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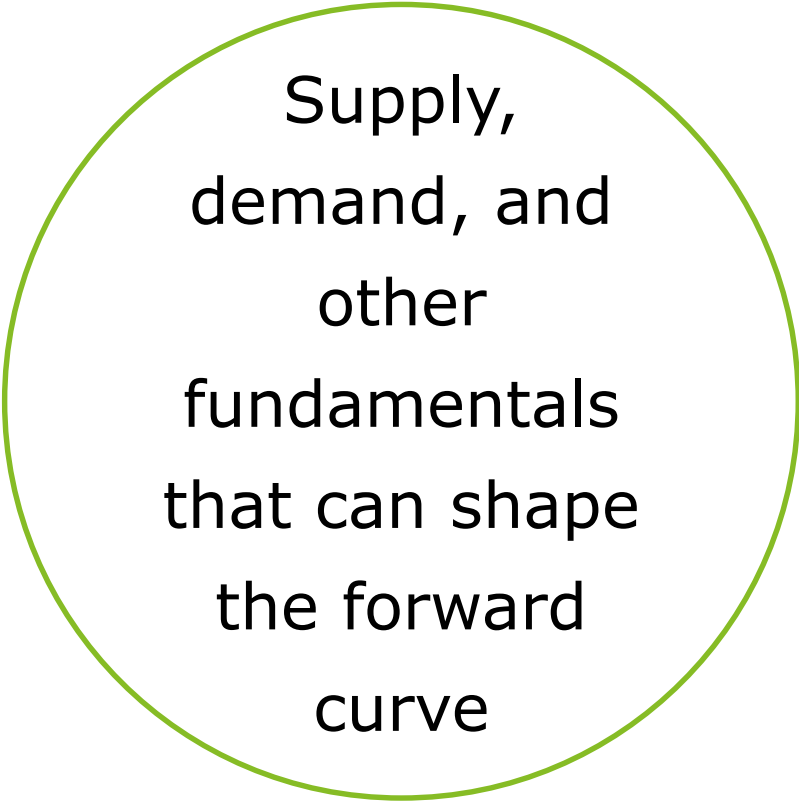


**2016 Deloitte Alternative Energy Seminar**

Setting new sights

November 14-16, 2016

Deloitte Center *for*  
**Energy Solutions**



Supply,  
demand, and  
other  
fundamentals  
that can shape  
the forward  
curve

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# Market volatility

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## Five-year prompt contract price range

Only constant is change.....

COMMODITY	5 YEAR HIGH - PRICE	5 YEAR LOW - PRICE	CURRENT PRICE	DIFFERENCE TO HIGH
WTI / BBL	\$ 110.53	\$ 26.54	\$ 48.24	-56%
HENRY HUB / MMBtu	\$ 6.15	\$ 1.64	\$ 2.91	-53%
PJM WEST ON / MWh	\$ 164.75	\$ 25.84	\$ 36.33	-78%
PROPANE (MTB) / Gal	\$ 1.67	\$ 0.32	\$ 0.50	-70%
S&P 500	2,190	1,099	2,168	-1%
LIBOR (1M)	0.52%	0.15%	0.52%	0%
Euro/USD FX	1.395	1.055	1.084	-22%

*Source: CME NYMEX as of 09/30/16; Yahoo Finance; X-Rates*

# Commodity prices

## Historical large movements

Daily price swings over the last 15 years

COMMODITY	DAYS BETWEEN 5TH STANDARD DEVIATION MOVES			
	AVG.	MIN	MAX	CURRENT
WTI / BBL	274	1	2,087	186
HENRY HUB / MMBtu	335	1	2164	2164
PJM WEST ON / MWh	197	3	911	86
PROPANE / Gal	311	14	1,712	59

*Source: CME NYMEX Prompt Month Prices as of 09/30/16.*

In a normally distributed daily population, a 5<sup>th</sup> standard deviation daily event should occur once every 4000 years

# ERCOT historical August prices

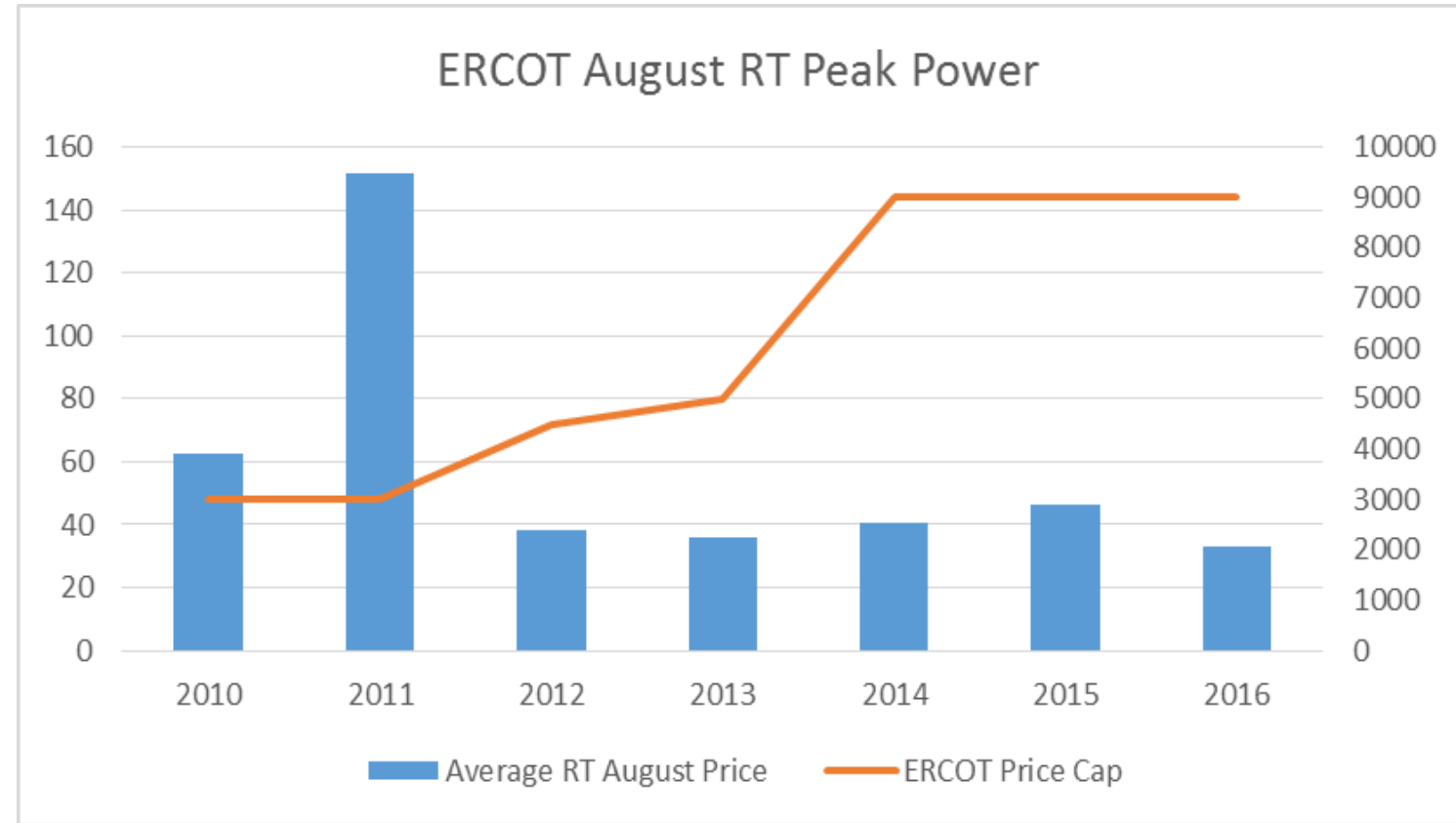
## Real-time peak

The ERCOT price Cap has increased 3 times over last 7 years to incentivize generation.

- Current cap is \$9k; other ISO's range from \$1k-\$2k

However, the ability to capitalize off the high price cap has been decreasing

- Both average summer prices and number of price spikes are down significantly



### Price Spikes over \$250

2010	2011	2012	2013	2014	2015	2016
<b>53</b>	<b>91</b>	<b>8</b>	<b>2</b>	<b>2</b>	<b>17</b>	<b>2</b>

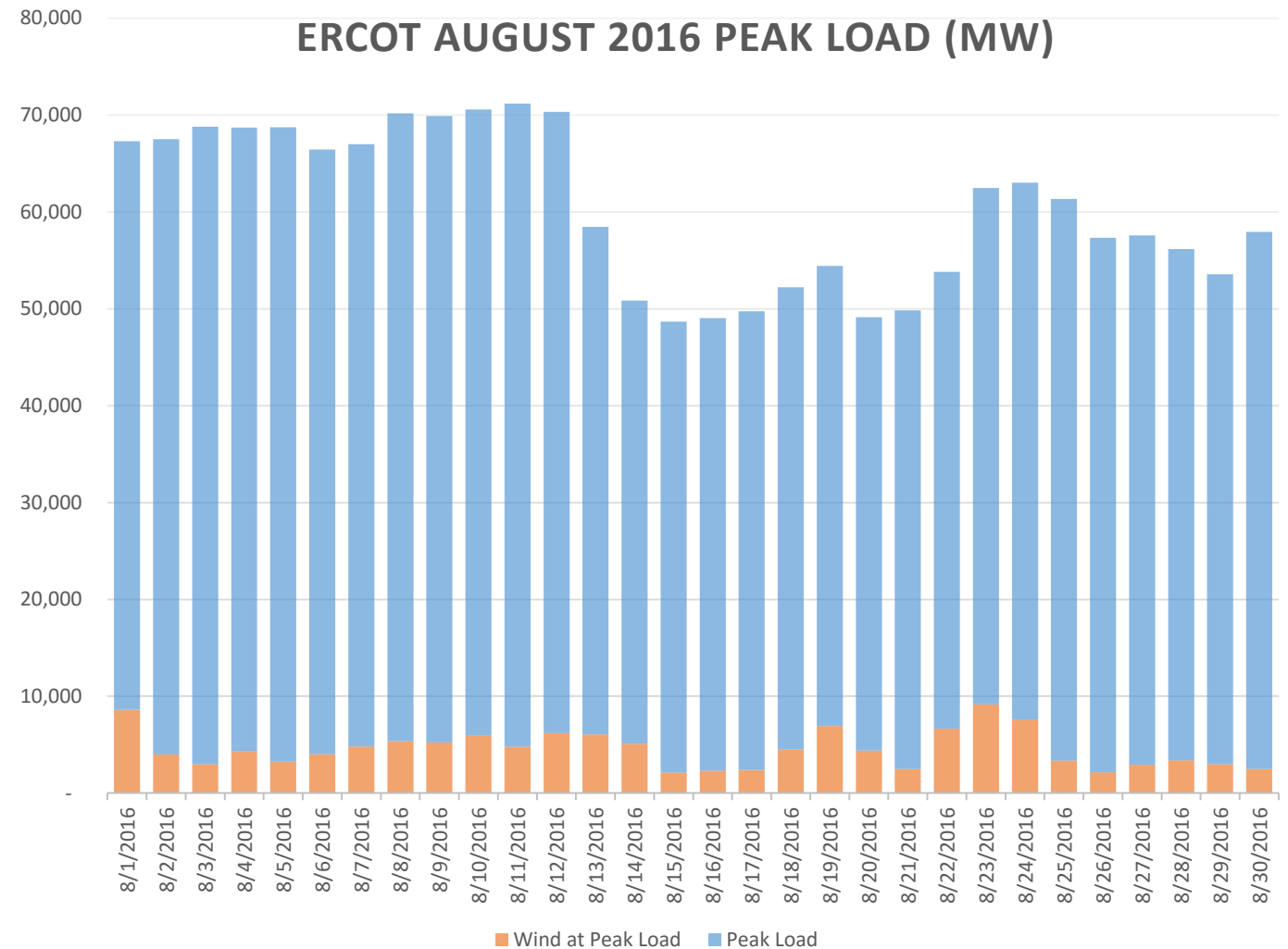
Source: SNL Power Prices; ERCOT

# ERCOT August 2016

## Daily load @ peak hour

August 2016 was a record load month in ERCOT

- The 70k MW level was eclipsed four times
- Six “would be” new load records
- Wind’s contribution @ peak load hour was 3-15%
- Wind’s contribution during the top five load days was only 7-8%



Source: SNL Power Generation; ERCOT

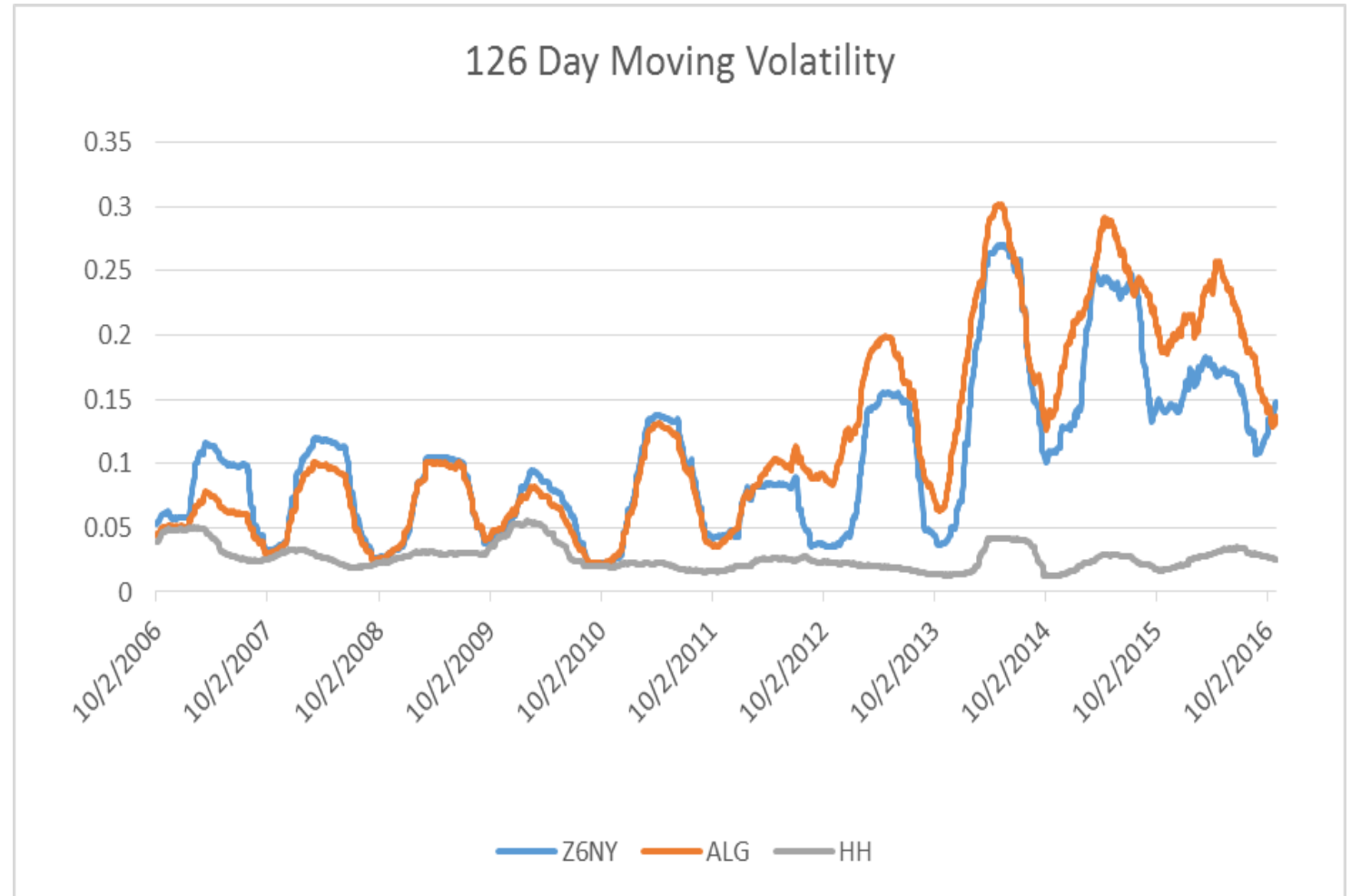


# Northeast gas volatility

## Algonquin, Transco Z6 NY, and Henry Hub daily volatility

One notable exception to the reduced volatility trend in commodity markets is Northeast gas

- Northeast has been 5-10x more volatile than Henry in recent years
- Infrastructure constraints should continue this volatility trend during peak demand seasons



Source: SNL Day-Ahead Gas Prices

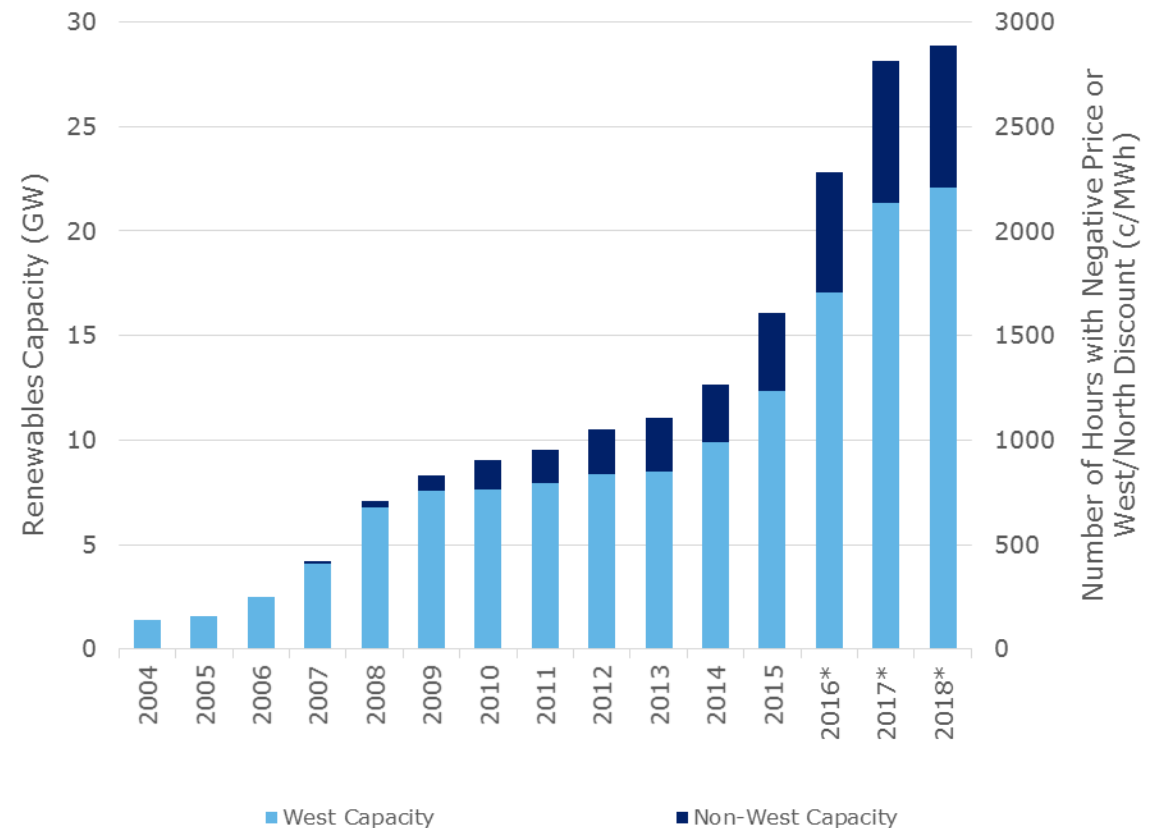
# Renewables development in ERCOT and the CREZ experience

# Renewables development in ERCOT

## Texas leads the nation in installed wind capacity with most of the capacity tied to the ERCOT power market

- ERCOT experienced a wind capacity boom in the mid-2000s with additions primarily in the West Zone.
- By 2008, wind generation frequently exceeded available transmission capability resulting in congestion that caused West Zone prices:
  - To be at a discount to the North Zone
  - To become negative at times of high wind generation in the West
- With increasing congestion out of the West, development interest moved to the North, South, and Coastal regions which tended to be closer to the major demand areas.
- Extension of the federal production tax credit (PTC) and investment tax credit (ITC) is thought to have encouraged a resumption of capacity increases in the near term.

Renewables (Wind and Solar) Development in ERCOT Divided Between West/Panhandle and Non-West (North, South, and Coastal) Regions



\* Partial and/or projected year period

Source: ERCOT Capacity, Demand, and Reserve report, May 2016.

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# Renewables development in ERCOT

Installation of wind capacity in the West resulted in congestion at times of high renewables generation, peaking in 2008

- Congestion in 2008 resulted in over 1,500 hours with negative prices in the West Zone:
  - Negative balancing energy market prices were partially enabled by the PTC since the tax credit was associated with the actual production of energy. An operator could pay for an entity to take its energy generation and still make money using the credit.
- With congestion, the West Zone often priced at a discount to the neighboring North Zone:
  - The annual average West Zone discount to North Zone reached a maximum in 2009 at over \$22/MWh.
- Congestion in the West slowed new development and led to the implementation of CREZ by the Public Utility Commission of Texas:
  - CREZ was to enable more wind capacity at a cost of nearly \$7 B.
  - Approved in 2009 with completion of all projects in 2013

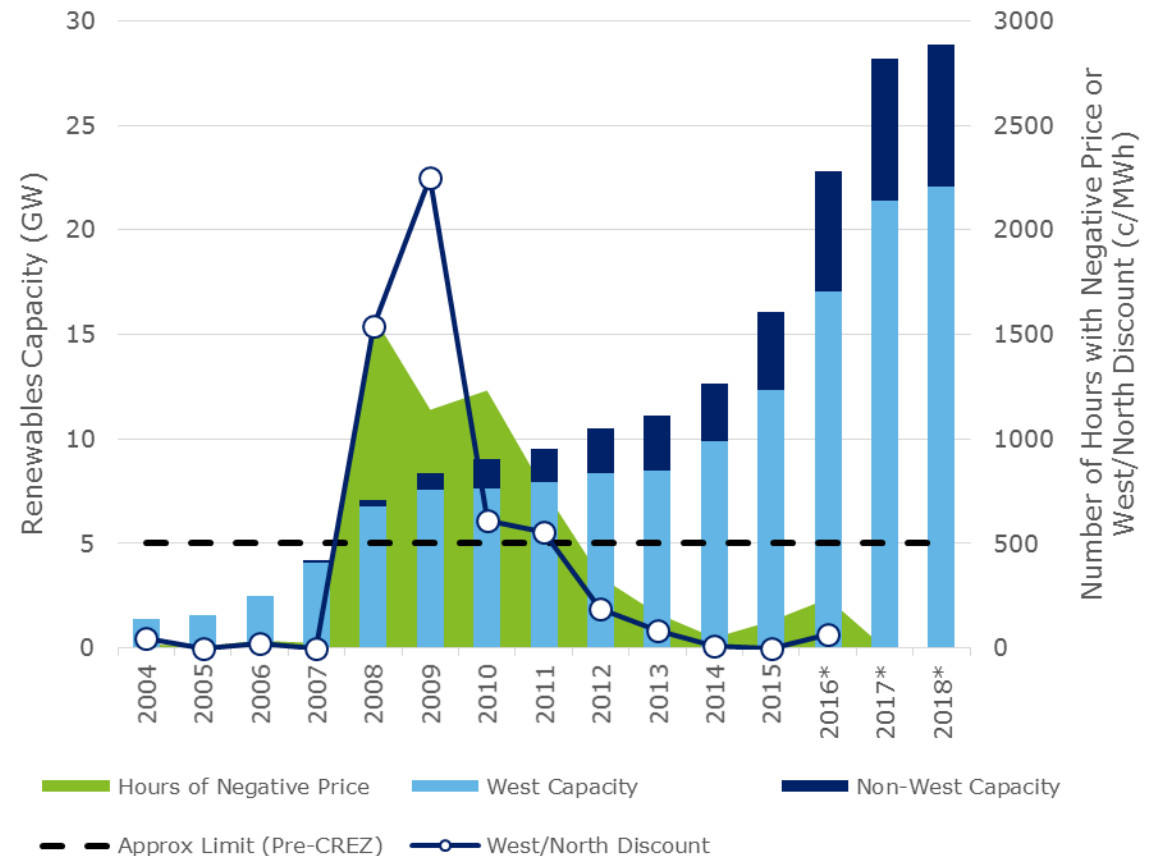
In Dec 2010, ERCOT moved from a nodal system to the Texas Nodal Market. Prices indicated are zonal balancing energy or nodal hub LMP, respectively.

\* Partial and/or projected year period

Source: ERCOT, SNL Energy

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Renewables (Wind and Solar) Development in ERCOT Divided Between West/Panhandle and Non-West (North, South, and Coastal) Regions

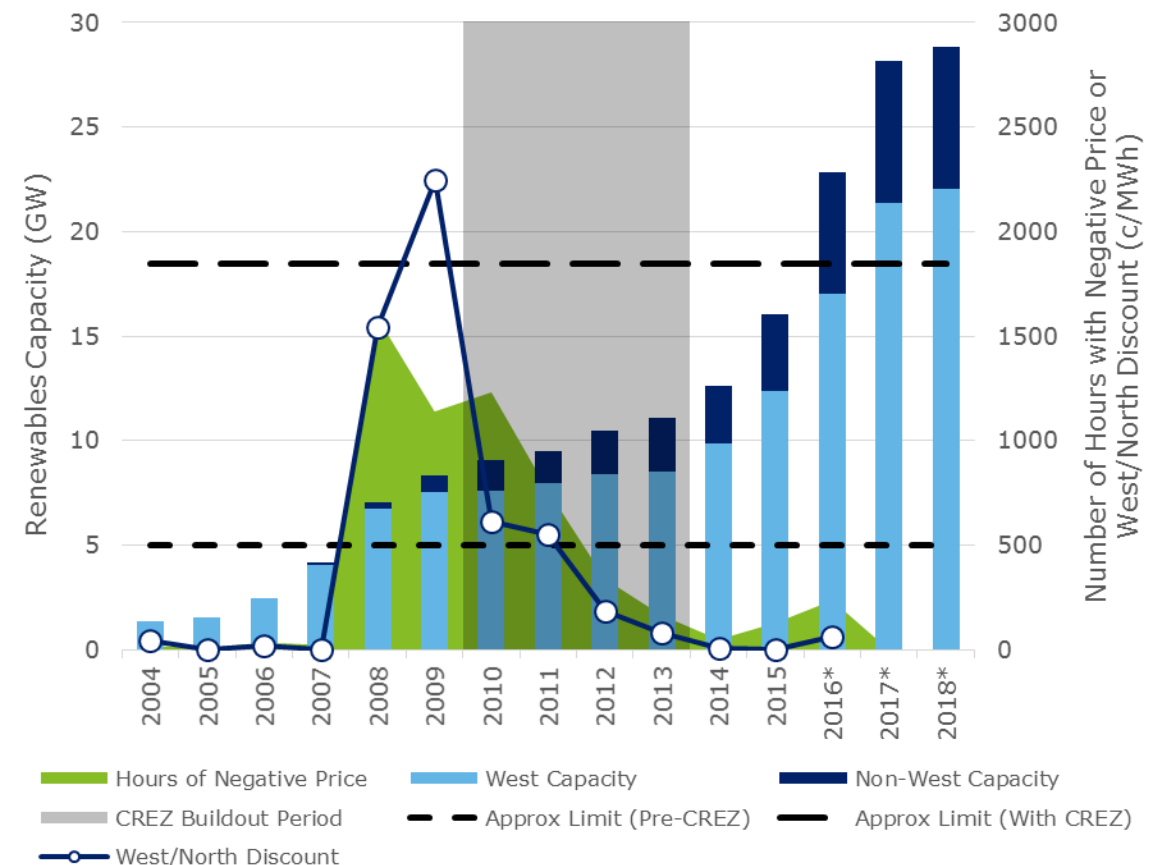


# Renewables development in ERCOT

## Will ERCOT need CREZ II?

- The buildout of CREZ saw a decline in both hours of negative West Zone prices and in the discount of West Zone prices to North Zone.
- Renewables capacity has increased since the completion of CREZ, and the renewables capacity expected by ERCOT in the West is below the 18.5 GW capability of CREZ.
- However, the renewables capacity expected in the West by ERCOT will exceed 21 GW in 2017 and 22 GW in 2018:
  - Can ERCOT experience the return of congestion, negative prices in the West, and a West discount to North?

Renewables (Wind and Solar) Development in ERCOT Divided Between West/Panhandle and Non-West (North, South, and Coastal) Regions



In Dec 2010, ERCOT moved from a nodal system to the Texas Nodal Market. Prices indicated are zonal balancing energy or nodal hub LMP, respectively.

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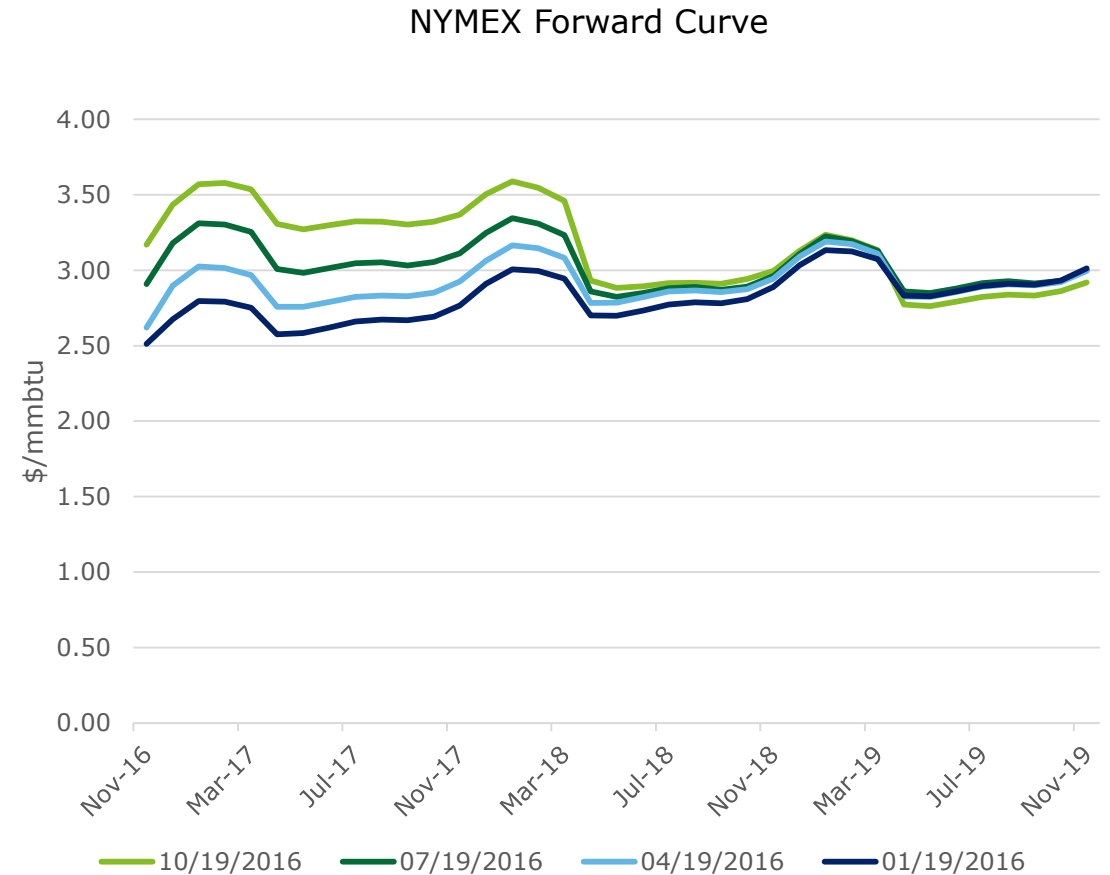
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# Natural gas forward curve

# NYMEX forward curve

## Why is the NYMEX forward curve in backwardation in 2018-2019?

- Expected increases in demand seem to indicate a bullish market in 2018-2019:
  - Continued transition away from coal towards natural gas and renewable energy for power generation
  - Additional pipeline capacity expected to be built to meet growing demand from Mexico
  - More than 8 Bcf/d of additional LNG export capacity is expected online in 2018-2019 from Cameron LNG, Corpus Christi LNG, Sabine Pass Train 5, Cove Point LNG, and Freeport LNG
- So, does the market really expect lower natural gas prices in 2018-2019 relative to 2017?:
  - Is the market expecting significant supply at prices at or just above \$3/mmbtu?
  - Does the market doubt that this increased demand will materialize?
  - Could this be a liquidity issue in the market?



Source: SNL and Deloitte MarketPoint LLC

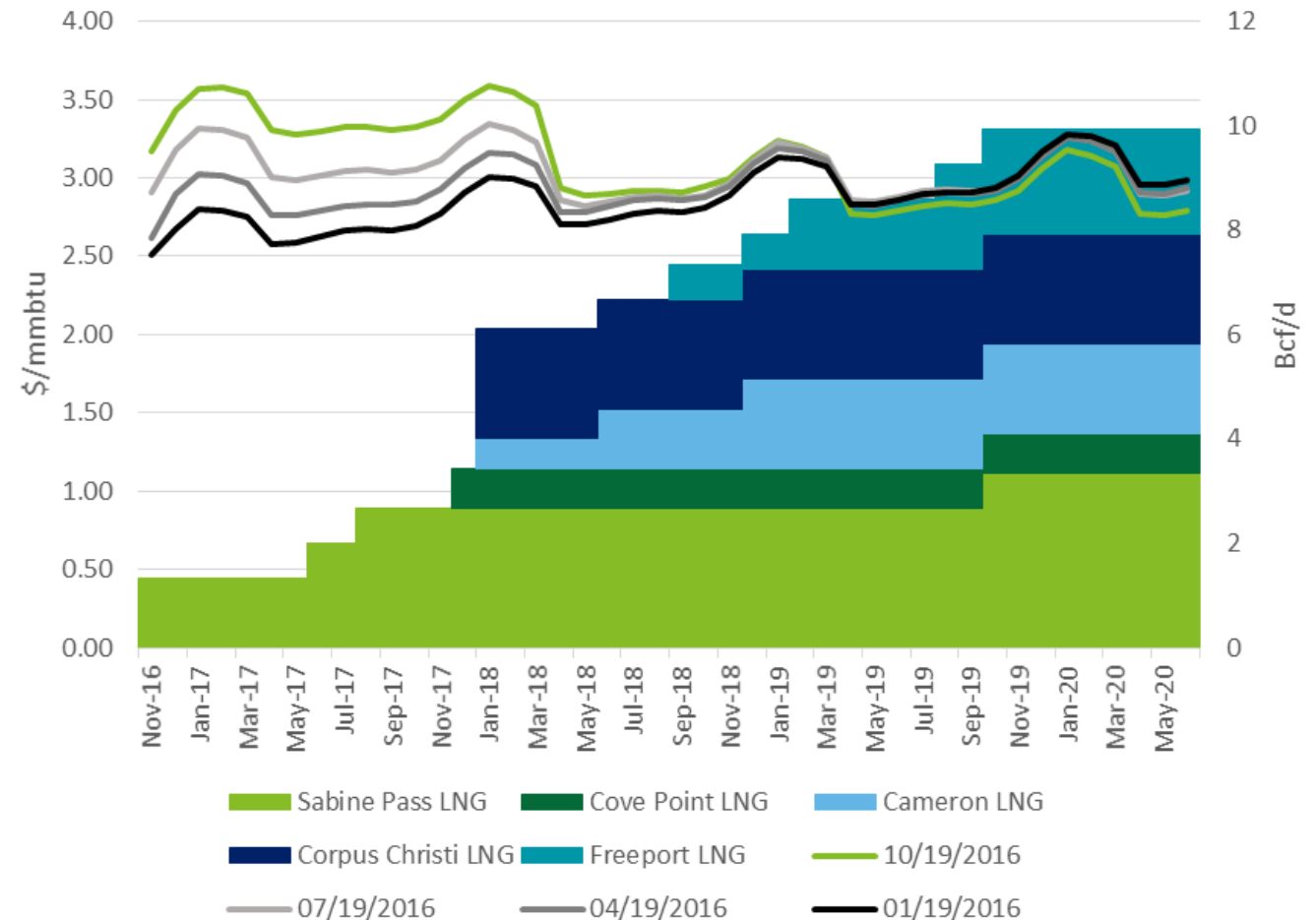
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# NYMEX forward curve

## What is the forward curve saying about LNG export capacity development?

- More than 8 Bcf/d of additional LNG export capacity is expected online in 2018-2019 from:
  - Cameron LNG
  - Corpus Christi LNG
  - Sabine Pass Train 5
  - Cove Point LNG
  - Freeport LNG
- The front of the curve has increased over the year while prices for 2018-2020 have been relatively unchanged. Now 2017 is higher than the subsequent few years:
  - Is the market expecting significant supply at prices at or just above \$3/mmbtu?
  - Does the market doubt that this increased demand will materialize?

NYMEX Forward Curve vs. Expected US LNG Export Capacity



Source: SNL, DOE, Company Websites, and Deloitte MarketPoint LLC



# Potential presidential policy scenarios

## Potential presidential policy scenarios

For illustration purposes, we have two scenarios roughly representing a continuation of existing policies versus a shift in policy direction.

- Utilizing MarketBuilder, Deloitte MarketPoint's economic modeling platform, market fundamentals such as supply costs, emissions and renewables policies, and other factors can be analyzed for their potential impacts on market prices, capacity expansion, and generation mix.

### Policy continuation scenario

- Costs of renewables are lower due in part to extension of the federal production tax credit (PTC) and investment tax credit (ITC) and technological/manufacturing improvements
- Renewable portfolio standards (RPS) increases in certain states such as California and New York
- Limited capacity factors for coal plants
  - Inspired by the US Environmental Protection Agency (EPA) Clean Power Plan (CPP)

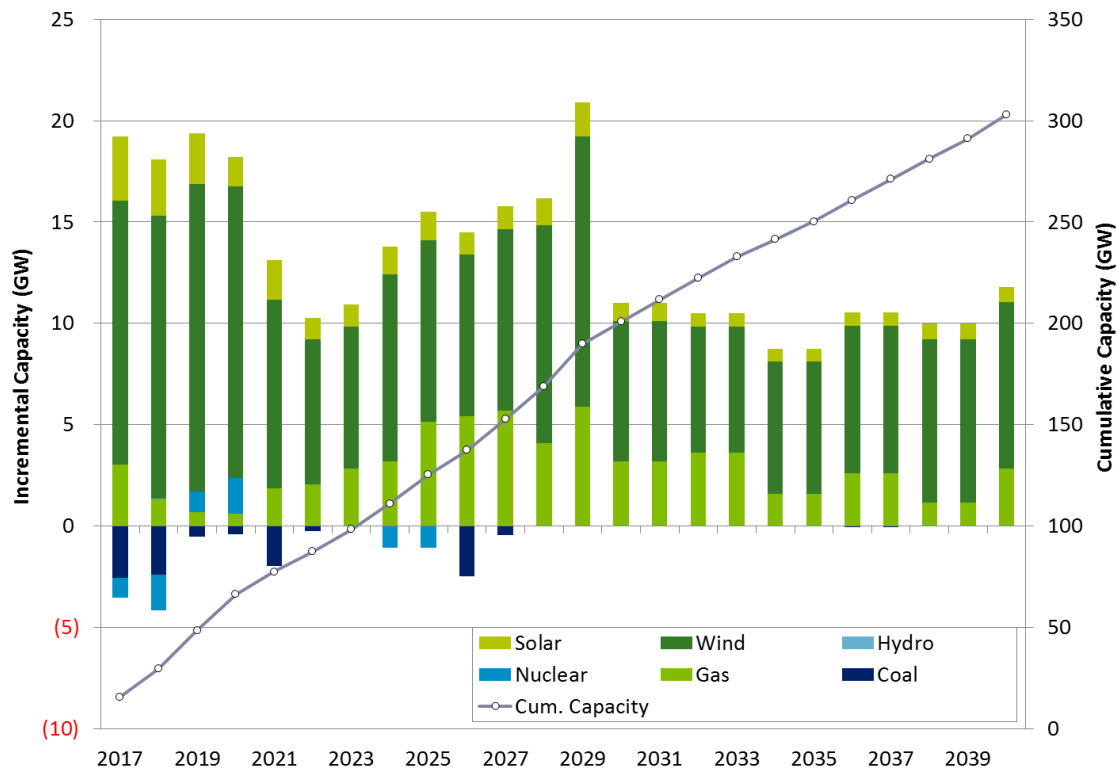
### Policy shift scenario

- Costs of renewables do not decline as rapidly as the pace of technological/manufacturing improvements slows
- RPS are met on an extended schedule and at lower levels in some areas
- Coal plant utilization is unaffected by incremental restrictions on greenhouse gas and other emissions
  - EPA's CPP is significantly delayed or reduced

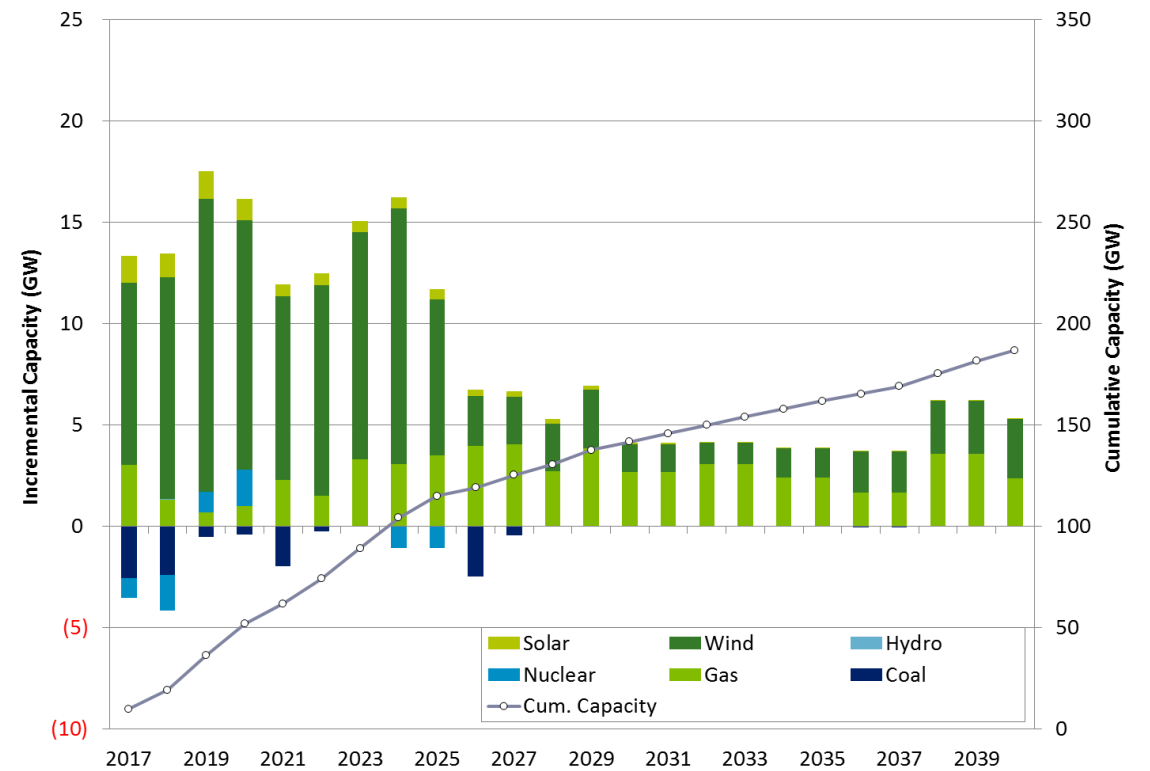
# Potential presidential policy scenarios

## How might generation capacity evolve under the different policies?

### Policy Continuation Scenario



### Policy Shift Scenario

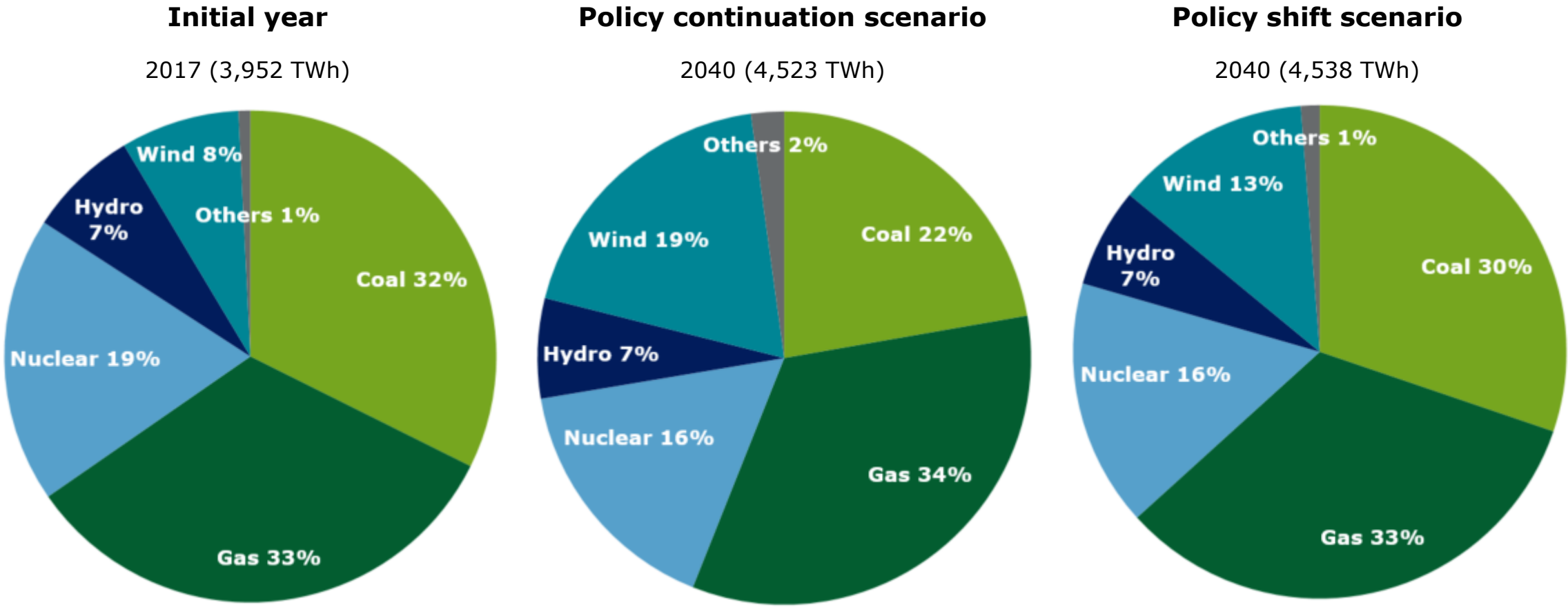


Source: Deloitte MarketPoint LLC

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# Potential presidential policy scenarios

How might the generation mix differ under the different scenarios?



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