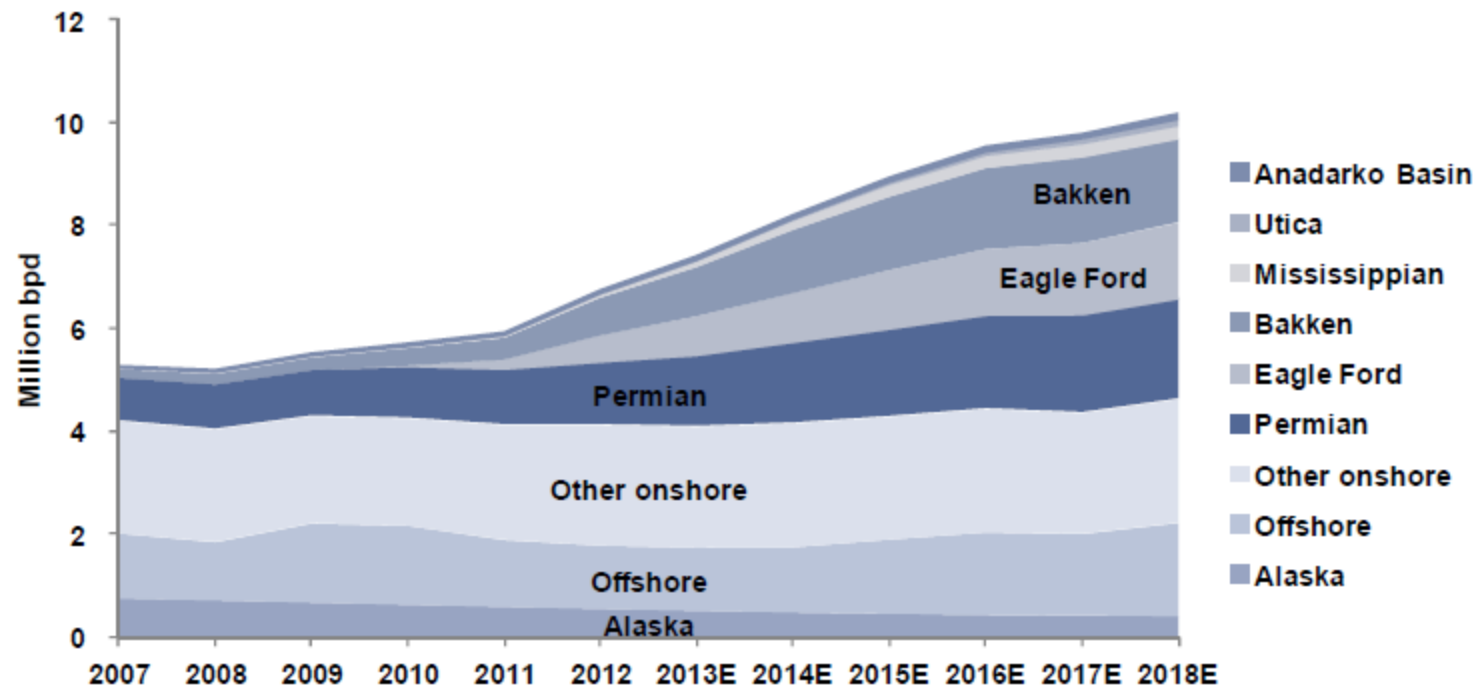
**Haynesville operators' breakevens**



- › 45% of new-drilled gas volumes have breakevens below \$3/mmbtu, while 33% of gas rigs operate in plays with breakevens below \$3/mmbtu
- › 200 gas rigs operate in plays with average breakevens above \$4/mmbtu, contributing 26% of new-drilled gas volumes
- › The cost curve at left shows average breakevens by play, but each play features a range of breakevens—supporting some drilling even in plays with higher costs on average, as illustrated in the Haynesville chart at right

## US Oil Boom

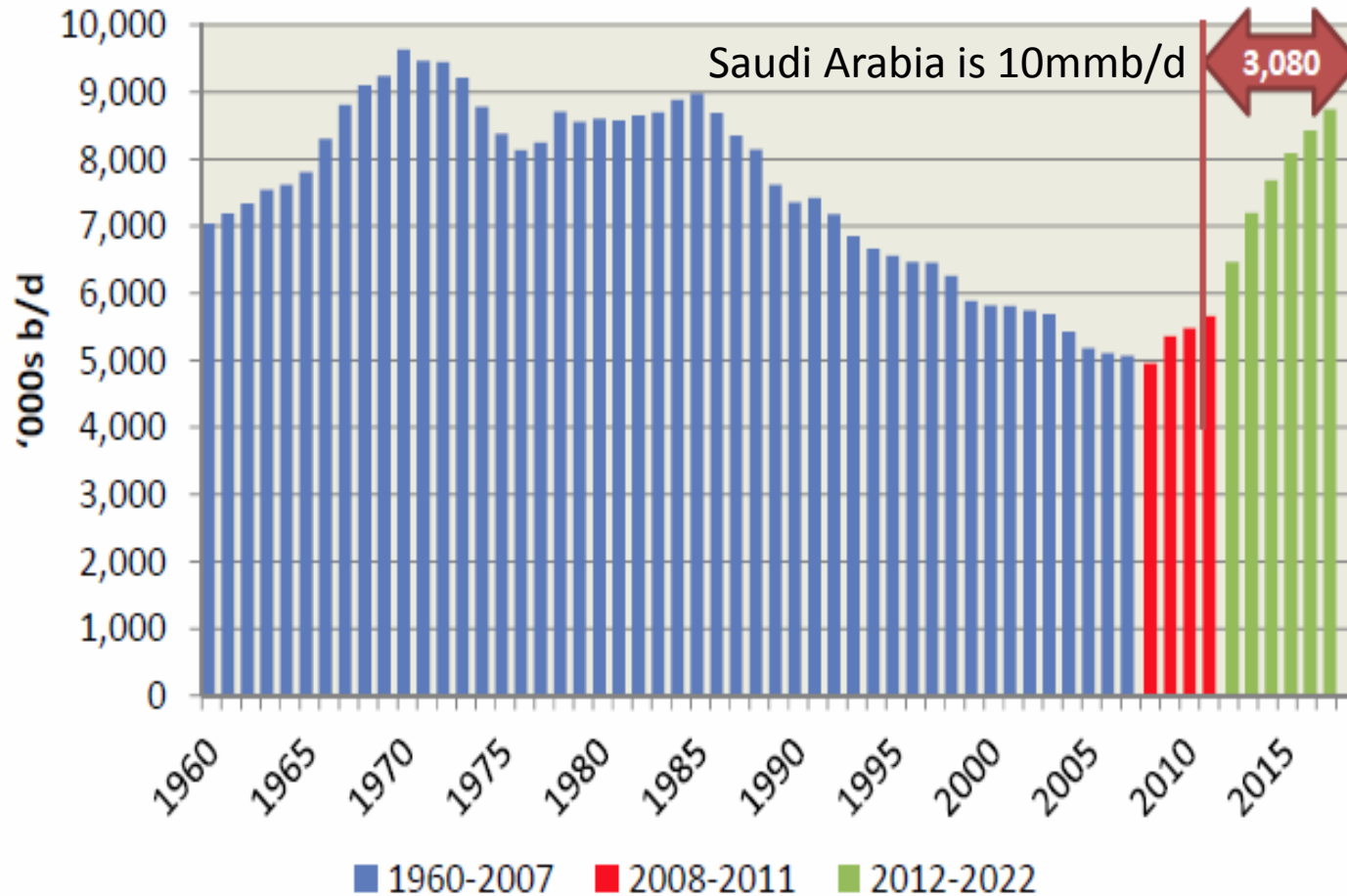
Annual US crude oil production, 2007-18E, million barrels per day



Source: EIA, Goldman Sachs Research estimates



## US Crude Oil Production



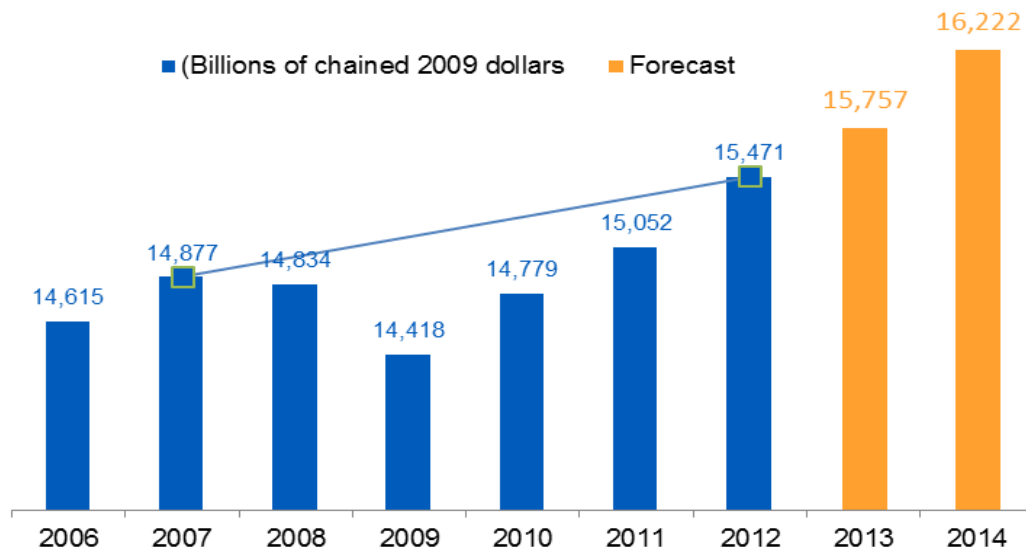
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**Weak Demand**

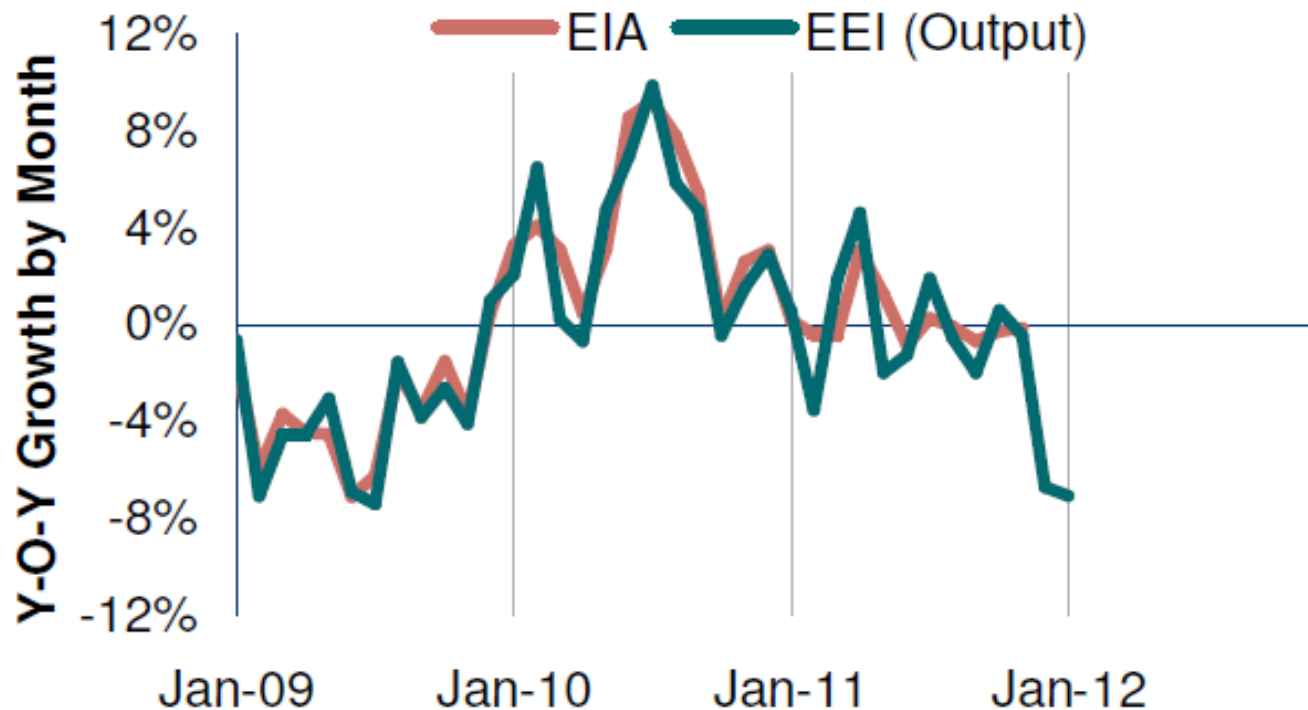
## Weak Demand: .8% Realized GDP Growth '07-'12



Source: BEA, Economic Watch

- Structural industrial demand losses due to global recession.
- Structural job losses due to global recession.
- Increase in proportion of economy based on services.
- Increased productivity.
- Demand response and efficiency.

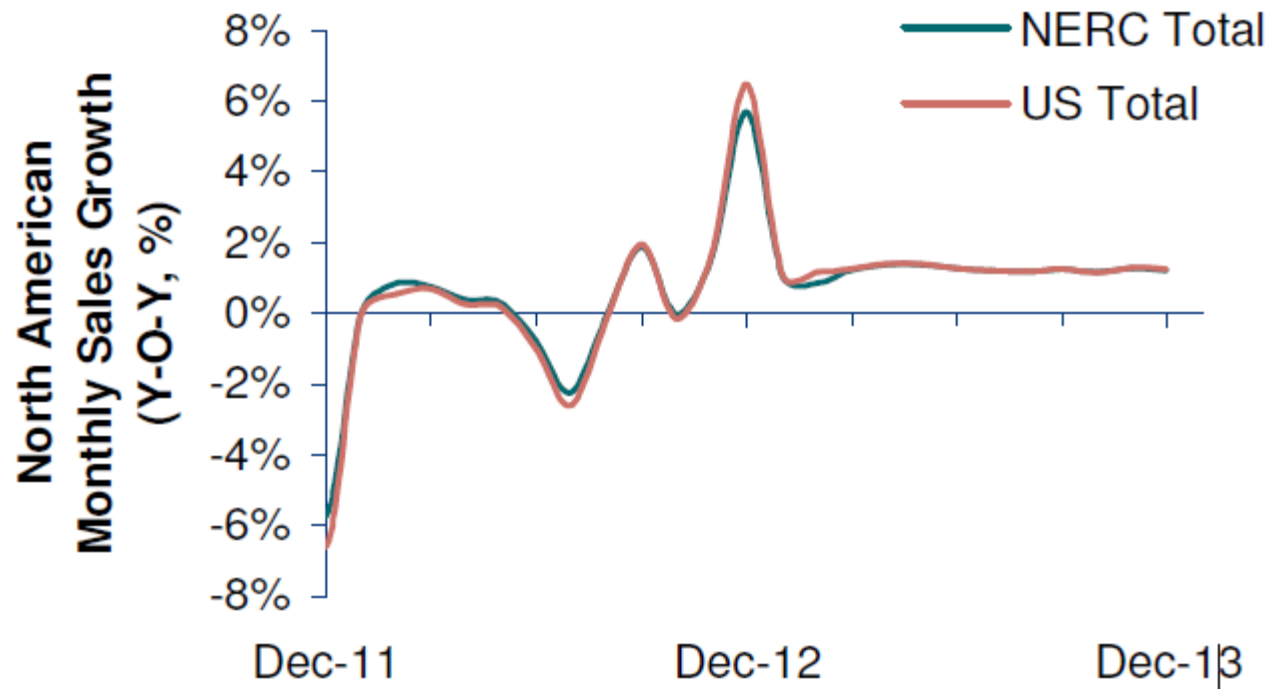
## Growth in US Electricity Demand and Output



Source: EIA, EEI and Wood Mackenzie North America Power Service



## Sales Growth (yoy)



Source: Wood Mackenzie North America Power Service

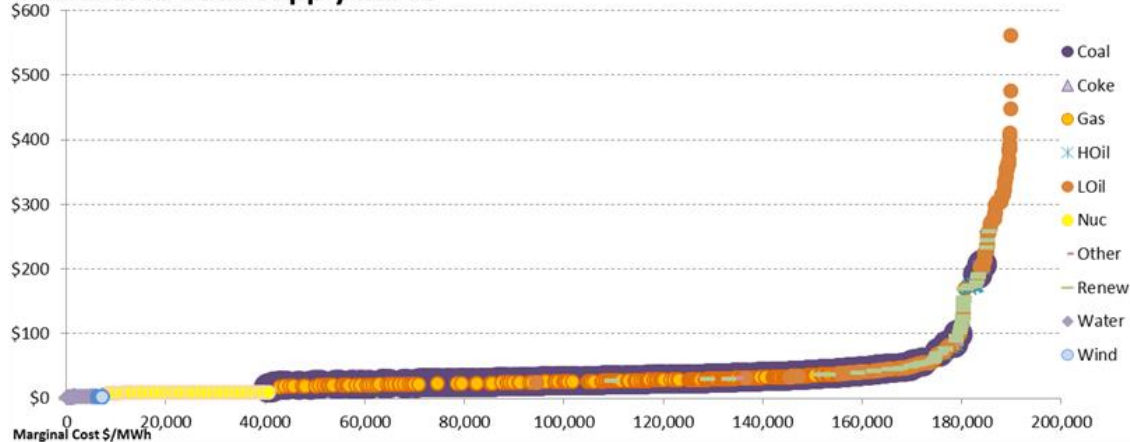
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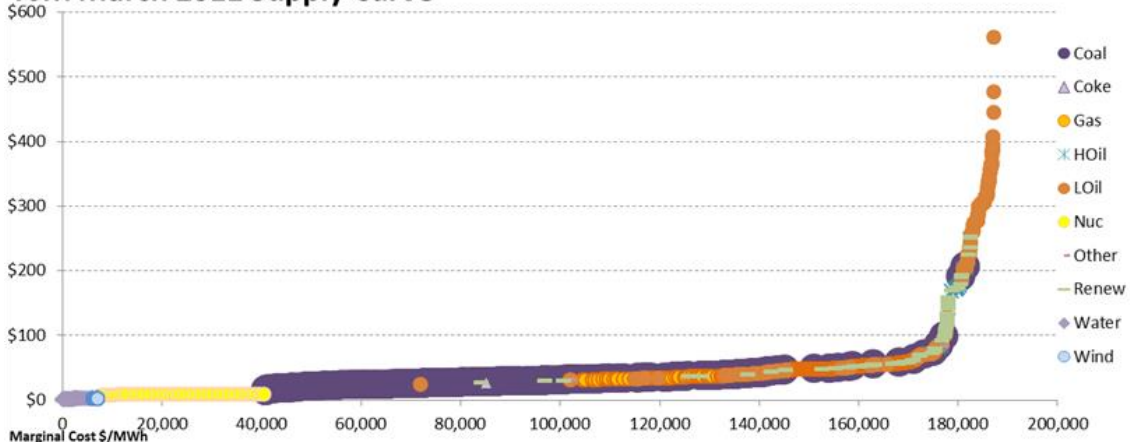
**Coal-to-Gas Switching**

## Coal-to-gas Switching

PJM March 2012 Supply Curve

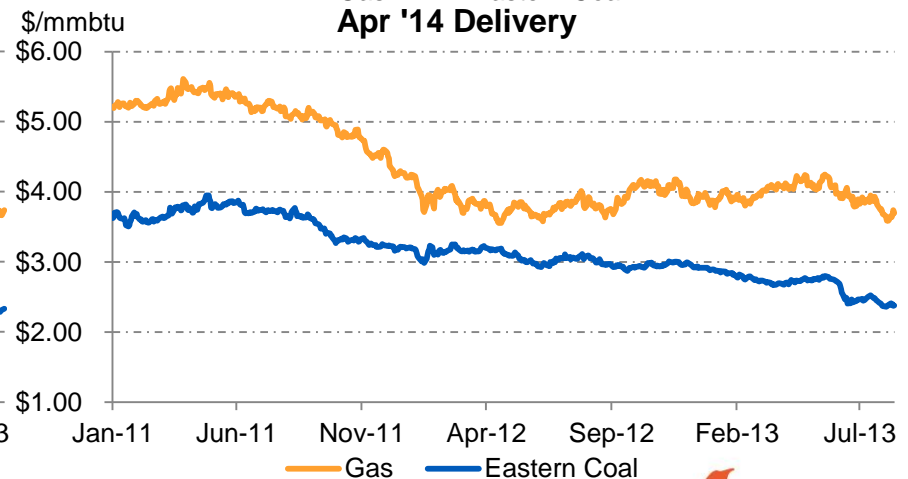
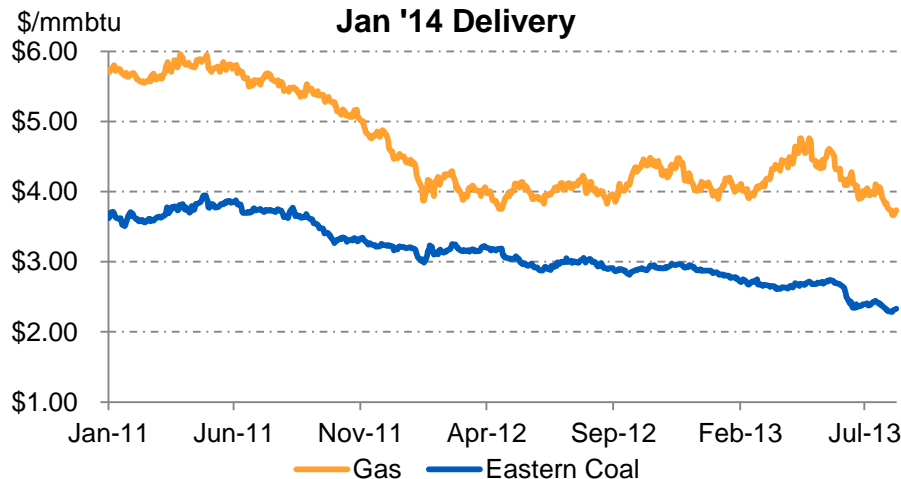
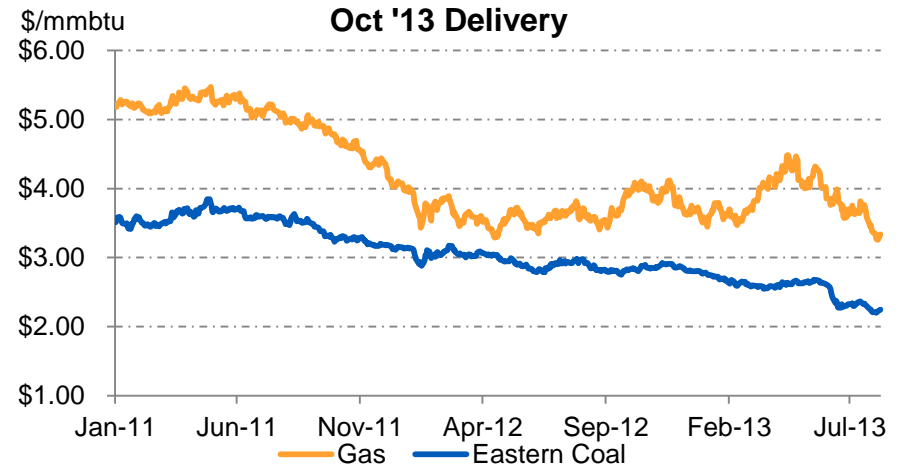
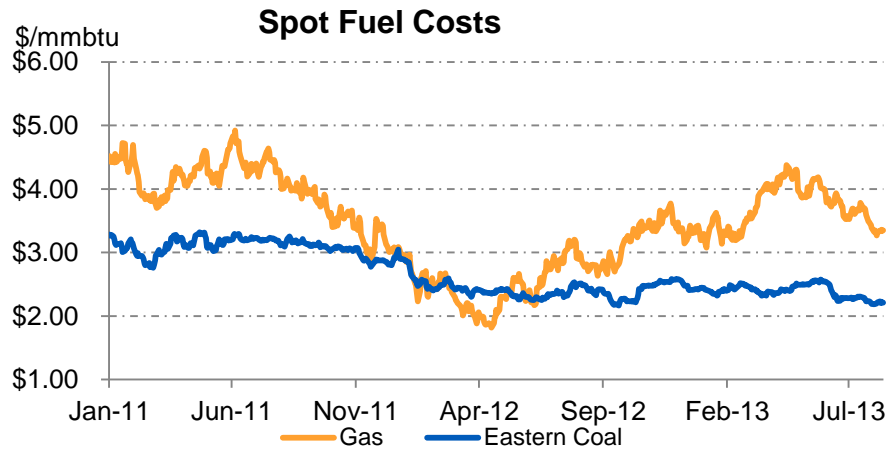


PJM March 2011 Supply Curve



- Natural gas weakness has pushed gas generation below coal generation in the dispatch stack in many regions (SERC, PJM first)
- This switching has grown to the extent that not only CCGTs, but also peakers have begun to displace coal assets
- The extent of switching is a function of the market's ability to adjust to coal on the margin
- Our estimate is that with current forwards, a normal summer will result in 3.4bcfd switching

# Coal-to-gas Switching Economics





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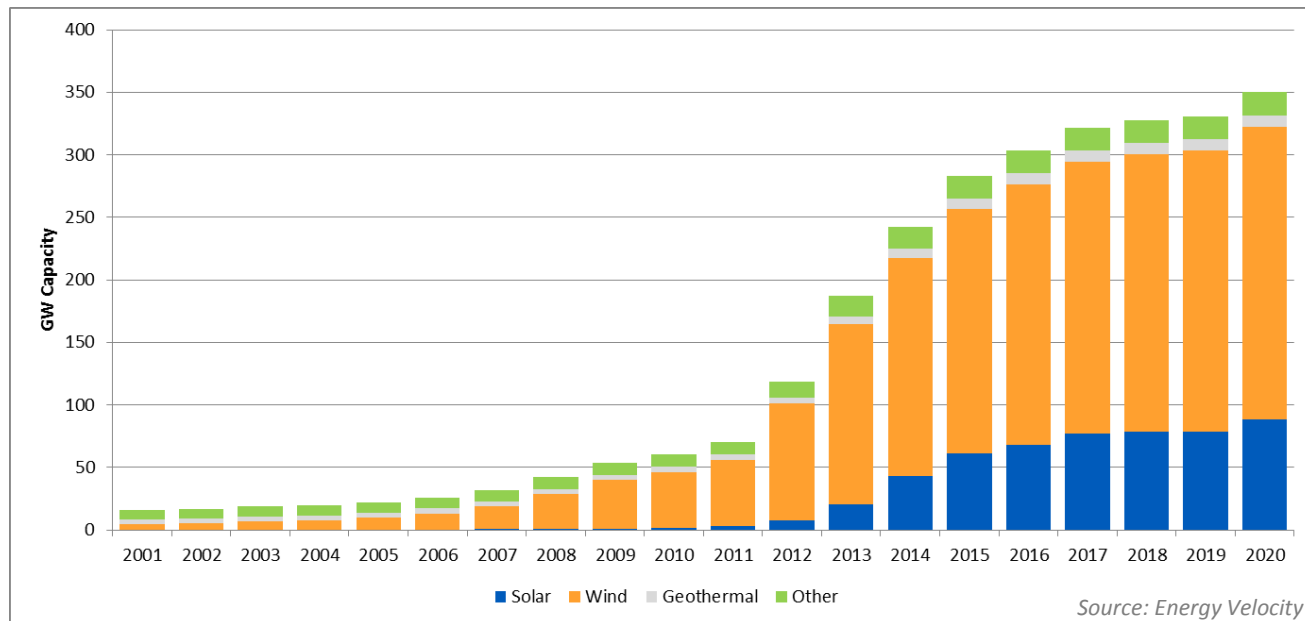
**Growth of Renewables**

## Growth of Renewables

Since 2001 more than 3,000 MW of solar and 50,000 MW of wind have been built across North America, with consequences:

- Increased congestion;
- Increased need for expensive peaking, quick-start and regulation services;
- Dampening of forward curves with consequent affect on new build economics.

### United States Renewable Generation and Proposed Generation



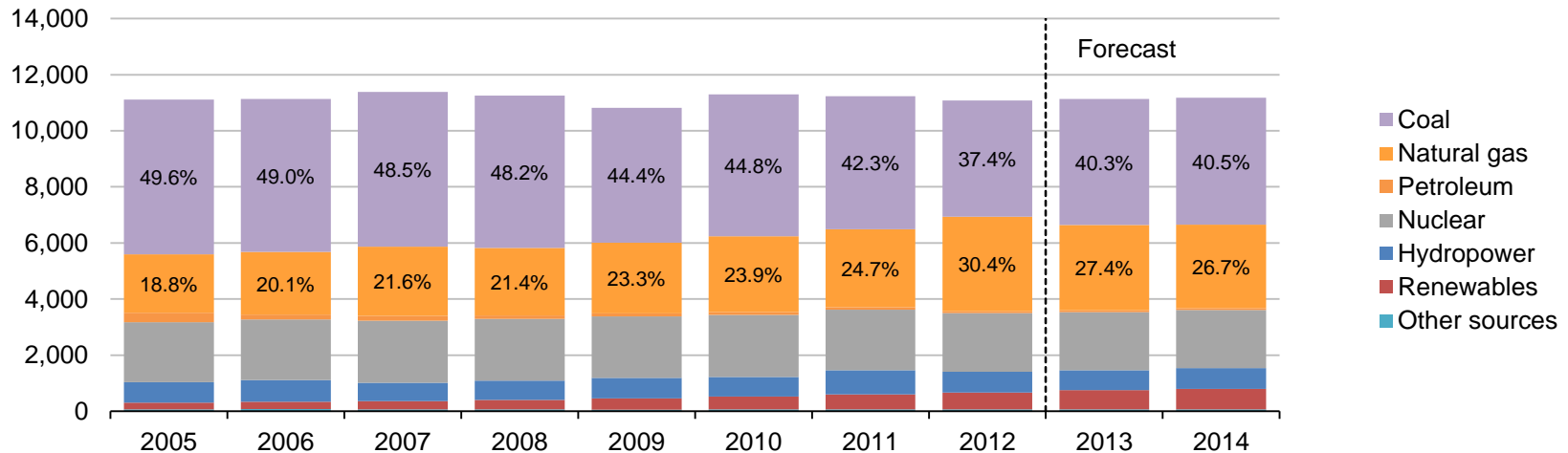
## Changing US Generation Mix

- Natural gas' share of total generation has gone from approximately 12% in 2001 to more than 30% in the 2012 .
- Non-hydro renewable generation is growing from 5% share in 2012. Wind penetration is already affecting power plant dispatch and prices in ERCOT, MISO and Pacific Northwest.
- The growth in gas and renewable generation has largely come out of coal's share of total generation.

### North American Power Generation by Fuel Type

#### U.S. Electricity Generation by Fuel, All Sectors

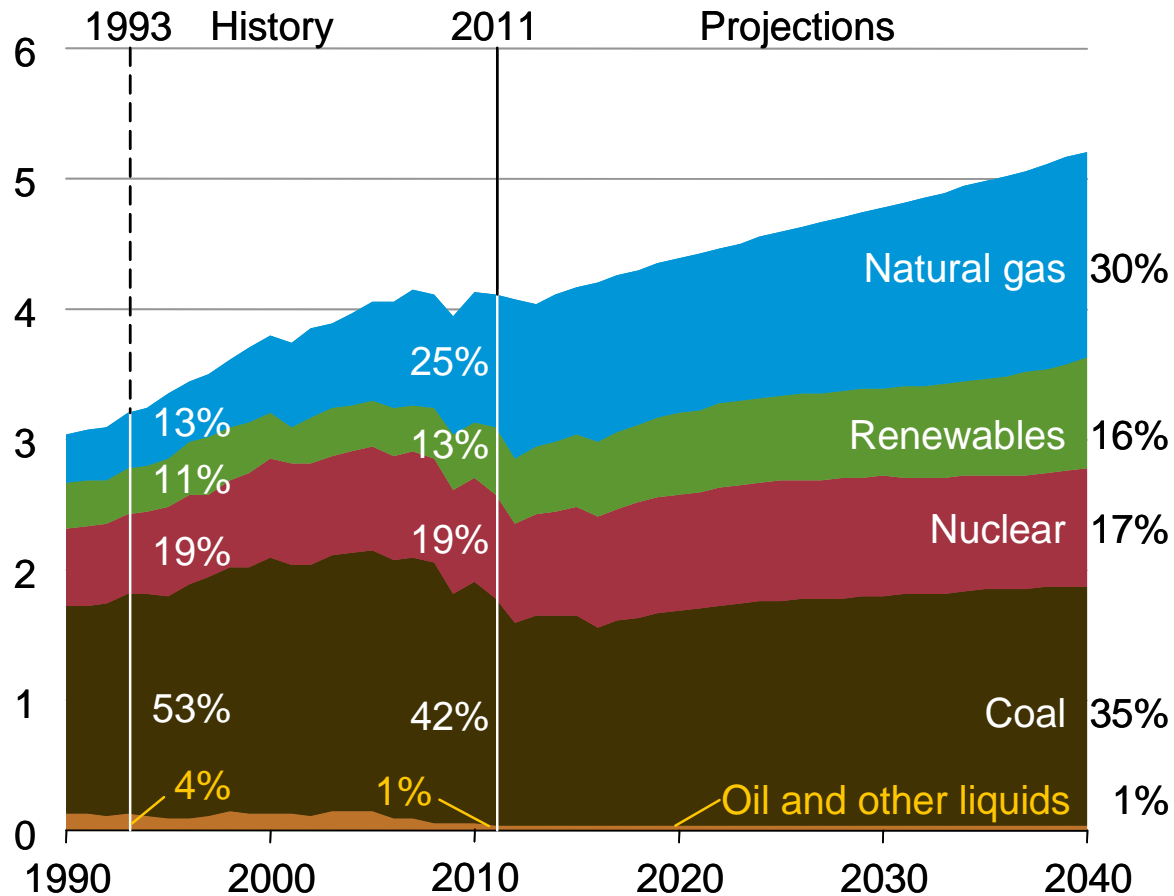
thousand megawatt hours per day



Note: Labels show percentage share of total generation provided by coal and natural gas.

# Changing Fuel Mix

Electricity generation by fuel type ((trillion KWh per year))



Source: EIA

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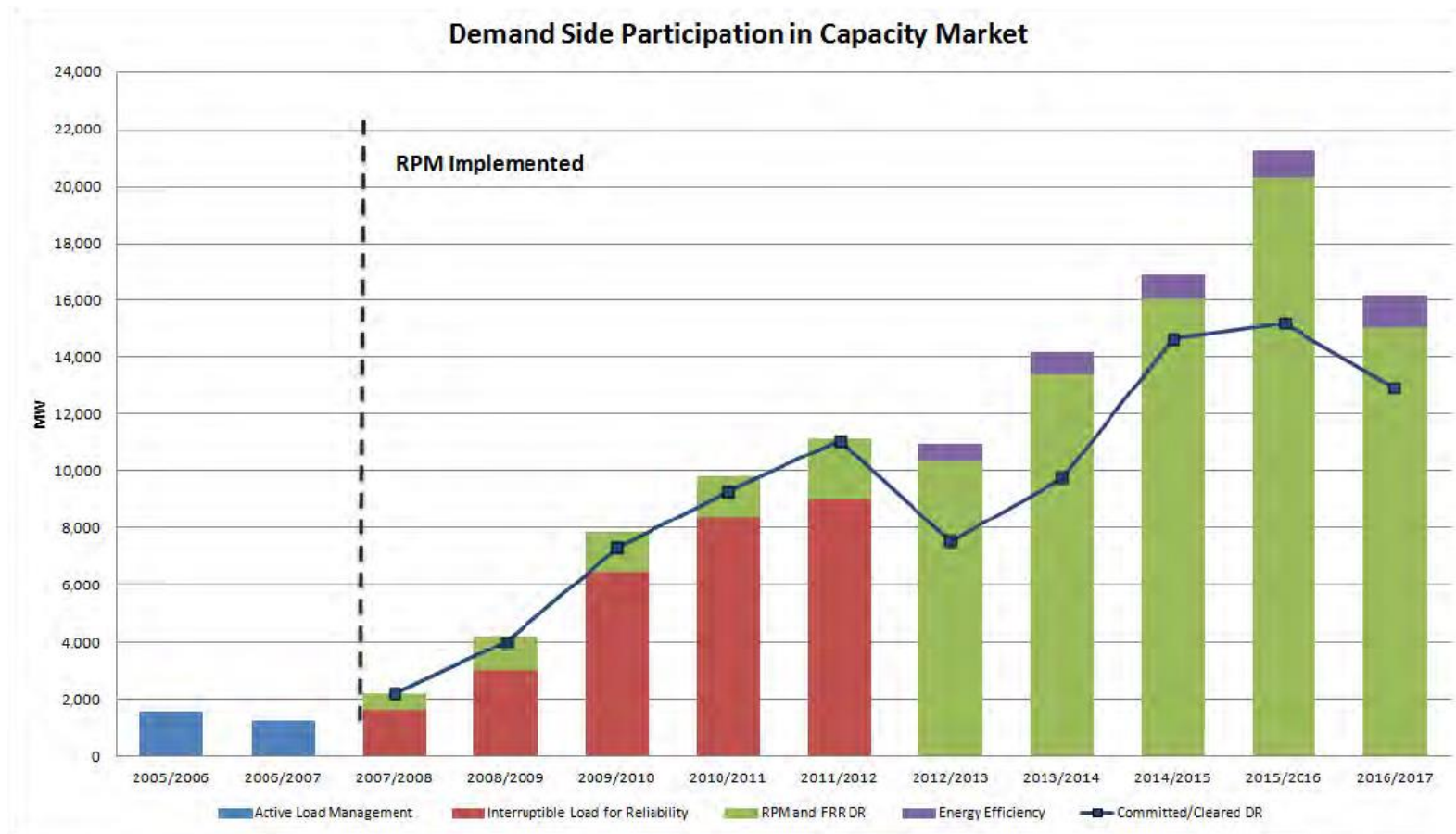
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**Demand Response & Efficiency**



## Growth of Demand Response (PJM)



Source: PJM

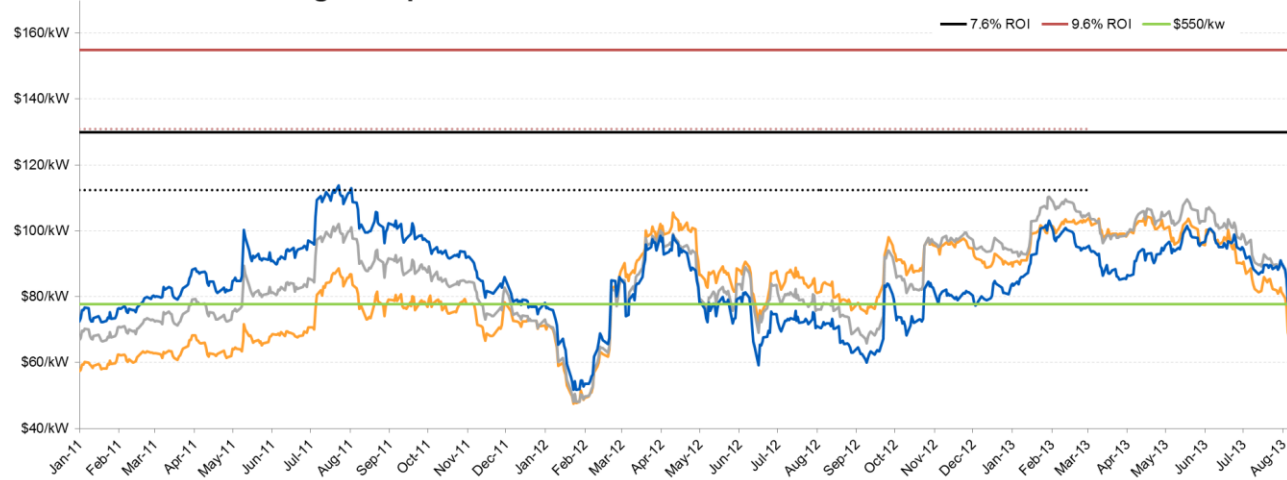
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**Resource Adequacy**

# Forward Curves Do Not Support New Build in ERCOT

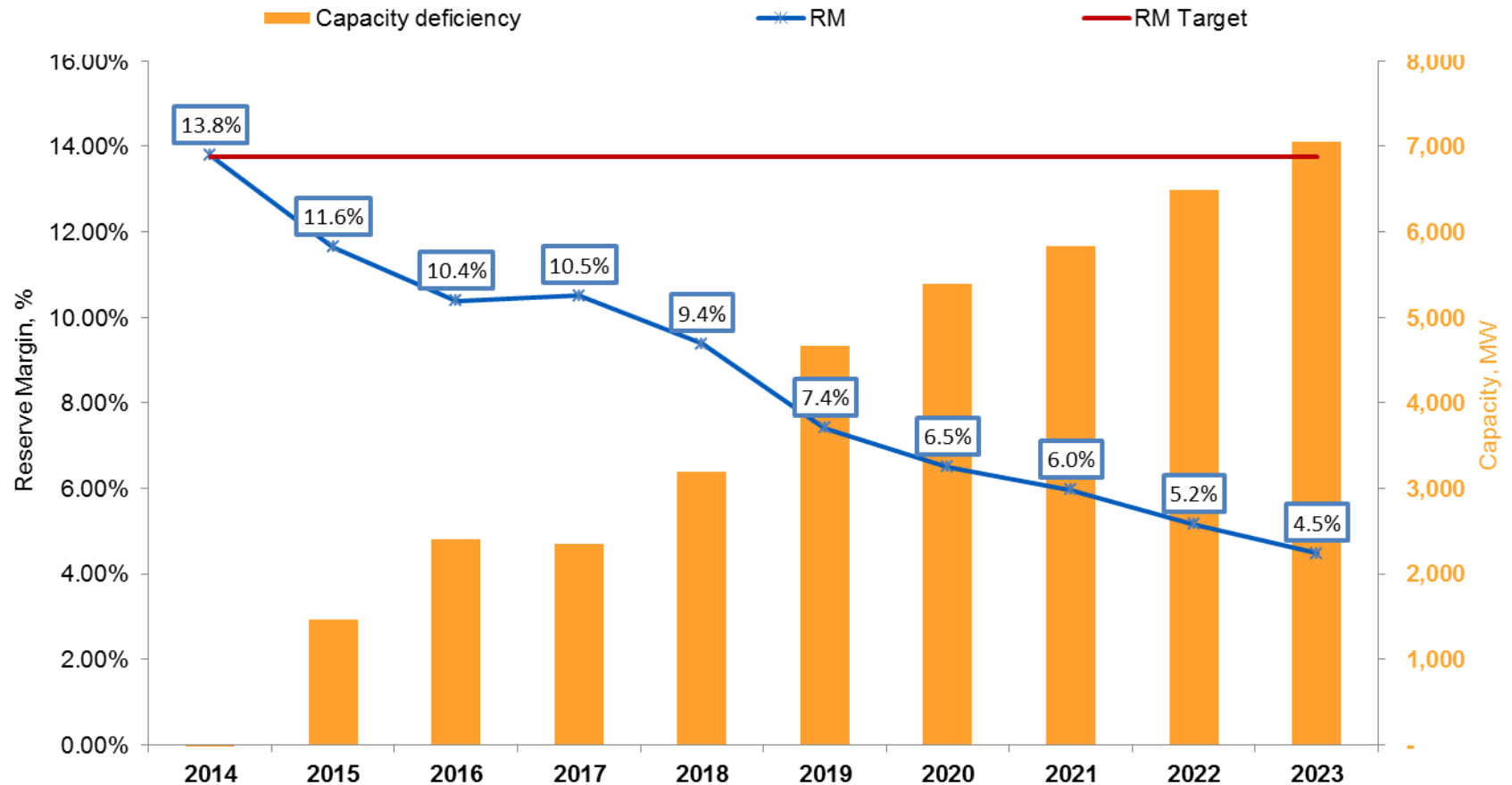
**ERCOT North Hub Margin Required to meet New Build Economics**



**ERCOT North Hub Margin % of CONE**



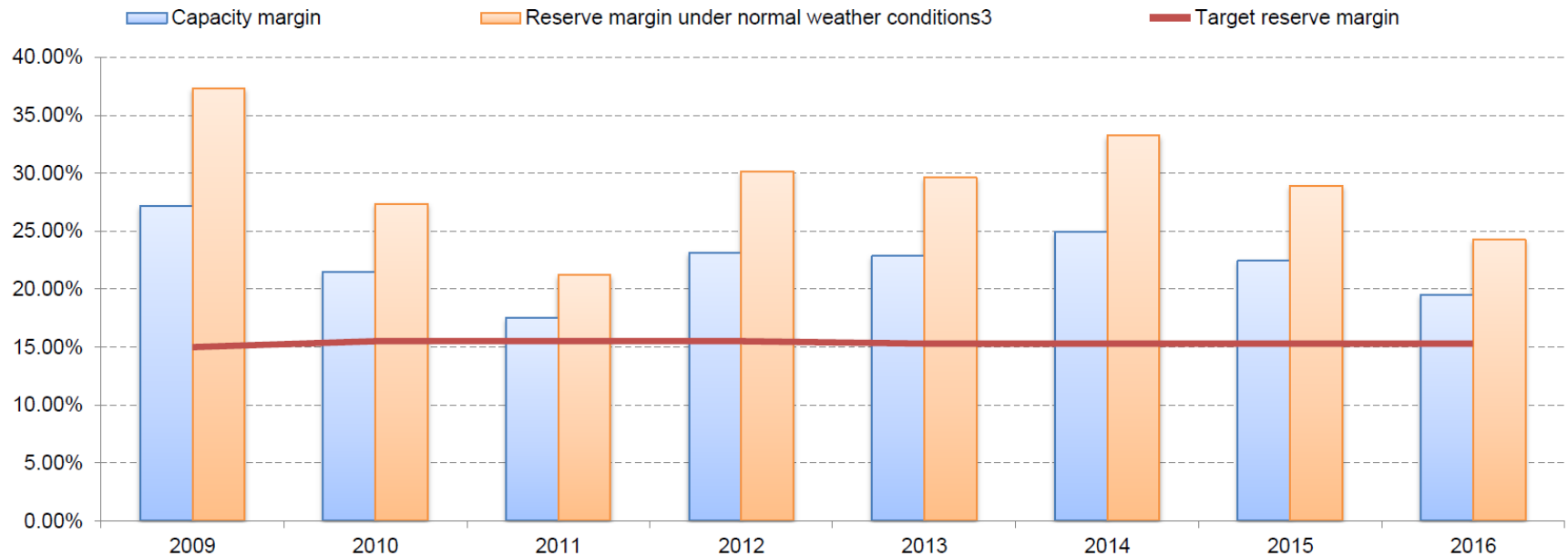
## Yet, Reserve Margins (RM) Decline



Source: ERCOT

## Excess Reserve Margins Persist in East

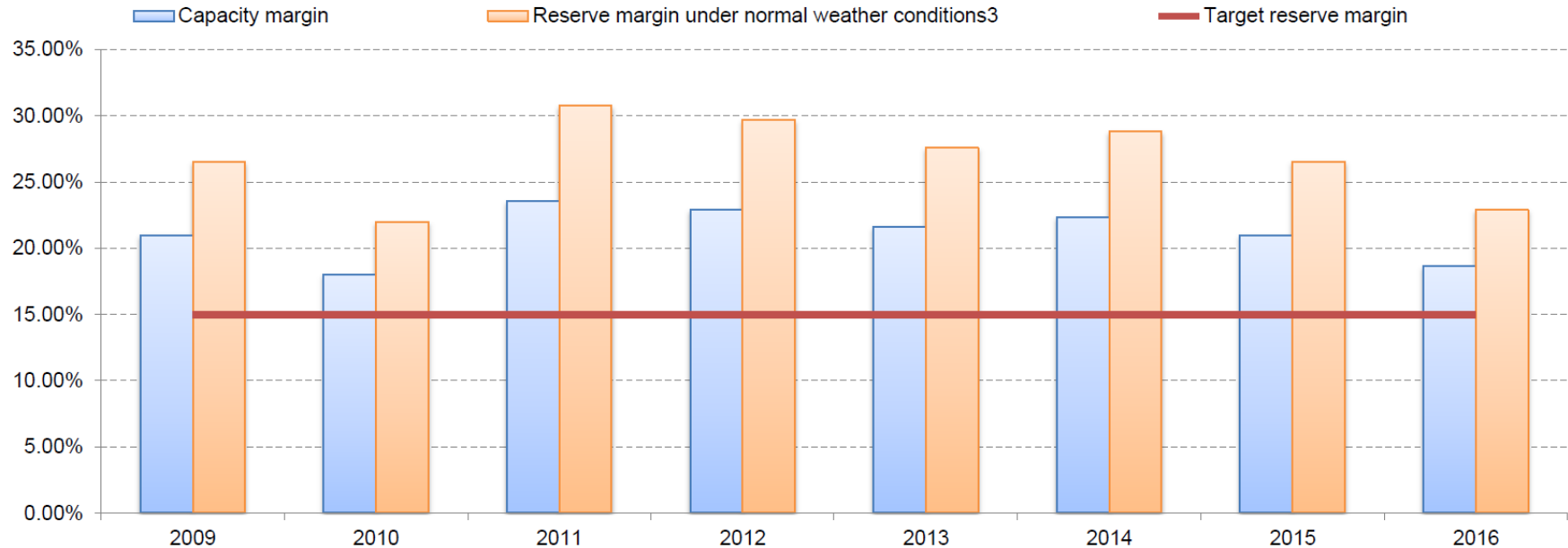
### Summer Peak Demand, Supply, and Capacity and Reserve Margins





## Excess Reserve Margins Persist in West

### Summer Peak Demand, Supply, and Capacity and Reserve Margins



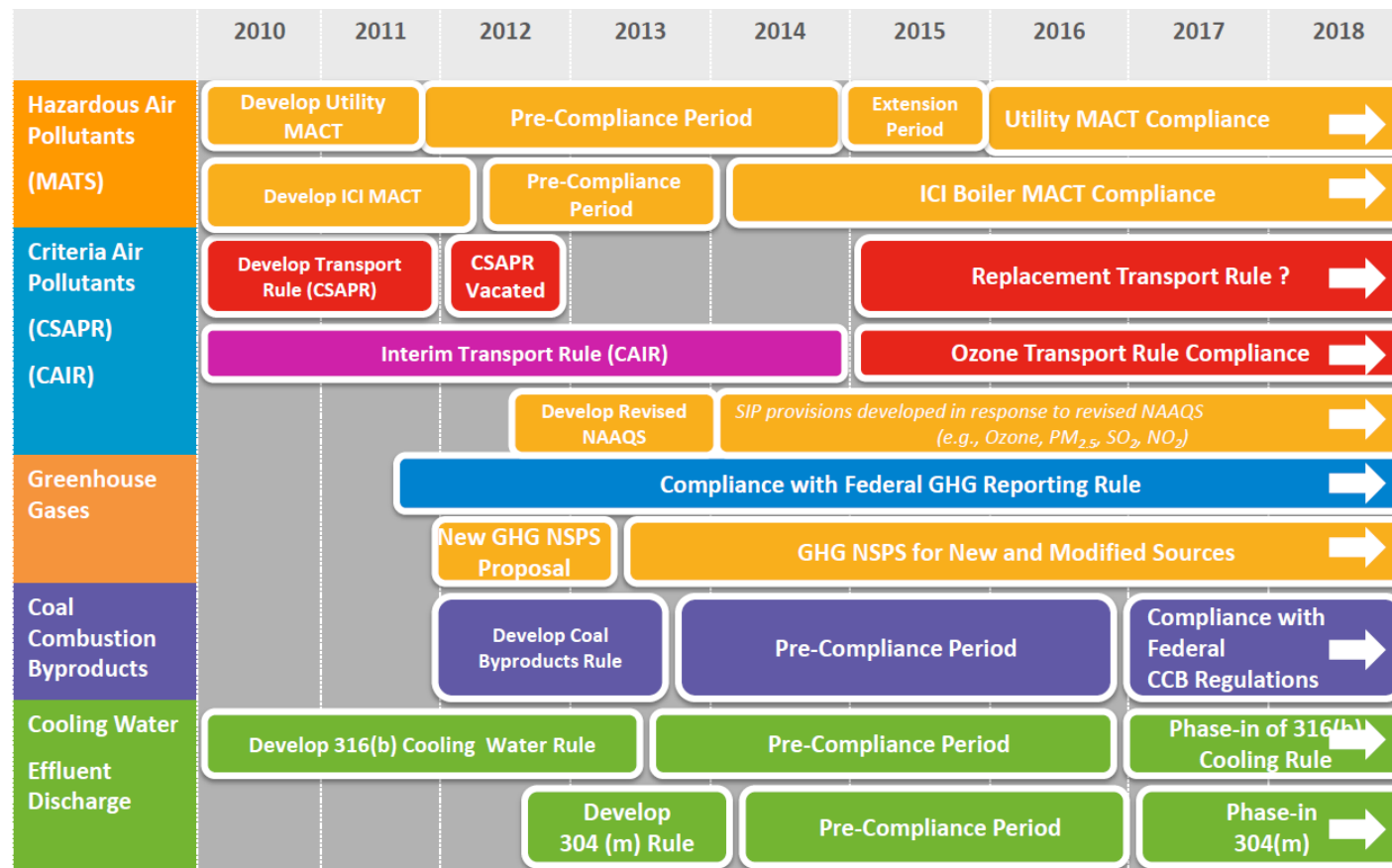
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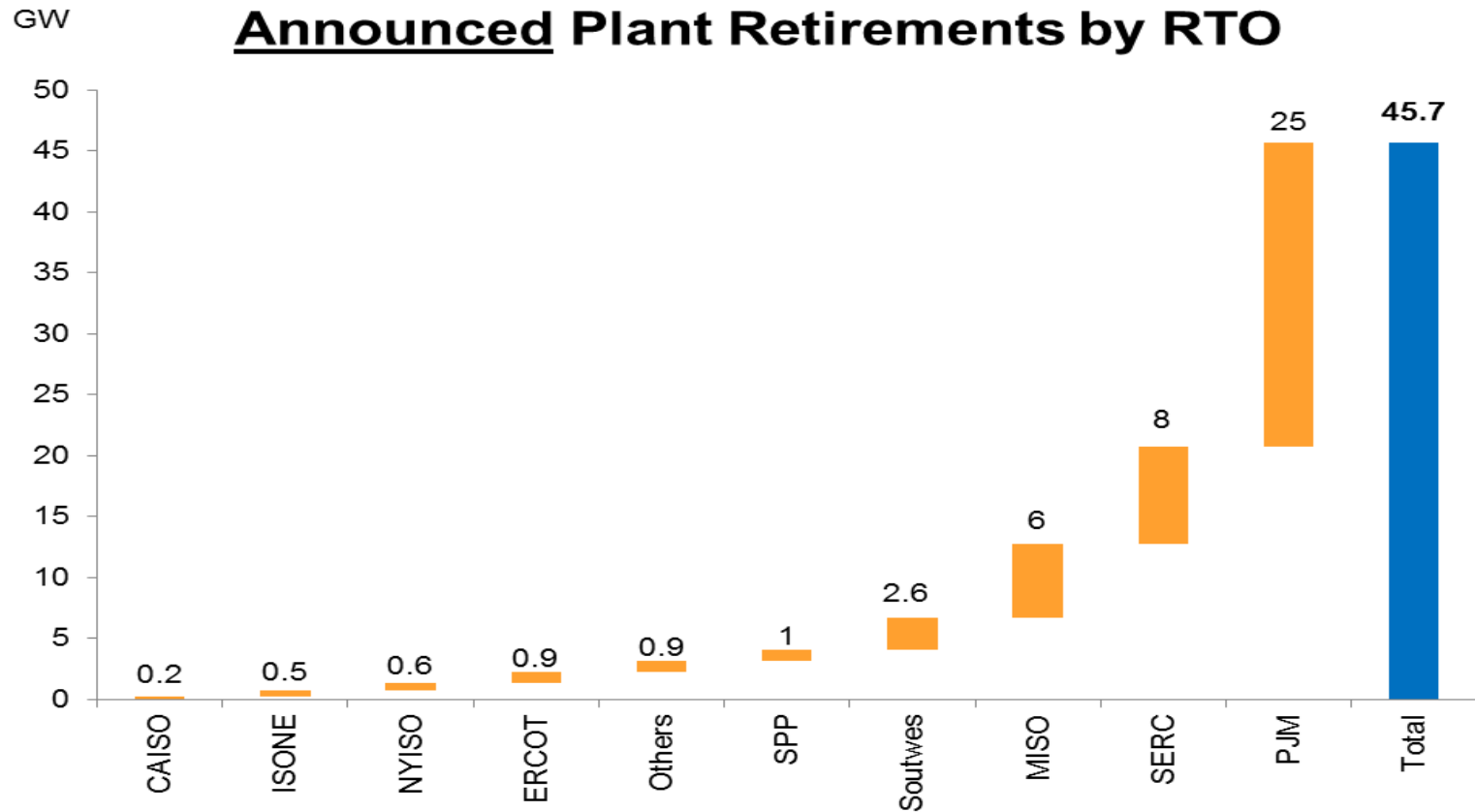
**Regulatory Pressure**

## Regulatory Pressure

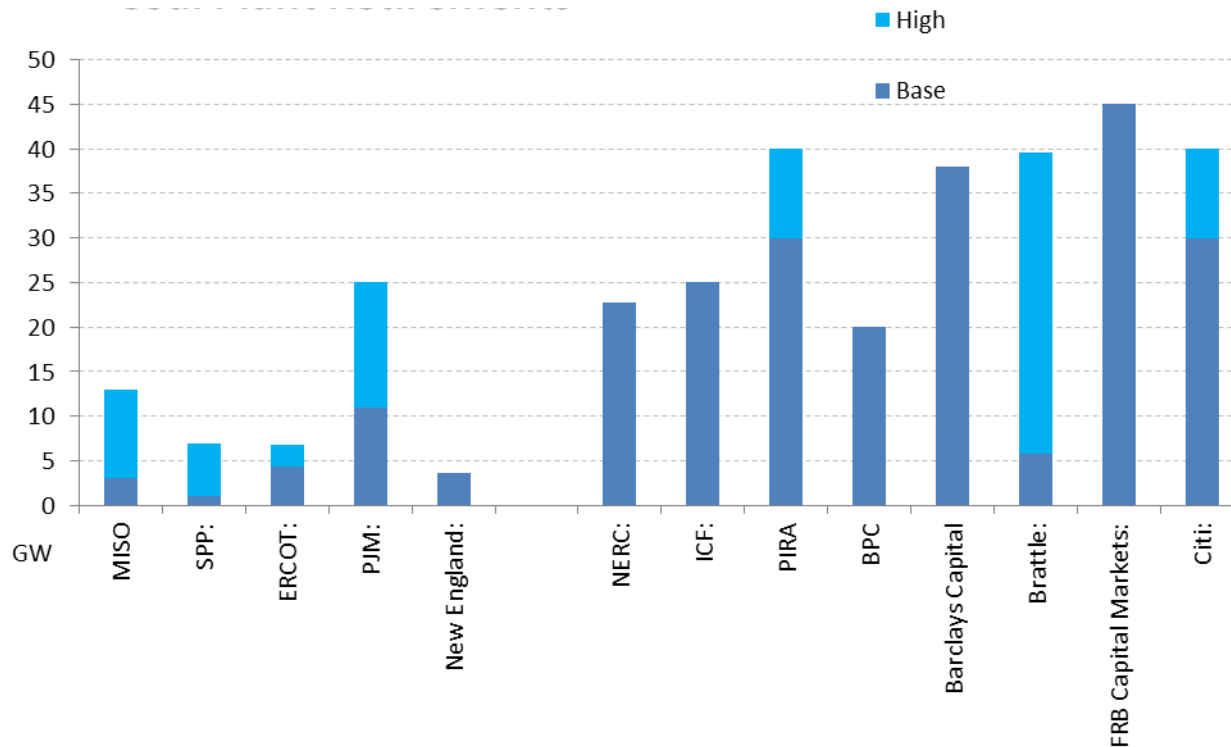


Source: PJM; adapted from M. J. Bradley & Associates LLC

## Capacity Reductions Key in Many Regions



## Coal Plant Retirements

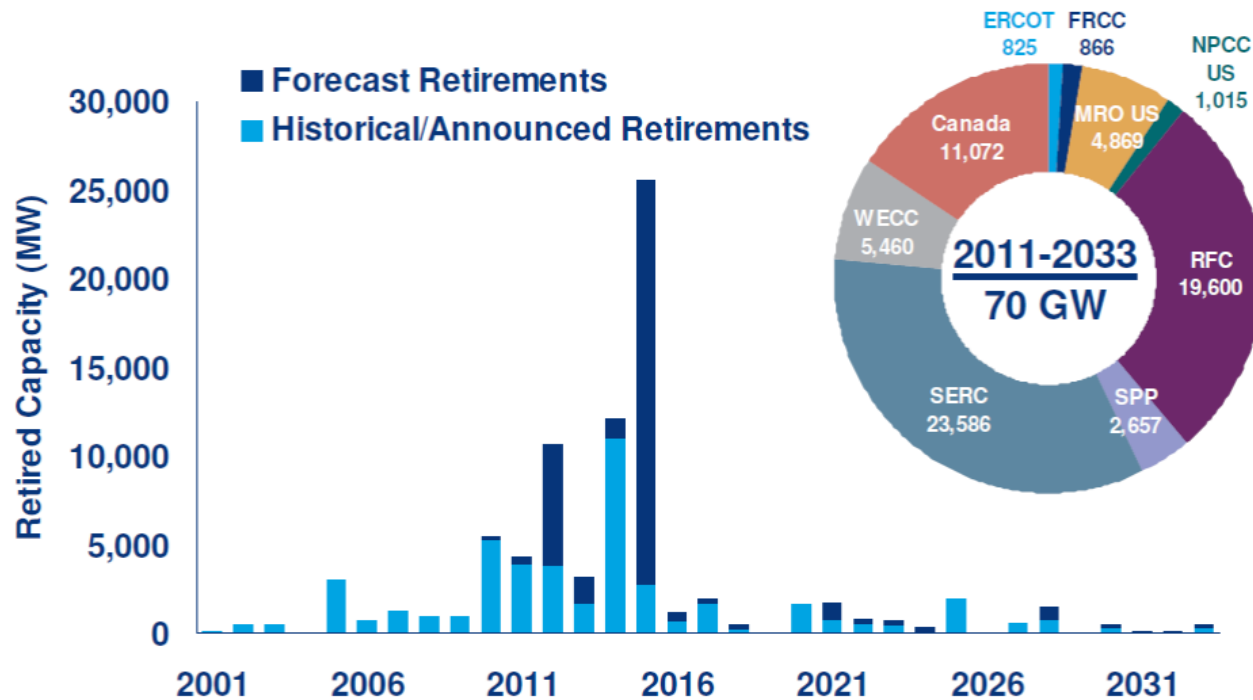


Source: Barclays

- Retirements from EPA mandates are estimated to be between 20 and 50 gigawatts, with some outliers around 70 gigawatts
- At least 10 gigawatts are already in the process

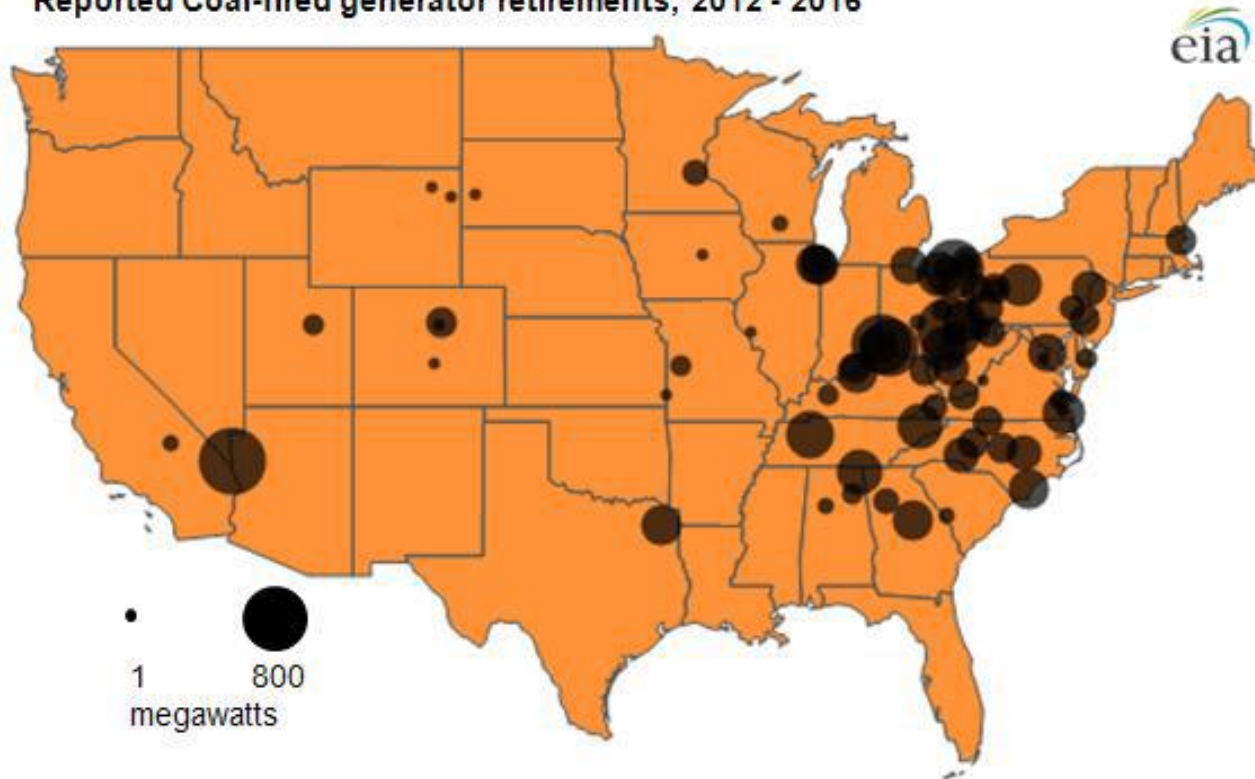


## Coal Plant Retirements



## Coal Plant Retirements

Reported Coal-fired generator retirements, 2012 - 2016



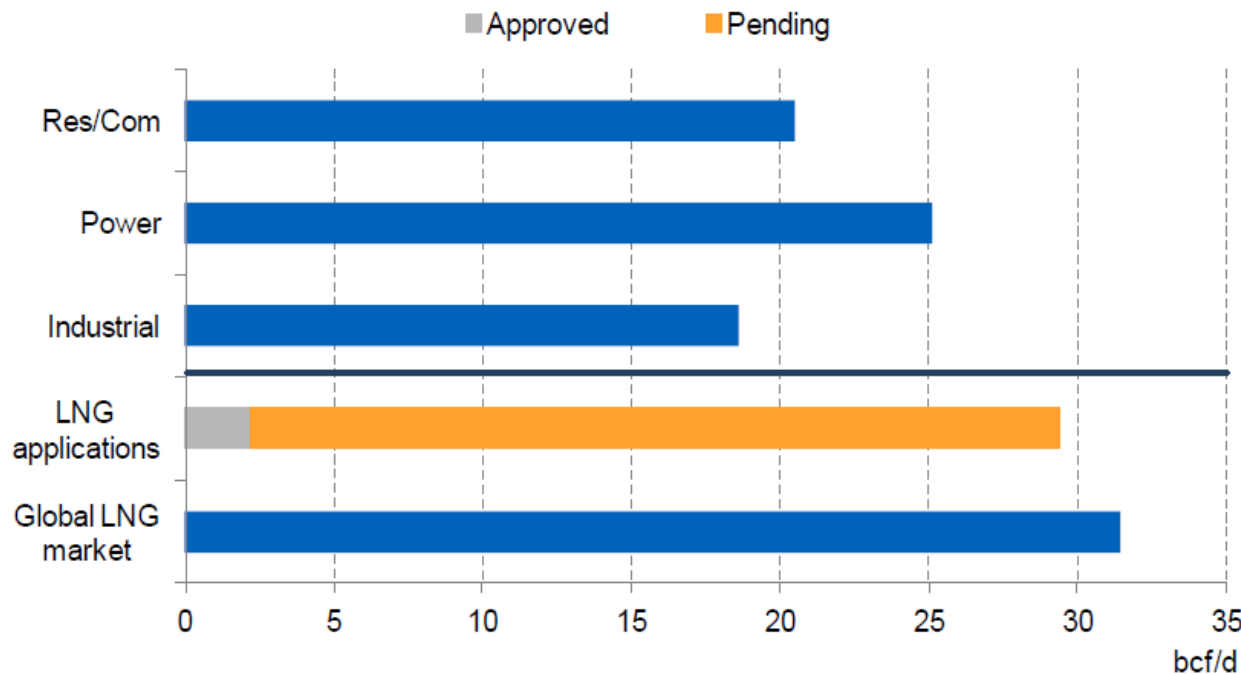
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**LNG Exports**

## LNG Exports

**Fig 1. LNG export applications vs. primary US demand sectors and global LNG market**



Source: EDFT, EIA

- First exports in 2015
- DOE assumes a net macroeconomic benefit to the US economy
- 23 applications represent over 29bcf/d of natural gas export capacity (size of current global market)
- Most experts assume 6 to 12 bcf/d of final approved capacity
- Making LNG larger than any other potential form of price shock in the US market
- Also contributes to local congestion
- However, supports domestic production

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**US Industrial Renaissance**



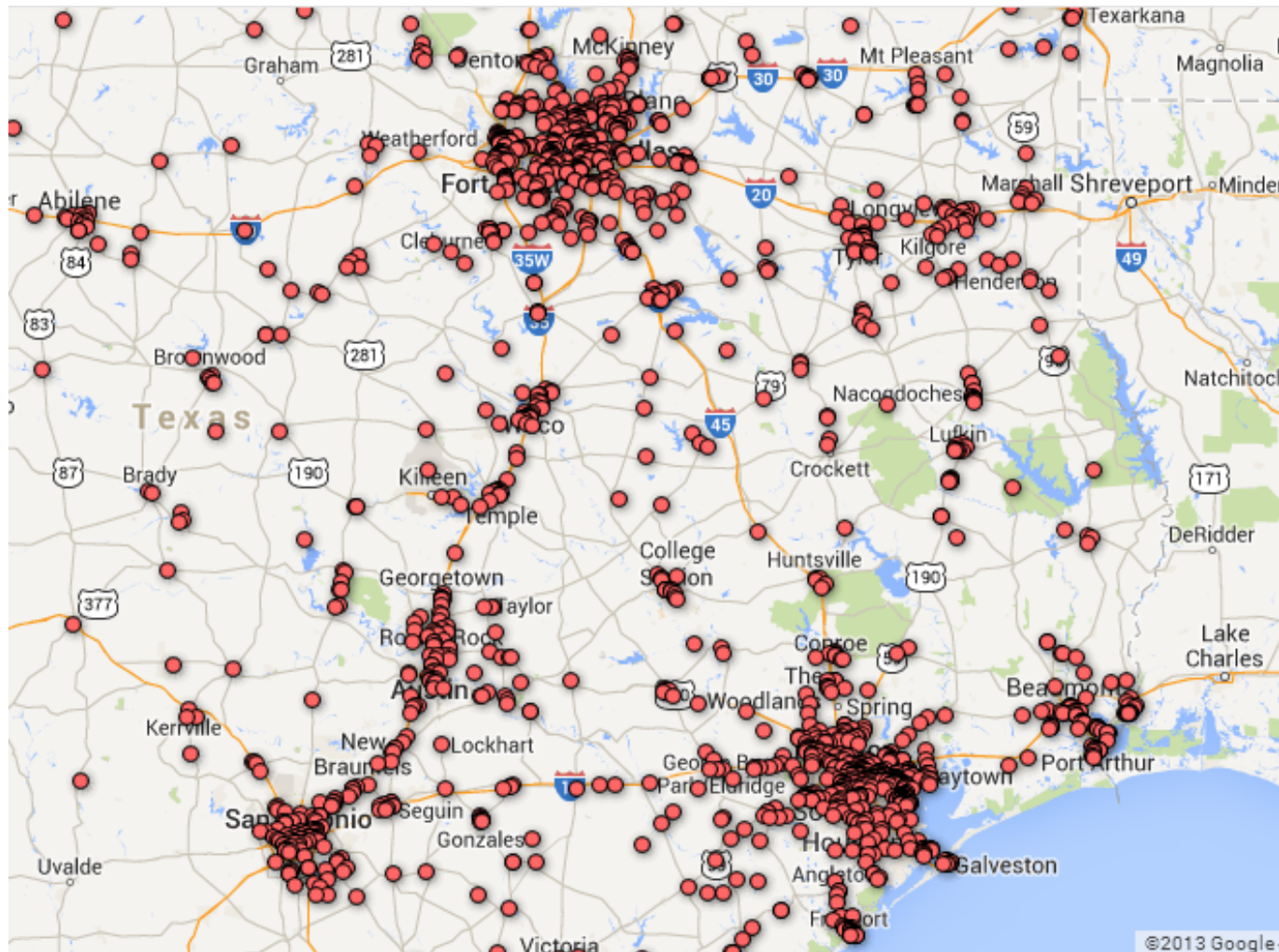
This map of Corpus Christi, Texas, illustrates the city's geographical context and infrastructure. Key features include:

- Water Bodies:** Nueces Bay to the north, Corpus Christi Bay to the east, and Oso Bay to the south.
- Major Highways:**
  - Interstate 37:** Runs north-south through the center of the city.
  - State Route 361:** Runs east-west along the coast.
  - State Route 181:** Runs north-south through the northern part of the city.
  - State Route 35:** Runs north-south through the northern part of the city.
  - State Route 44:** Runs east-west through the western part of the city.
- Neighborhoods and Landmarks:**
  - West Guth Park:** Located in the northwest.
  - Northwest Corpus Christi:** A residential area in the west.
  - Central City:** The downtown area, featuring **Cole Park** and **Lamar Park**.
  - South Side:** Located south of the central city.
  - Bay Area:** A coastal area south of the central city.
  - Gregory:** A neighborhood in the northeast.
  - Ingleside:** A neighborhood in the northeast.
  - Aransas Pass:** Located further east.
  - Port Aransas:** Located on the coast to the east.
- Other Features:**
  - Sunset Lake Park:** Located near the northern shore of Corpus Christi Bay.
  - McGloin Rd:** A major road in the west.
  - S Padre Island Dr:** A major road in the south.
  - Webster Rd:** A major road in the south.
  - Ocean Dr:** A major road in the south.

The map is credited to Google, with data from 2013.

Source: EDFT and IIR with Google Fusion Tables

## US Industrial Renaissance: Led by Shale



Source: EDFT and IIR with Google Fusion Tables

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**Conclusions**

## Conclusions

- **Shale gas/tight oil explosion will not abate**
- **Weak demand is already recovering, yet with efficiency**
- **Coal-to-gas switching provides a floor to the market**
- **Renewables will continue, but with pause for infrastructure build-out and solutions for intermittency**
- **Demand Response and efficiency will revolutionize consumption**
- **Resource adequacy and reserve margin challenges will not be easy to fix**
- **CSAPR and other regulations add real costs, and reduce liquidity in the short run**



## Battle of the Fundamentals: Manage Risk!

