FUEL PRICE FORECASTING WITH A FOCUS ON COAL

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About Energy Ventures Analysis, Inc. (EVA)

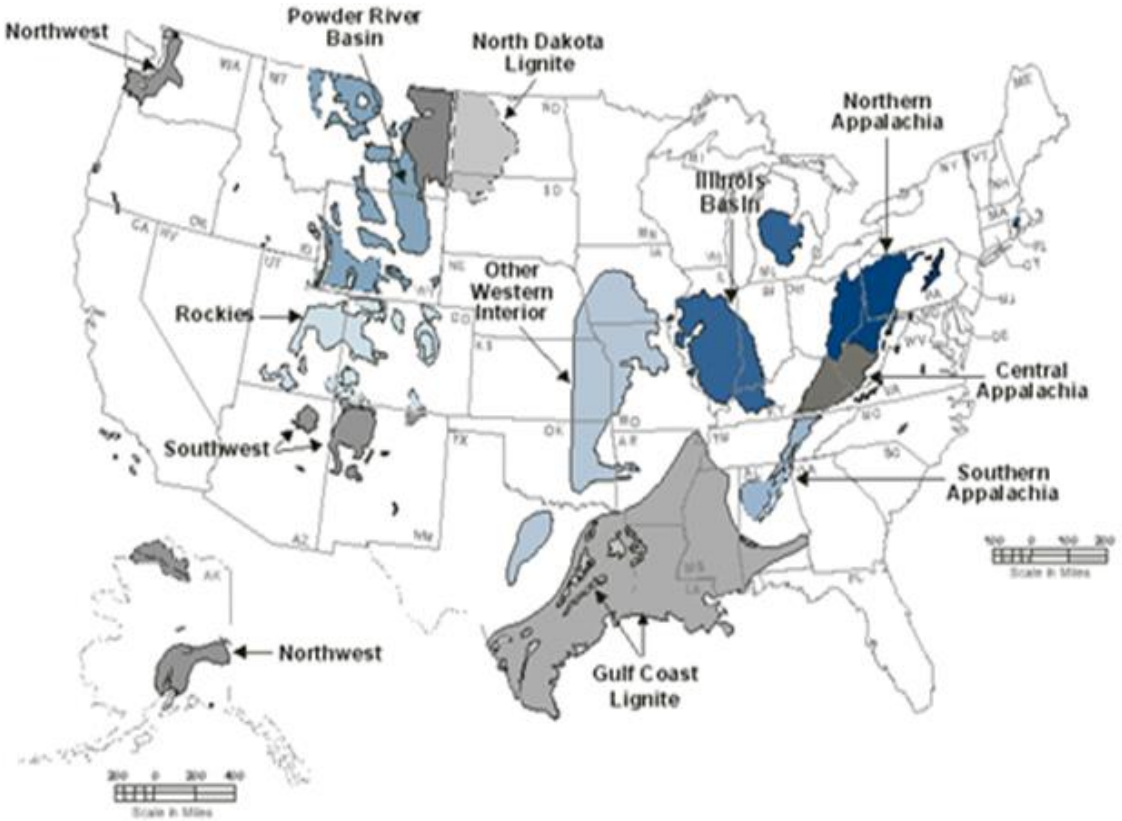
EVA, Inc. is a management consulting firm for the U.S. energy industry and is focused on economic, financial and risk analysis for the electric power, coal, natural gas, petroleum, and renewable, and emissions sectors.

Since 1981, EVA has been publishing supply, demand and price forecasts as part of its FUELCAST subscription service for these energy sectors.

EVA performs various analyses for an array of clients that include:

- **power utilities,**
- **fuel producers,**
- **fuel transporters,**
- **commodity traders,**
- **regulators, and**
- **financial institutions.**

U.S. COAL PRIMER



Demand

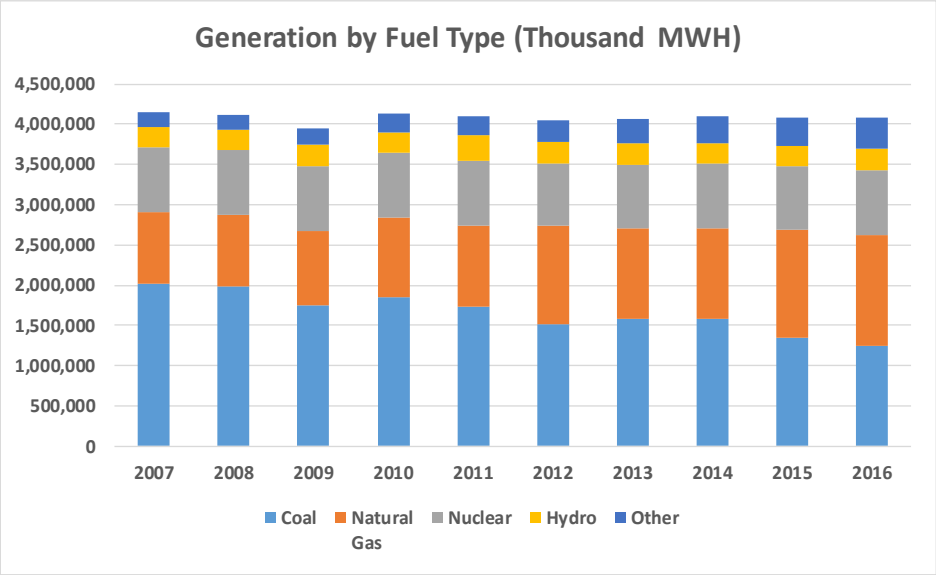
mm tons	2008	2009	2010	2011	2012	2013	2014	2015	2016
Electric Power Burn	1,040.4	930.8	970.4	932.0	822.5	857.1	850.3	736.6	670.6
Consumer stock change	*2.9*	*28.7*	*(16.2)*	*(2.4)*	*8.6*	*(42.8)*	*(4.1)*	*40.2*	*(30.9)*
Electric Power Receipts	1,043.3	959.5	954.2	929.6	831.2	814.3	846.3	776.8	639.7
Coke Ovens	22.4	15.2	21.1	22.1	20.9	21.1	21.7	19.5	16.5
Industrial/Commercial	59.9	50.9	49.1	47.8	44.8	45.0	45.3	40.3	34.1
Domestic Demand	**1,125.7**	**1,025.5**	**1,024.4**	**999.4**	**896.8**	**880.4**	**913.3**	**836.6**	**690.2**
Export metallurgical	42.5	37.1	56.1	69.0	68.2	61.2	57.6	44.6	40.5
Export steam	32.0	25.5	29.1	42.6	61.7	64.2	44.4	35.4	25.9
Total Exports	**74.5**	**62.6**	**85.2**	**111.6**	**129.9**	**125.5**	**102.0**	**80.0**	**66.4**
Total Demand	**1,200.2**	**1,088.2**	**1,109.6**	**1,111.0**	**1,026.7**	**1,005.9**	**1,015.3**	**916.6**	**756.6**

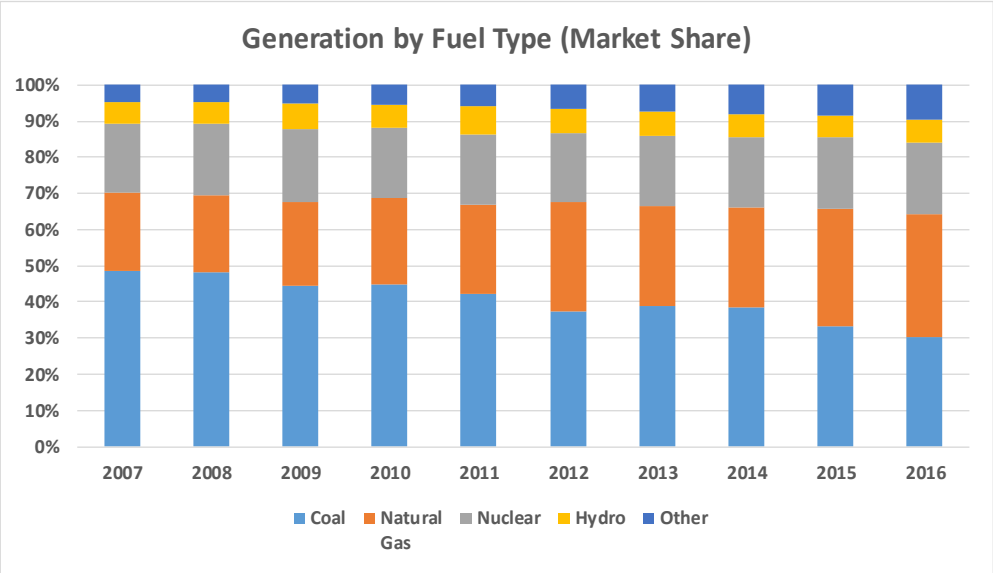
- Power sector dominates demand for US coal
- Exports are an attractive market but only when US dollar is weaker than it is today

Production

mm tons	2008	2009	2010	2011	2012	2013	2014	2015	2016
Northern Appalachia	135.2	126.1	129.1	131.2	124.5	121.7	132.0	114.8	101.9
Central Appalachia	233.5	194.9	184.1	182.7	147.2	127.6	116.6	90.4	66.6
Alabama	20.4	18.7	20.1	19.1	19.6	18.4	16.6	13.2	9.1
Appalachia Total	**389.1**	**339.7**	**333.2**	**333.0**	**291.2**	**267.7**	**265.1**	**218.4**	**177.6**
Illinois Basin	99.0	102.3	105.1	115.8	126.9	131.6	136.8	123.3	98.2
East Total	**488.2**	**442.1**	**438.3**	**448.7**	**418.1**	**399.3**	**401.9**	**341.7**	**275.8**
Powder River Basin	496.0	455.7	468.4	462.6	419.1	407.6	418.2	398.6	313.7
Rockies	81.5	74.9	70.8	74.5	74.1	71.5	70.9	58.5	47.1
Lignite	75.7	72.5	78.9	81.1	78.9	77.0	79.5	70.9	71.5
Southwest	24.0	22.4	20.5	20.0	20.1	20.9	18.9	18.7	13.9
Interior	2.0	1.6	1.6	1.8	1.6	1.6	1.4	1.9	2.7
West Total	**679.1**	**627.1**	**640.3**	**639.9**	**593.7**	**578.5**	**588.8**	**548.5**	**448.9**
Alaska	1.5	1.8	2.2	2.1	2.1	1.5	1.5	1.2	0.9
Anthracite	1.7	1.7	1.7	2.2	2.3	2.1	1.9	2.0	1.5
U. S. Coal Total	**1,170.5**	**1,072.7**	**1,082.5**	**1,093.0**	**1,016.2**	**981.4**	**994.1**	**893.4**	**727.0**
Imports	32.2	20.9	17.8	11.4	7.6	7.3	9.5	9.6	8.8
Waste Coal									
Total Production	**1,202.7**	**1,093.6**	**1,100.3**	**1,104.4**	**1,023.8**	**988.7**	**1,003.6**	**903.0**	**735.8**

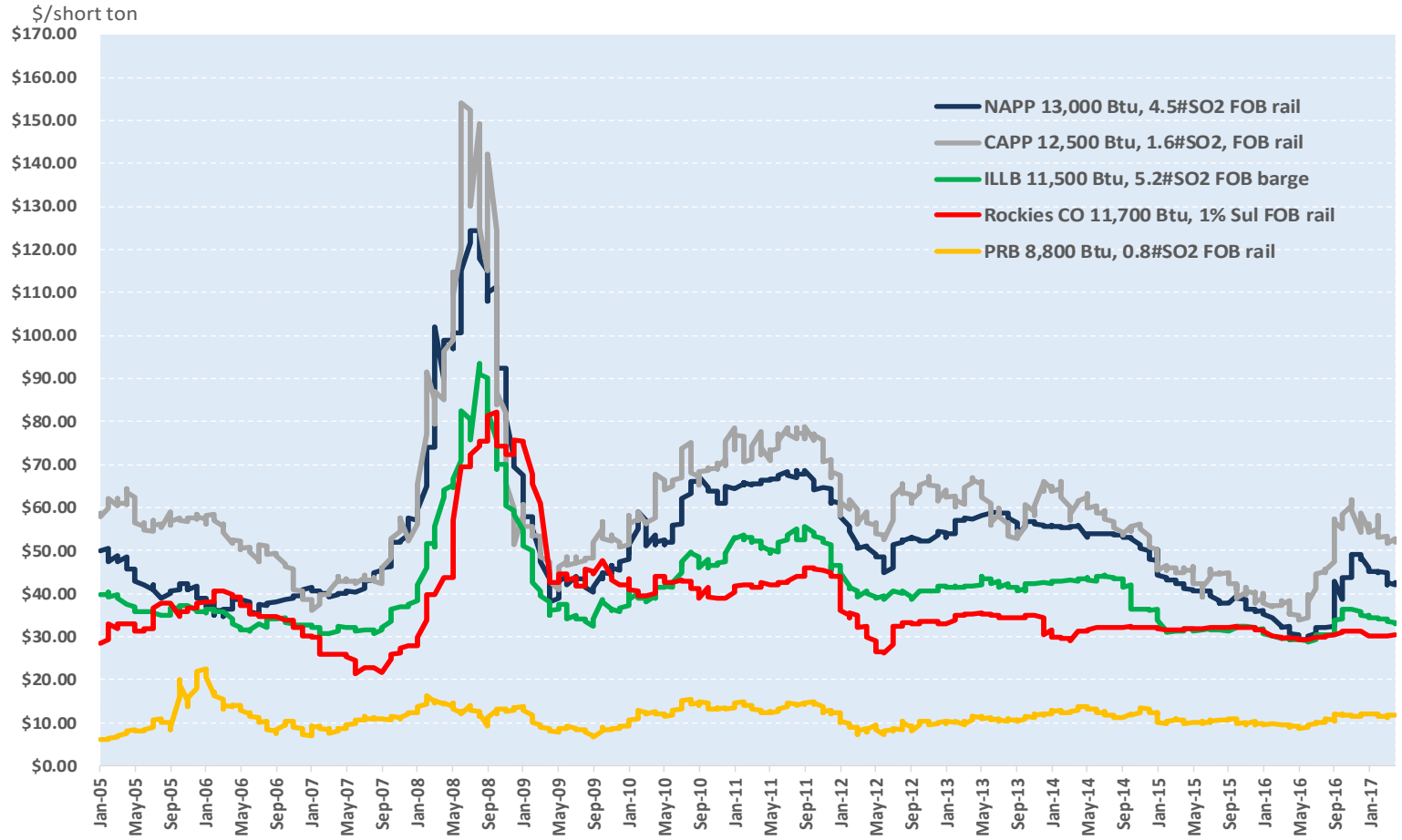
Power Sector





- **Takeaways**
  - Electricity demand growth has disappeared
  - Coal was the swing fuel in 2012, 2015 and 2016 because of low gas prices.
  - Growth in renewables will eat into baseload generation (coal or gas)

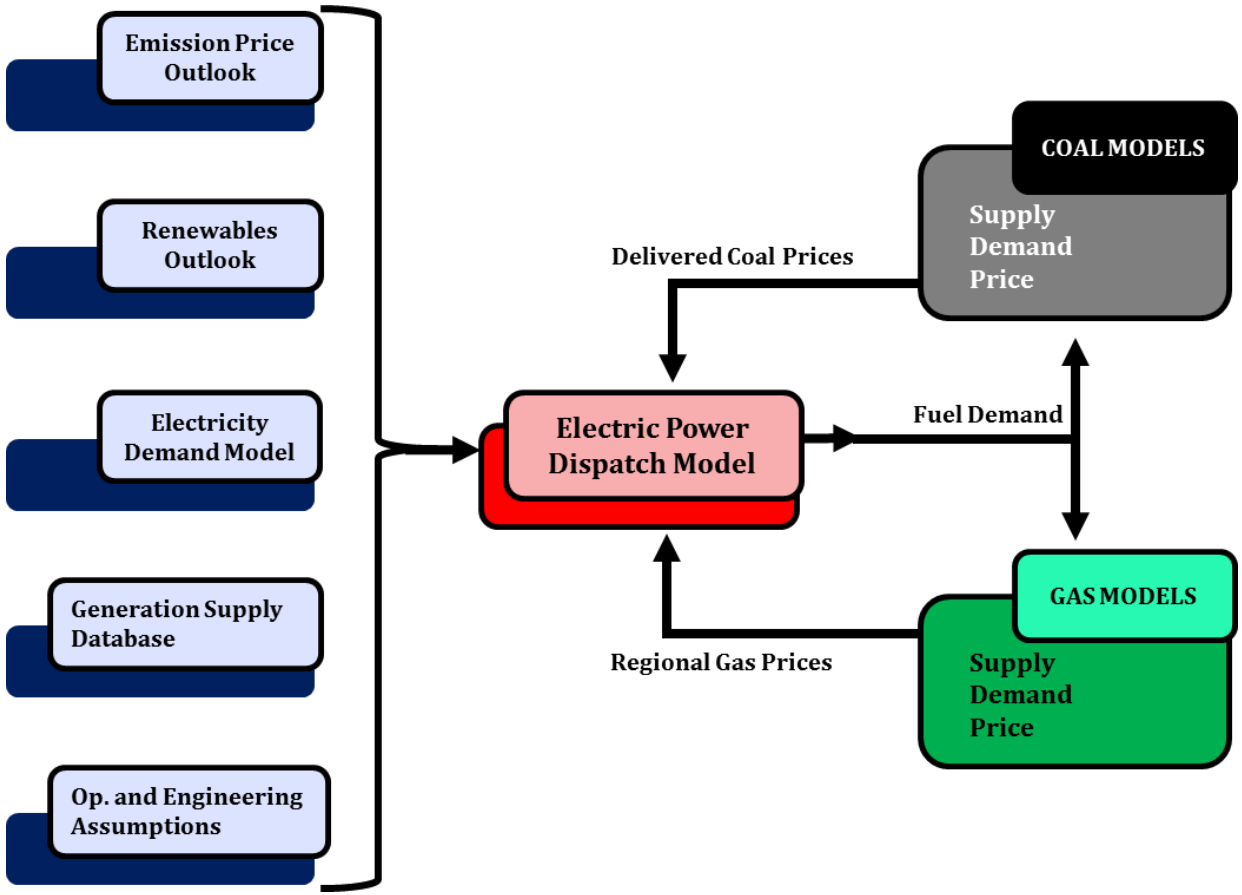
Historical U.S. Steam Coal Prices



- In the last decade, coal prices have become quite volatile.
- Impact on consumers is muted due to contract portfolios

FORECASTING FUEL PRICES

Integrated Forecasting Is Required Due To Relationship Between Fuels



- Forecast of prices must reflect supply/ demand balances in each market (e.g., power, industrial, export, etc.)
- Forecasts often require iterations to reflect the demand/supply response to different price levels.

Short- and Long-Term Price Forecasts

- **Long-Term forecasts typically reflect Short-Term price outlooks for the first few years and Long-Term outlooks for the balance of period. Both Short- and Long-Term Forecasts are influenced by market fundamentals (i.e., supply and demand).**

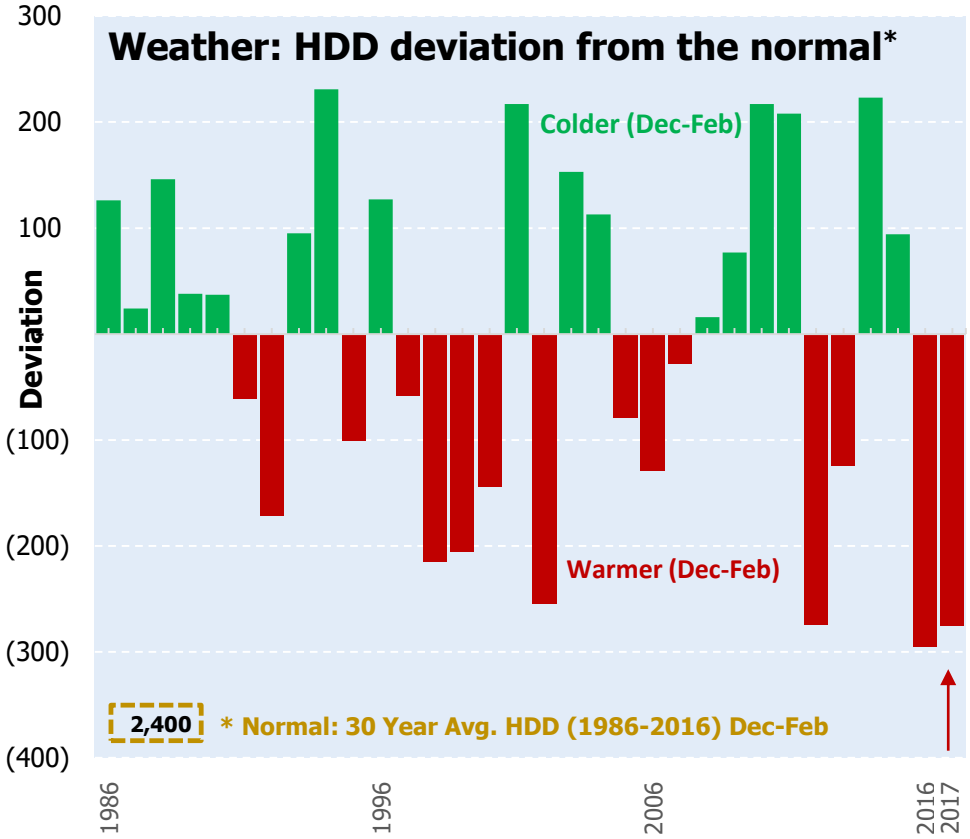
- **In addition, Short-Term forecasts are influenced by:**
  - Relevant market developments
  - Weather
  - Stockpile levels
  - Forward price curves

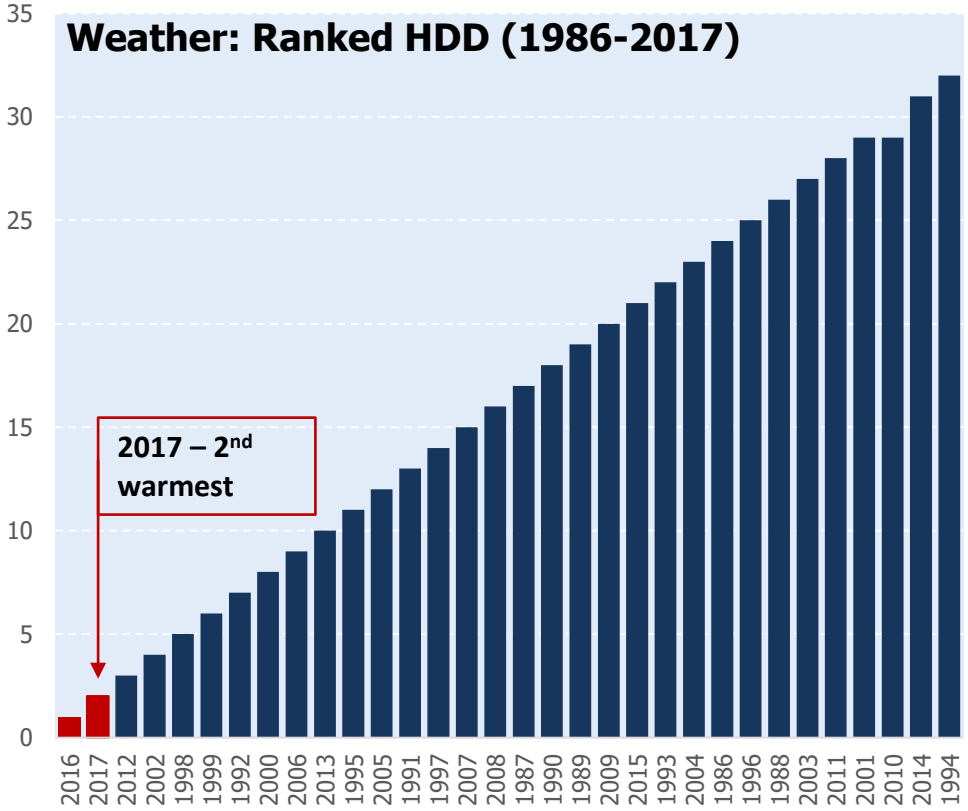
SHORT-TERM COAL PRICE FORECASTING

Relevant Coal Market Developments

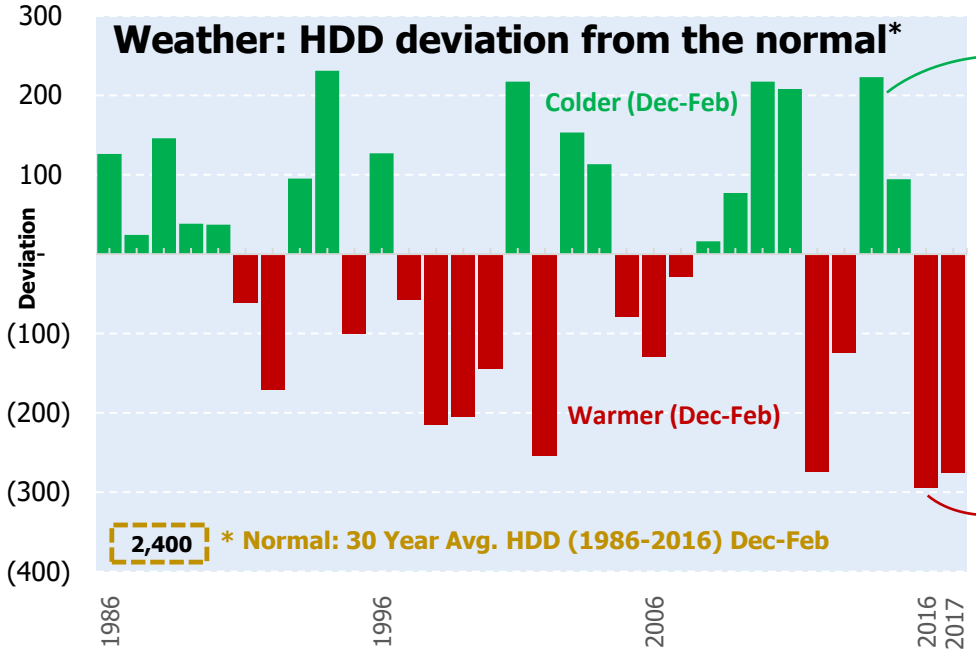
- China partially reverses production cuts
- More coal plant retirements are underway
- Atypically warm winter
- Credit markets reopen for coal companies easing potential coal supply contraints
- Cyclone Debbie
- Trump gets elected

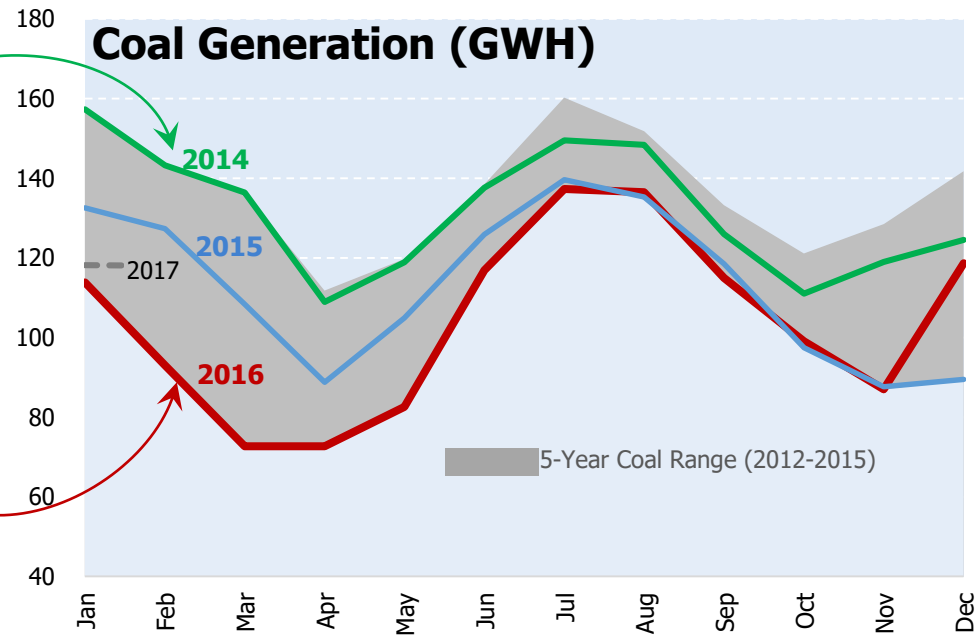
Winter Was 2nd Warmest On Record Since 1986

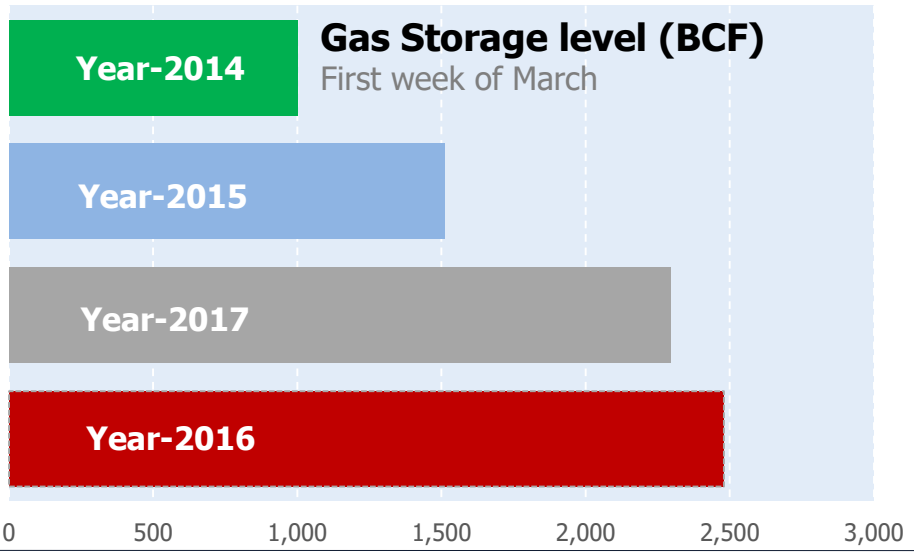


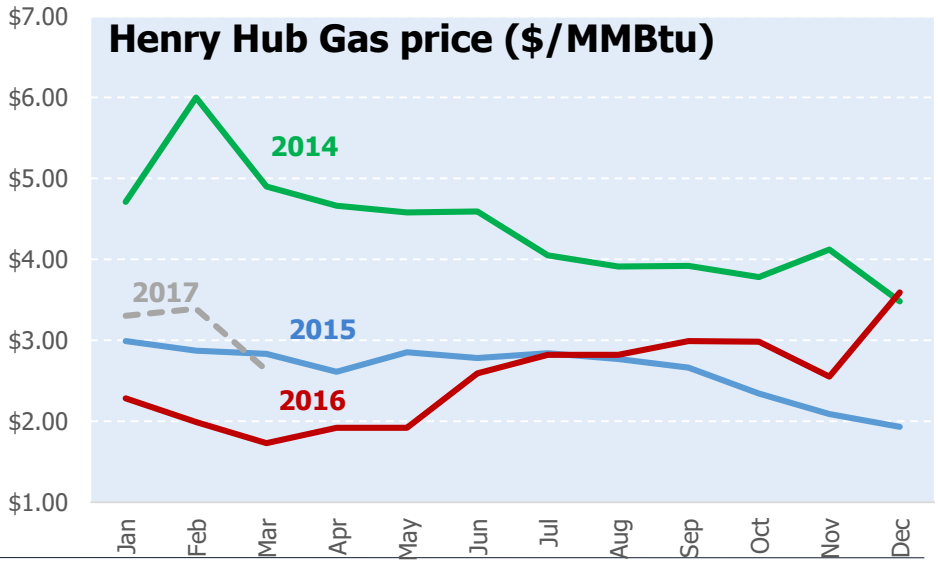


Winter Weather Is Key For Coal Burn As High Gas Storage Level Keeps Pricing Pressure In The Near Term

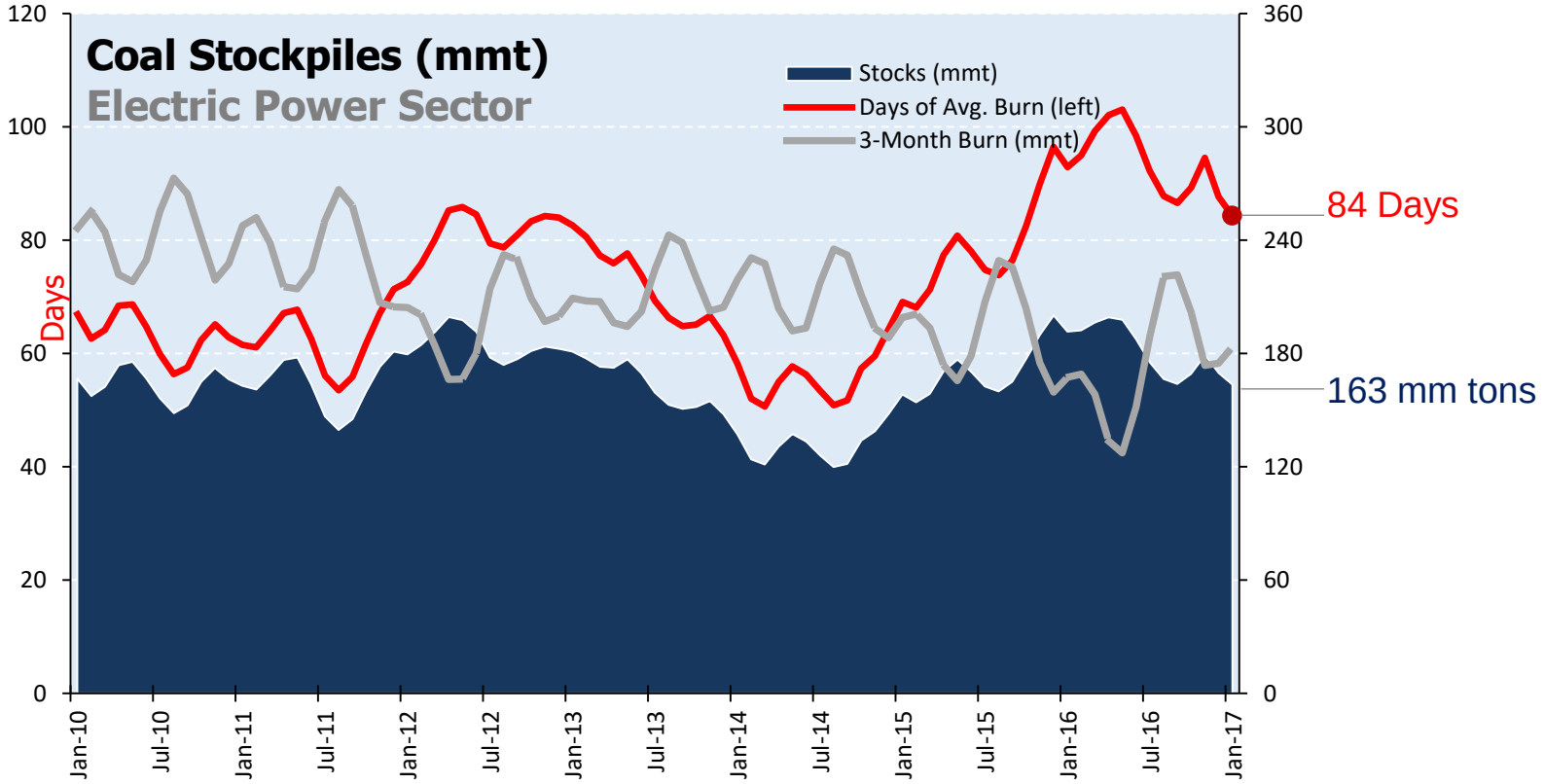




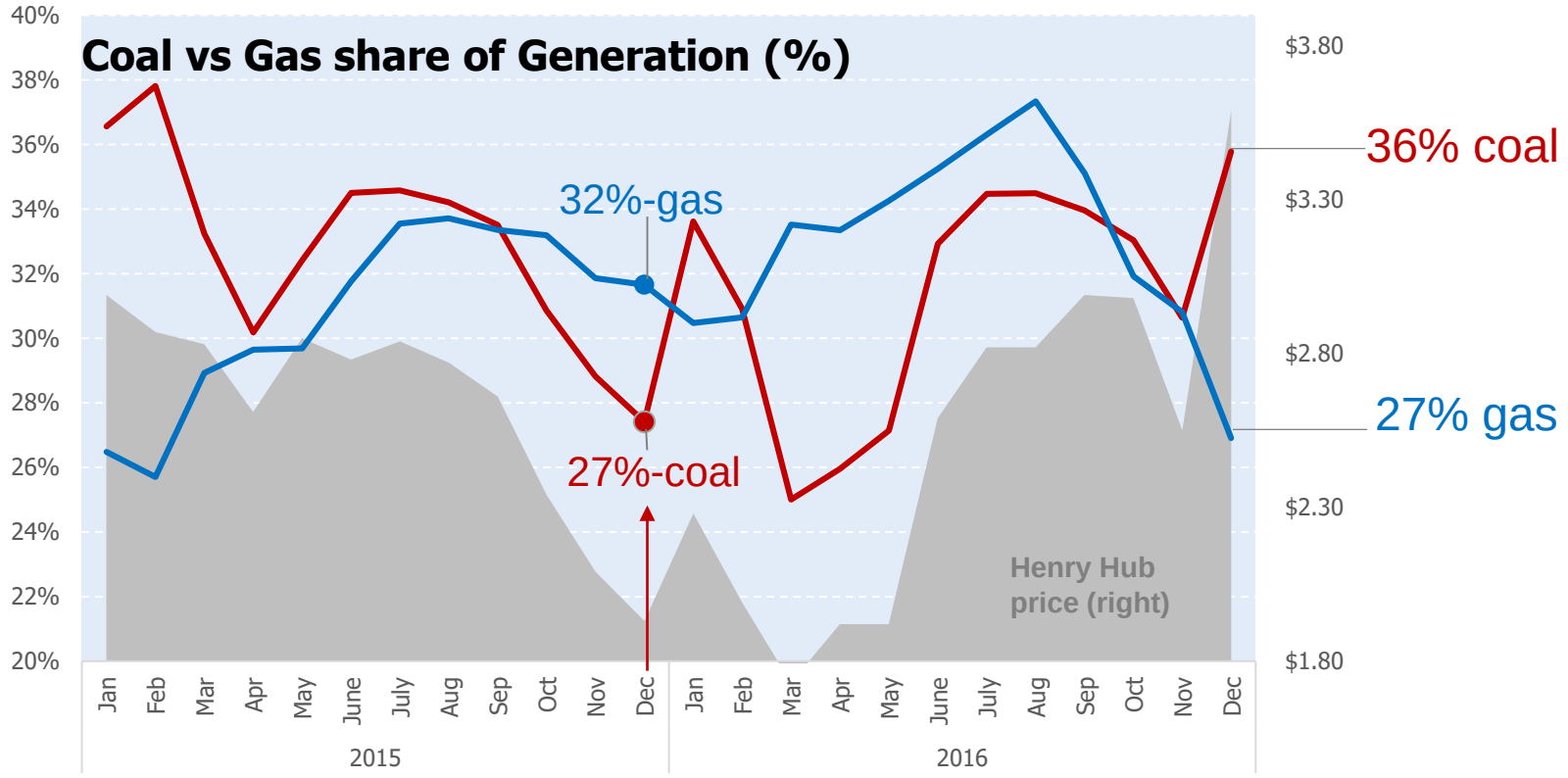




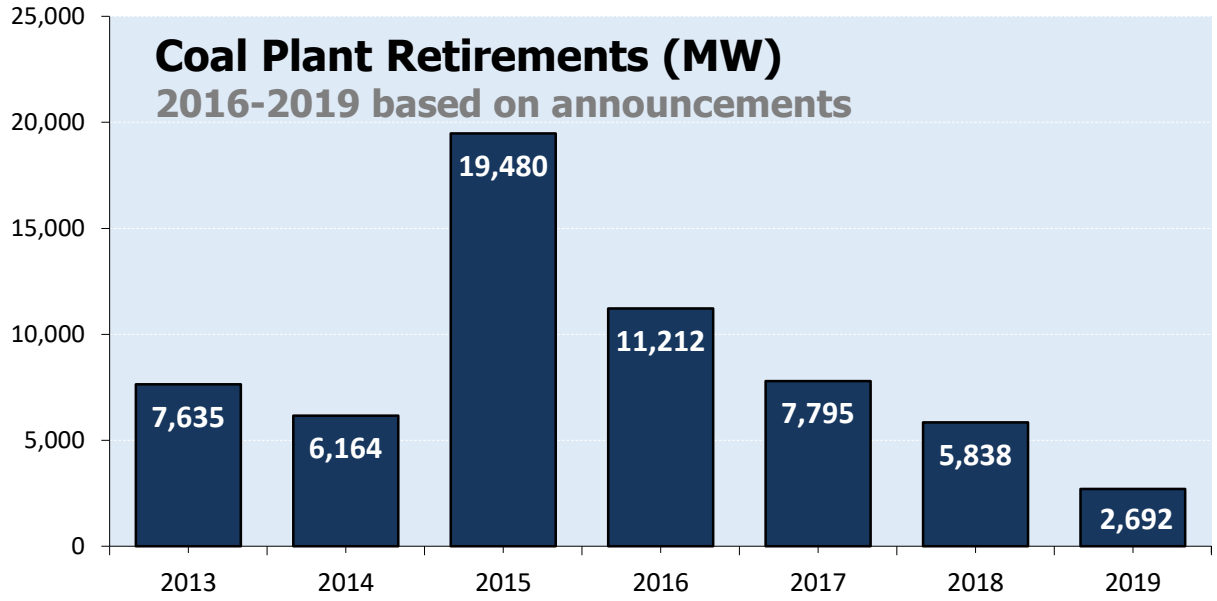
Higher Gas Prices In Late 2016 Lead To An Increase In Coal Burn And Reduction In Stocks



Coal Gained Market Share As Henry Hub Gas Crossed $3.50/MMBtu In December 2016



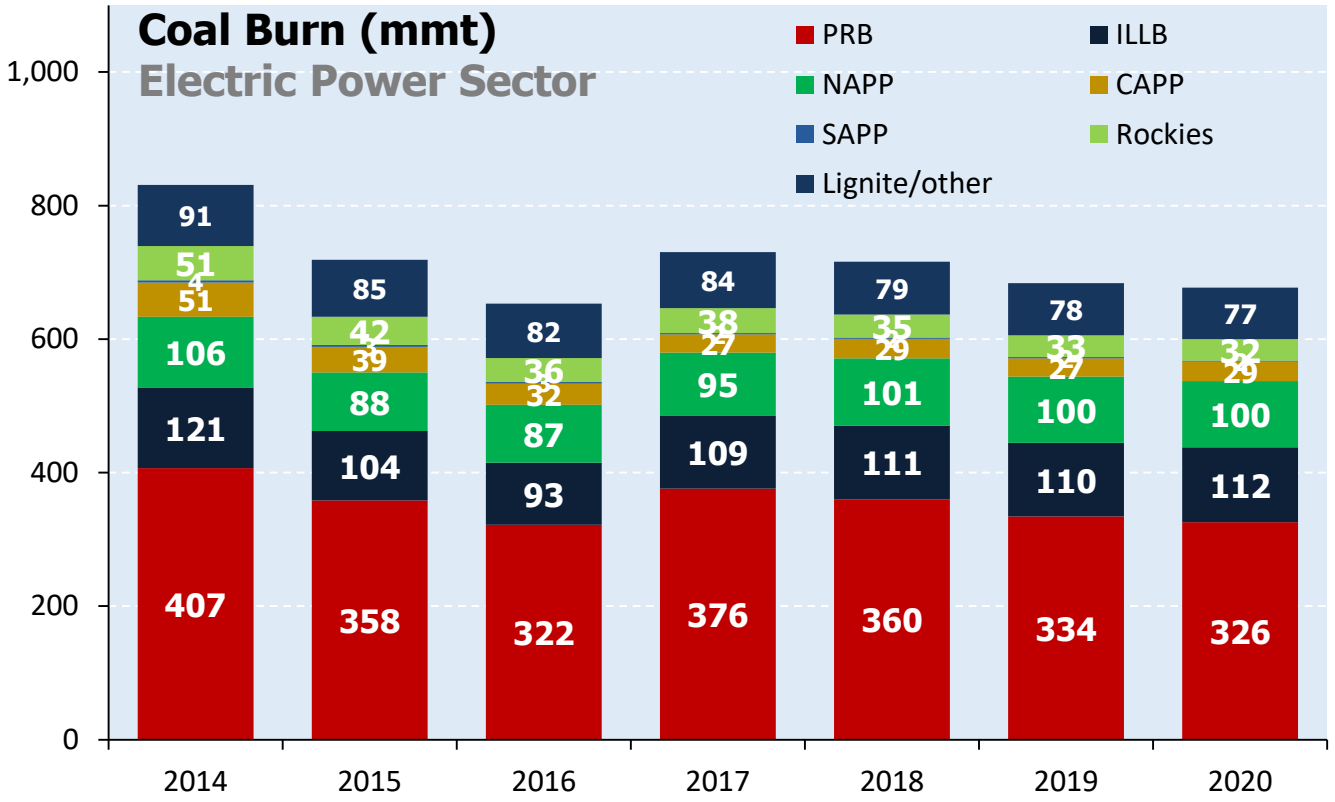
Near-Term Coal Plant Retirements



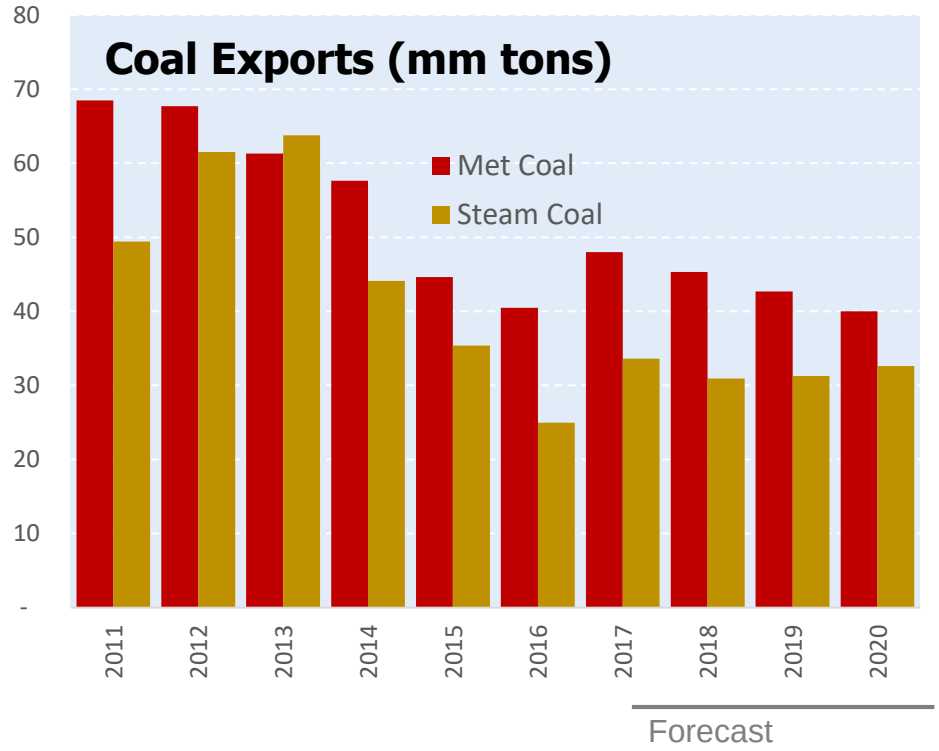
2017 Announced retirements

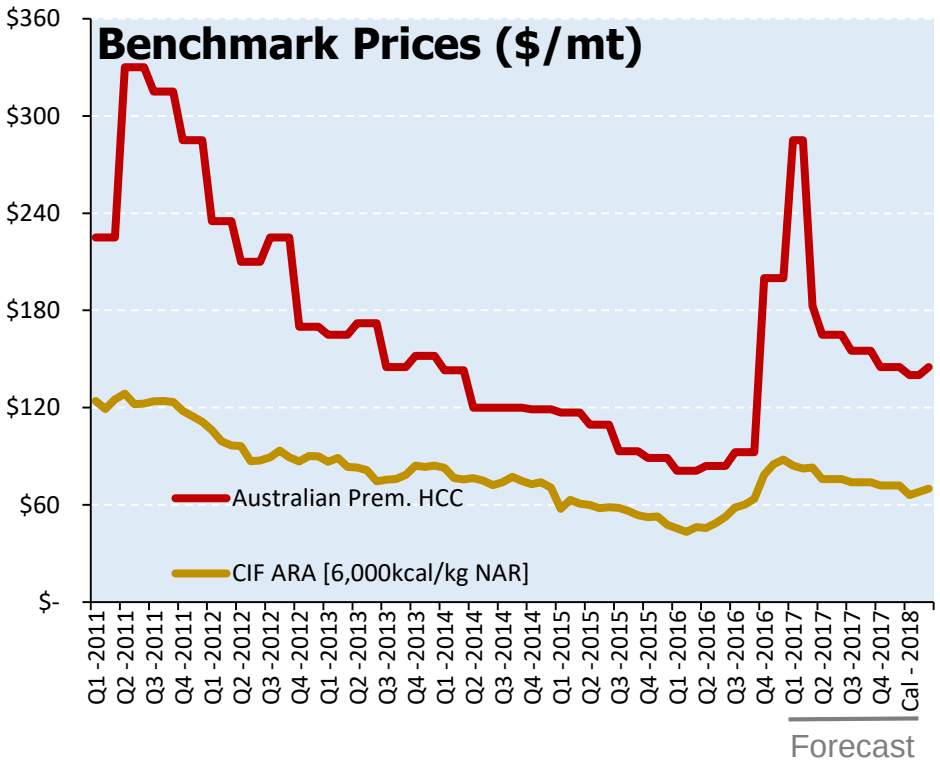
				Retirement decision				
Primary Coal	**Plant**	**Unit**	**MW**	**Economic**	**MATS**	**Haze Rule**	**BART**	**State**
CAPP	Yorktown	1-2	326		X			
	ROVA	1-2	209	X				
	Brayton Point	1-3	1,100	X				
PRB	Welsh	2	528			X		
	GRDA	1	490			X		
NAPP	BL England	2	155	X				
	Cayuga	1-2	306	X				
	Mercer	1-2	648	X				
ILB	Hudson	2	608	X				
	Paradise	1-2	1,224		X			
Rockies	Reid Gardner	4	225	X				
	Cherokee	4	352					X
	Naughton	3	330				X	
	Valmont	5	186					X
Other Coal	San Juan	2-3	815				X	
	Stanton	1	189	X				
	All other		105	X				
			7,795	**3,544**	**1,550**	**1,018**	**1,145**	**538**

Coal Burn Forecasts By Region Are A Function Of Forecast Coal Generation By Plant



Other markets for coal affect pricing . China curtailed domestic production increasing import demand. As a result, met coal prices jumped. After falling, cyclone Debbie struck and prices jumped again.



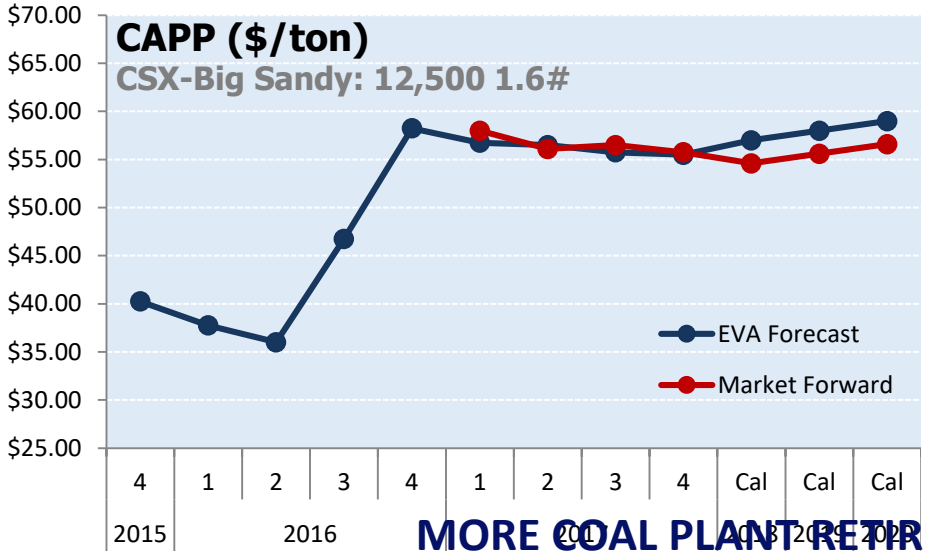


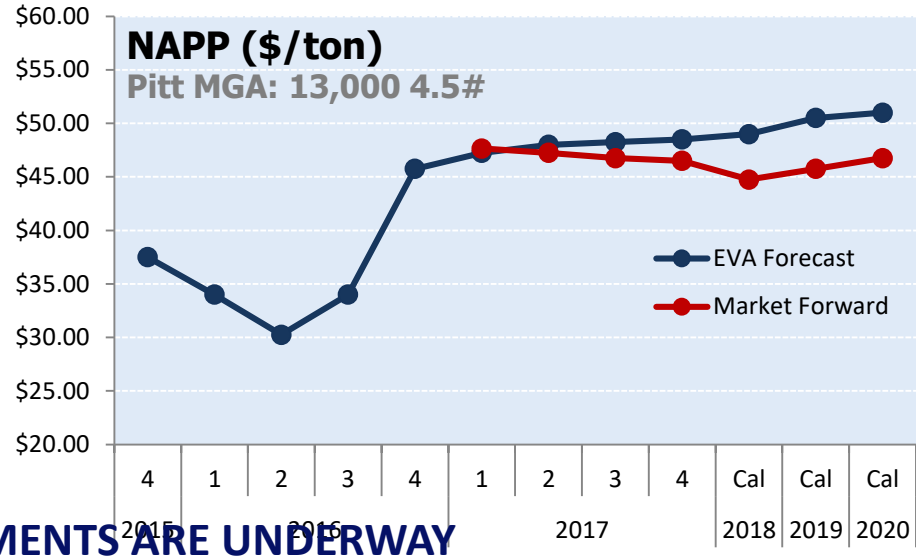
Summary Of EVA Q1 2017 Short-Term Coal Supply And Demand Forecast

US Coal Supply (mmt)	2016	2017	2018	2019	2020
Northern Appalachia	101.9	112.6	115.8	115.4	115.0
Central Appalachia	66.5	74.1	74.6	71.4	71.6
Southern Appalachia	9.1	12.5	12.7	13.1	13.2
Illinois Basin	98.2	117.2	119.3	121.0	122.0
Powder River Basin	311.9	362.3	365.0	346.5	338.9
Rockies	47.1	51.6	51.6	49.4	48.6
Lignite and Other	90.8	94.1	90.0	89.3	88.3
U.S. Production	**725.4**	**824.4**	**829.1**	**806.1**	**797.6**
Import, PC, Waste	24.0	19.7	20.5	21.4	22.8
Total Supply	**749.5**	**844.1**	**849.6**	**827.5**	**820.4**
-Producer stock & unaccounted	*(12.0)*	*1.2*	*1.2*	*1.2*	*1.2*

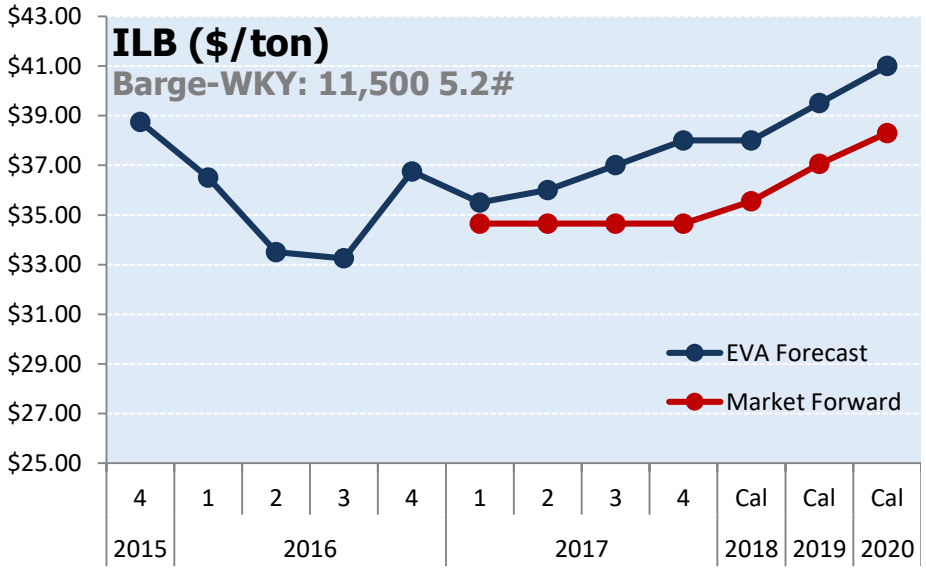
US Coal Demand (mmt)	2016	2017	2018	2019	2020
Electric Burn	676.0	748.7	735.6	704.2	699.1
Stockpile Change	(30.6)	(37.0)	(12.0)	-	-
Electric Receipts	645.4	711.7	723.6	704.2	699.1
Coke Ovens	16.3	16.9	16.6	16.6	16.5
Comm./Indust.	34.3	32.7	31.9	31.5	31.1
Domestic Receipts	**696.0**	**761.3**	**772.1**	**752.3**	**746.6**
Export Metallurgical	40.5	48.0	45.3	42.7	40.0
Export Steam	25.0	33.6	30.9	31.3	32.6
Total Exports	**65.5**	**81.6**	**76.3**	**73.9**	**72.6**
Total Demand[1]	**761.5**	**842.9**	**848.4**	**826.2**	**819.2**
[1] Includes Import, PC, WC	*24.3*	*22.9*	*19.7*	*21.4*	*22.8*

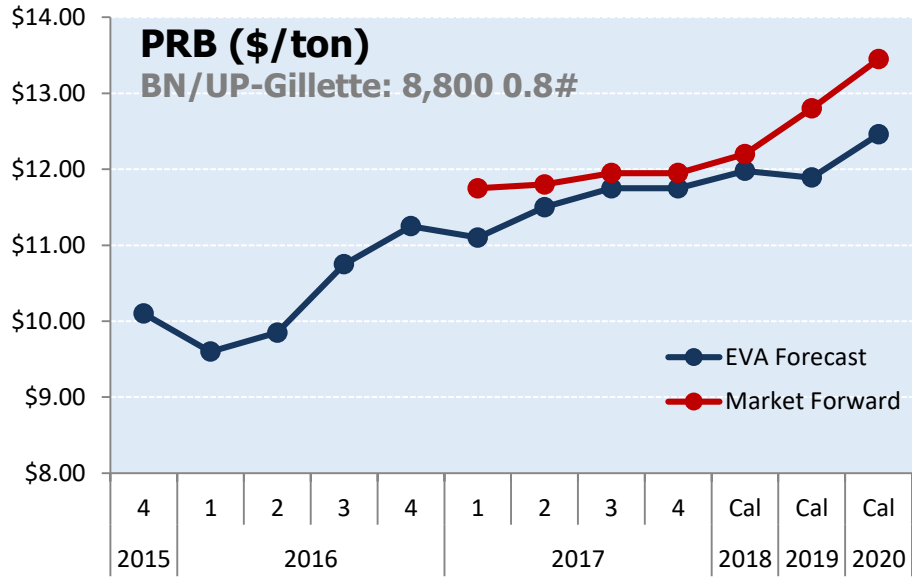
Short-Term Coal Price Forecast Is Influenced But Not Determined By Forward Price Curves





MORE COAL PLANT RETIREMENTS ARE UNDERWAY



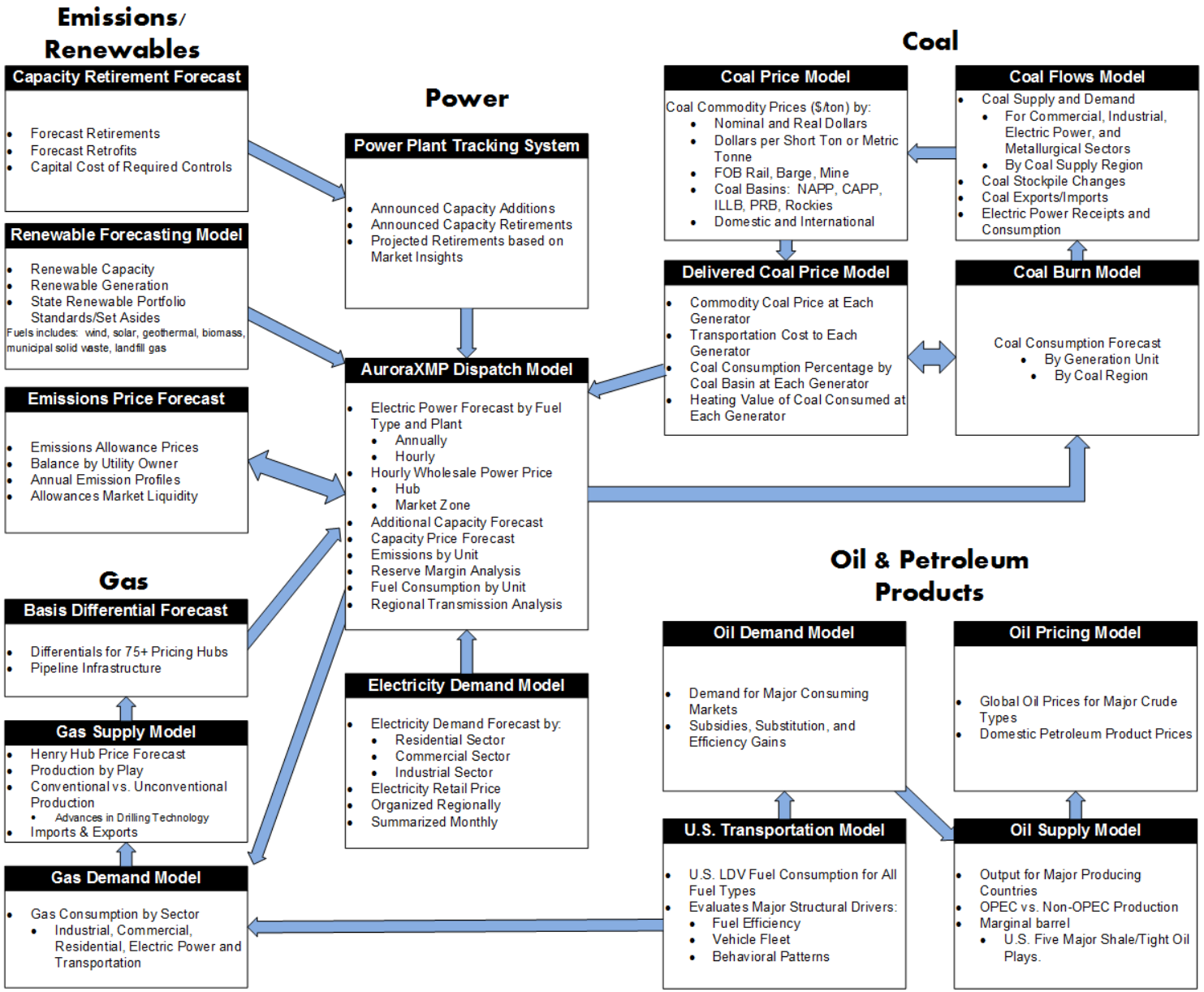


Trump Administration Actions to Date

- Trump rescinded Stream Protection Rule (Feb 16)
- Trump nominee Scott Pruitt confirmed as EPA Administrator (Feb 17)
- Broad “Energy Independence Executive Order” with extra focus on Clean Power Plan (March 28)
- DOJ Motion to Hold ELG Compliance in Abeyance (March 28)
- Withdrawal of Federal Plan for CPP Compliance published in Federal Register (April 3)
- EPA motion for continuance of oral arguments to give the appropriate officials adequate time to fully review the 2015 ozone NAAQS. (April 7)
- Administrative Stay by the EPA of the Effluent Limitation Guidelines (April 12)
- Department of Energy initiated 60 day study on impact of renewable energy mandates and subsidies on baseload generation. (April 14)

LONG-TERM COAL PRICE FORECASTING

Long-Term Integrated Price Forecasting for the Power Sector



Key Long-Term Assumptions For Coal Price Forecasting

Demand

- Electricity demand growth
- Installed capacity`
  - Renewables
  - Retirements (coal and nuclear of particular interest)
  - Additions
- Regulatory requirements
- Other domestic demand (industrial and met)
- Export
  - Type (Met and Thermal)
  - Export Terminal Capacity
  - Relative strength of the U.S. dollar
- Gas prices

- Supply

- Production capacity
- Production costs
- Mining regulations
- Reserve profiles
- Health of the coal industry

Key Long-Term Assumptions For Natural Gas Price Forecasting

Demand

- Residential/Commercial
- Existing industrial
- Power
- LNG exports
- Pipeline exports to Mexico
- New industrial facilities
- Fleet conversions

- Supply

- Shale expansion and technology
- Decline of off-shore production
- Decline of conventional production
- Infrastructure status and improvements

Closing Thoughts On Long-Term Forecasts

- **Coal vs Gas Price Forecasts**
  - Coal is purchased typically through staggered multi-year contracts which mutes coal price volatility actually paid by generators
  - Gas is purchased typically day ahead or same day which exposes generators to volatile pricing absent hedging. Gas price forecasts do not include hedging costs.
  - These factors are hard to consider but significant to dispatch analysis which determines plant performance
  - IRP analyses do not appear to reflect these different profiles
- **Stochastic versus Deterministic Modeling**
  - Stochastic modeling addresses some of the uncertainty in price forecasts through probability distributions of possible outcomes subject to constraints defined above
  - Stochastic modeling does not replace the need for "designed scenario analysis" to capture either binary outcomes or specific scenarios that merit consideration

QUESTIONS?

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