US COAL MARKETS 2017 – THE NEW NORMAL?

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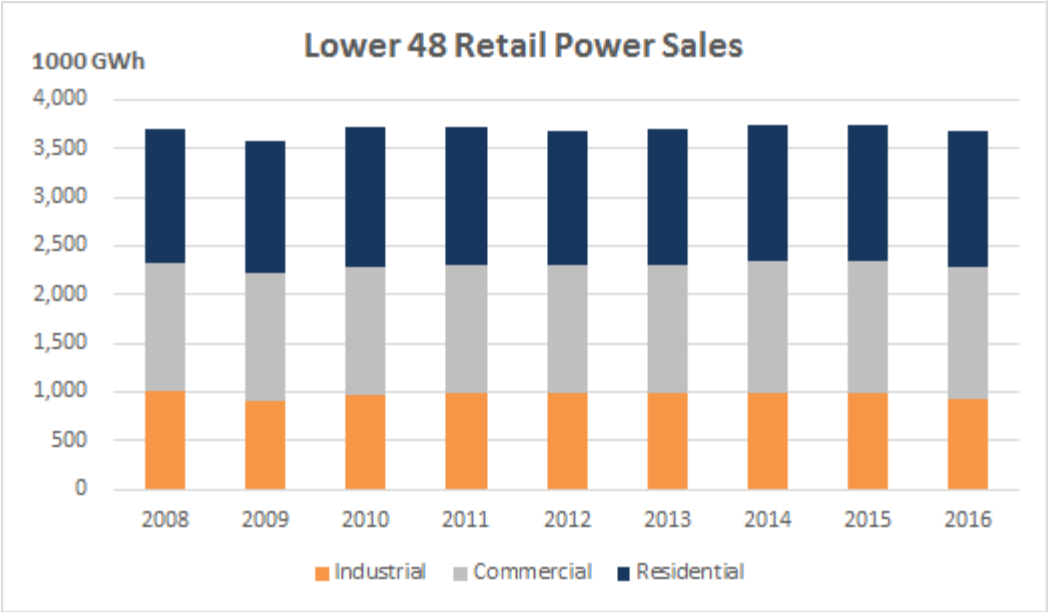
Energy Ventures Analysis
1901 N. Moore St. Arlington, VA 22209
(703) 276 8900

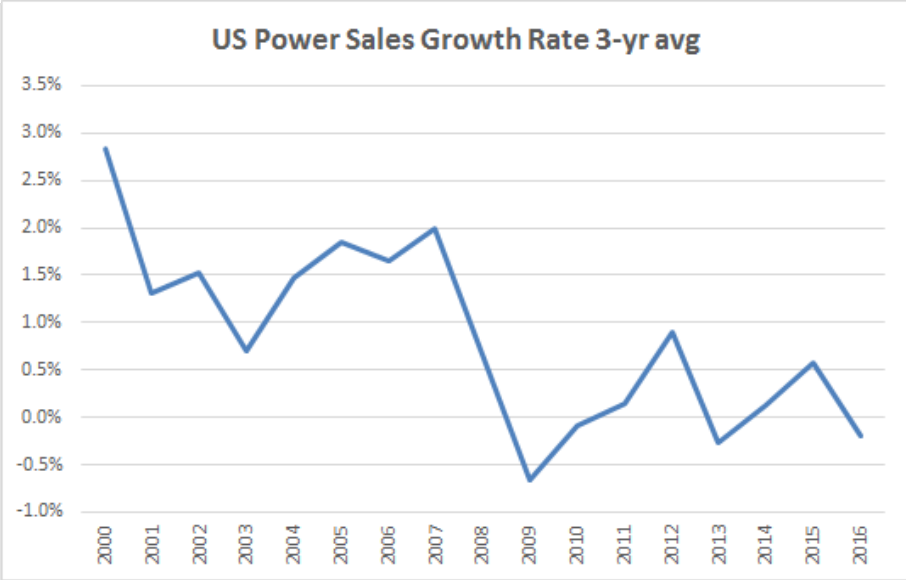
ELECTRIC POWER MARKET ISSUES

- **The top line – will there be any demand growth?**
  - Energy efficiency
  - Shift from an industrial economy
  - Distributed generation
- **Change in the generation fleet – can the US survive on just natural gas & renewables?**
  - Future of coal-fired plants & carbon regulations
  - Survival of the nuclear fleet
  - Risks of heavy reliance on natural gas
  - Economics of renewables without subsidies
- **Deregulation – does it add any value?**
  - Impact on power supply
  - Retail choice
- **Disruptive technologies could change the business faster than we expect**
  - Battery storage
  - Driverless cars

ELECTRIC POWER DEMAND GROWTH – WHERE DID IT GO?

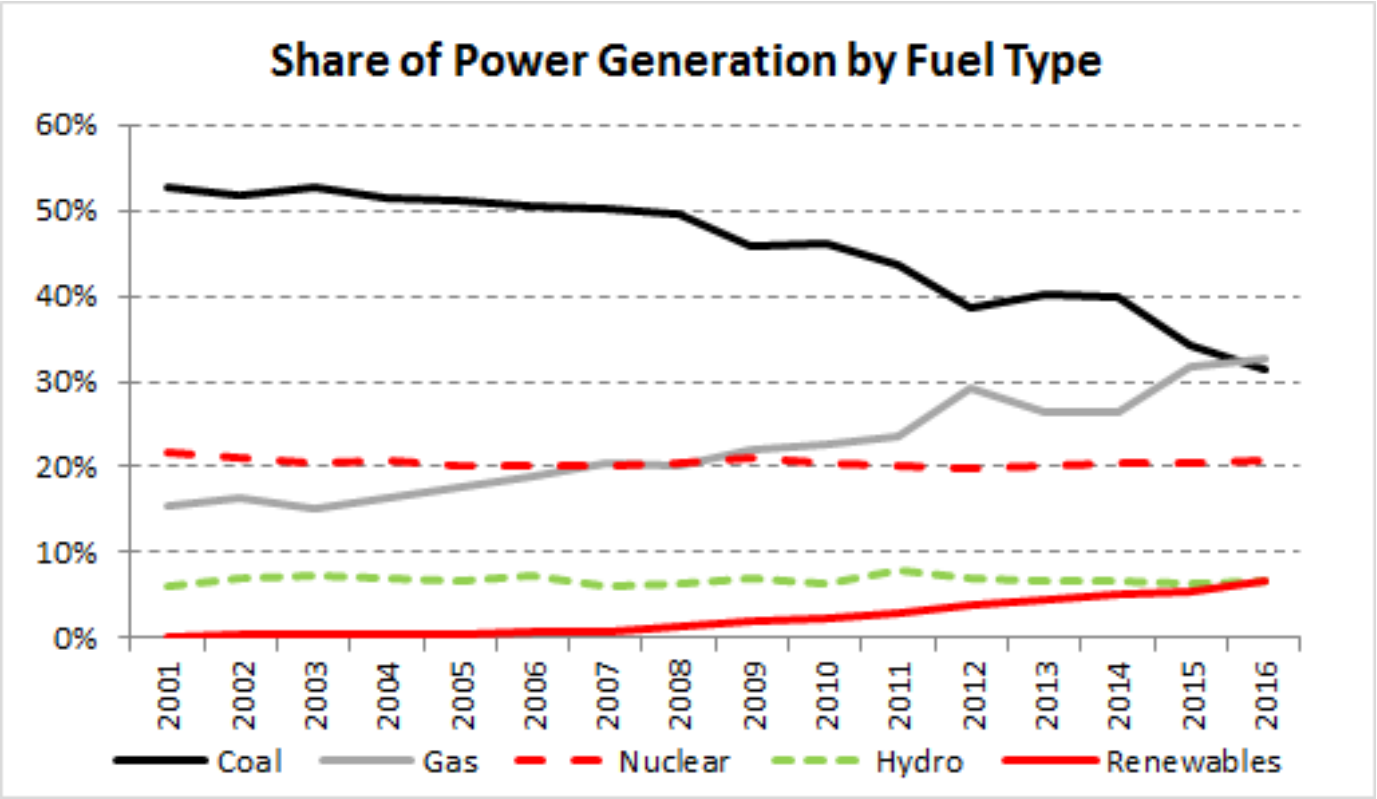
- **There has been zero growth in retail power sales since 2008**
  - Recession of 2009 is long over, yet total power sales are still below 2007 peak
  - Industrial sales have declined in part due to loss of load at energy-intensive facilities
    - Uranium enrichment, aluminum smelting, steel production
  - Residential and commercial sales are not growing either
- **Energy efficiency has had an impact since federal standards were passed in 2005**
  - Lighting and appliances use less power – lighting is about 15% of residential demand





LONG-TERM DECLINE IN COAL BURN

- **Coal burn fell 363 mm tons from 2008 to 2016 and coal's share fell from 49.7% to 31.5%**
- **The decline in burn is due to:**
  - No growth in power sales since 2007, so generation is just a fight for market share
  - Share of subsidized wind and solar generation has increased from 1.4% in 2008 to 6.7% in 2016
  - Natural gas CCGT share has increased from 20.2% in 2008 to 32.7% in 2016 due to increased gas supply
  - New EPA regulations on coal plants forced plants to retire in the face of increased competition

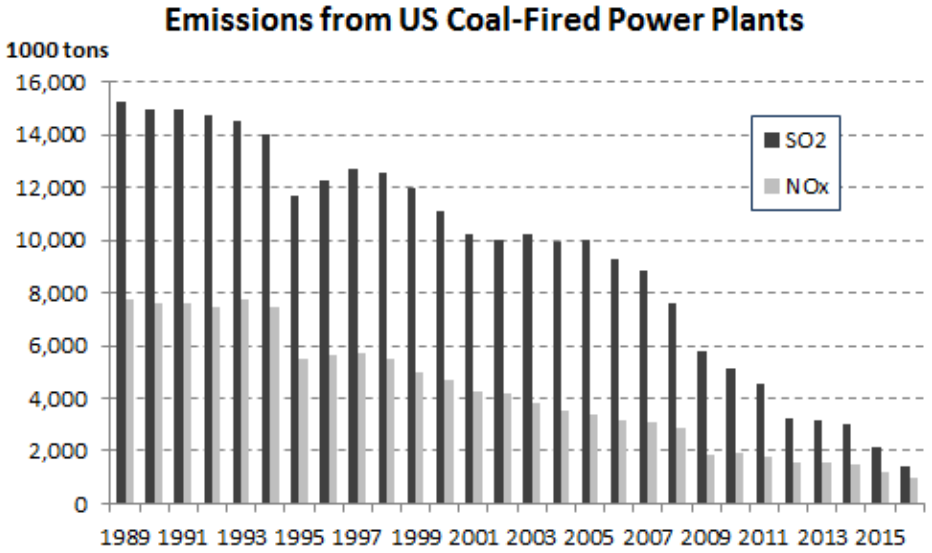


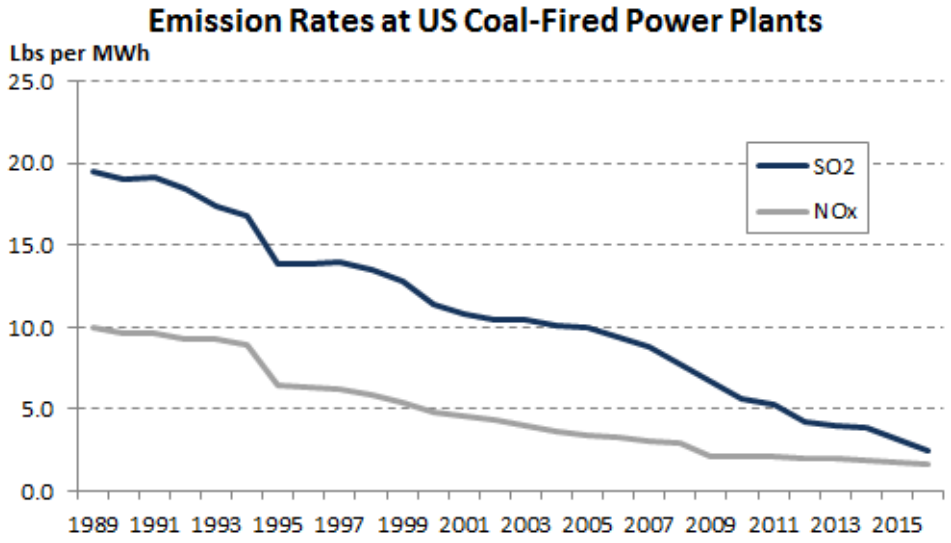
THE WAR ON COAL IS OVER – BUT THE CASUALTIES WERE HIGH

- **The list of new EPA rules affecting the coal fleet is overwhelming**
  - Mercury and Air Toxics Standard (MATS) – technology-forcing standards for mercury and chlorine
  - Effluent Limitation Guidelines (ELG) – expensive wastewater treatment for scrubbed plants
  - Coal Combustion Residuals (CCR) – forced conversion from wet ponds to dry landfills
  - Regional haze (BART) – forcing reductions in aerosol emissions (SO_2 and NOx)
  - Cross-State Air Pollution Rule (CSAPR) – state limits on fine particulate emissions (SO_2 and NOx)
  - National Ambient Air Quality Standards (NAAQS) – new one-hour limits on ozone and SO_2
  - Cooling water intake (316b) – limits on cooling water impacts on aquatic life
  - New Source Review (NSR) – compliance with new source standards when making major modifications
  - Clean Power Plan (CPP) – state caps on total carbon dioxide emissions
- **Impact is similar – force new environmental capital in order to keep coal plants open**
  - With lower gas prices and subsidized renewables, economic for new capital are less attractive
- **Can the new Trump Administration change this trajectory?**
  - Not clear yet; if EPA rules survive court challenges they must be revised by a new rulemaking
  - The Congressional Review Act has limited time; so legislative action is unlikely
  - Clean Power Plan is not likely to survive court case
  - ELG rule is the biggest threat to eastern coal plants with wet scrubbers

EMISSION RATES OF CRITERIA POLLUTANTS ARE ALREADY DOWN 90%

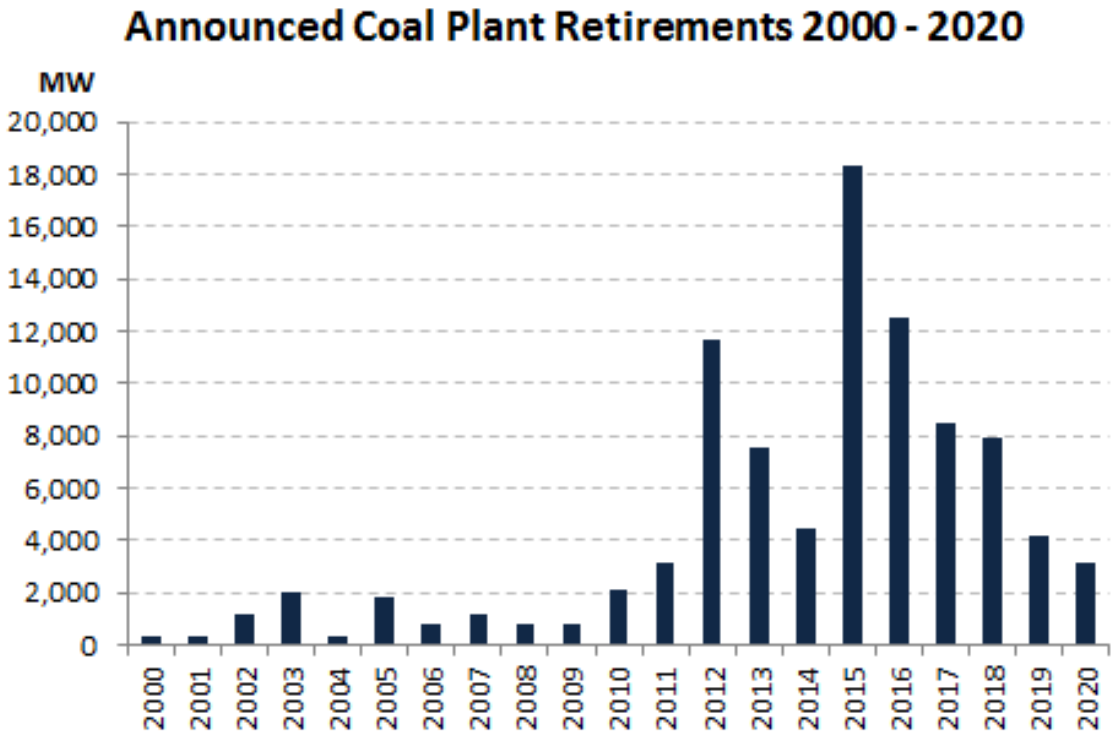
- **Previous rules have cut emissions of SO_2 and NOx by 90% since 1990**
  - Acid rain law cut emissions in half by 2000
  - Clean Air Interstate Rule (CAIR) cut emission rate by another 50% by 2010 before it was vacated
  - MATS rule cut emissions in half again by 2016
  - Emission rates will be even lower in 2017 before new rules take effect
- **Emission reductions were achieved through construction of expensive control equipment**
  - Scrubbers and selective catalytic reduction
- **Still, the cost-benefit analysis of every new EPA rule (even the CPP) is justified by reduced mortality rates from "fine particulates" – SO_2 and NOx**





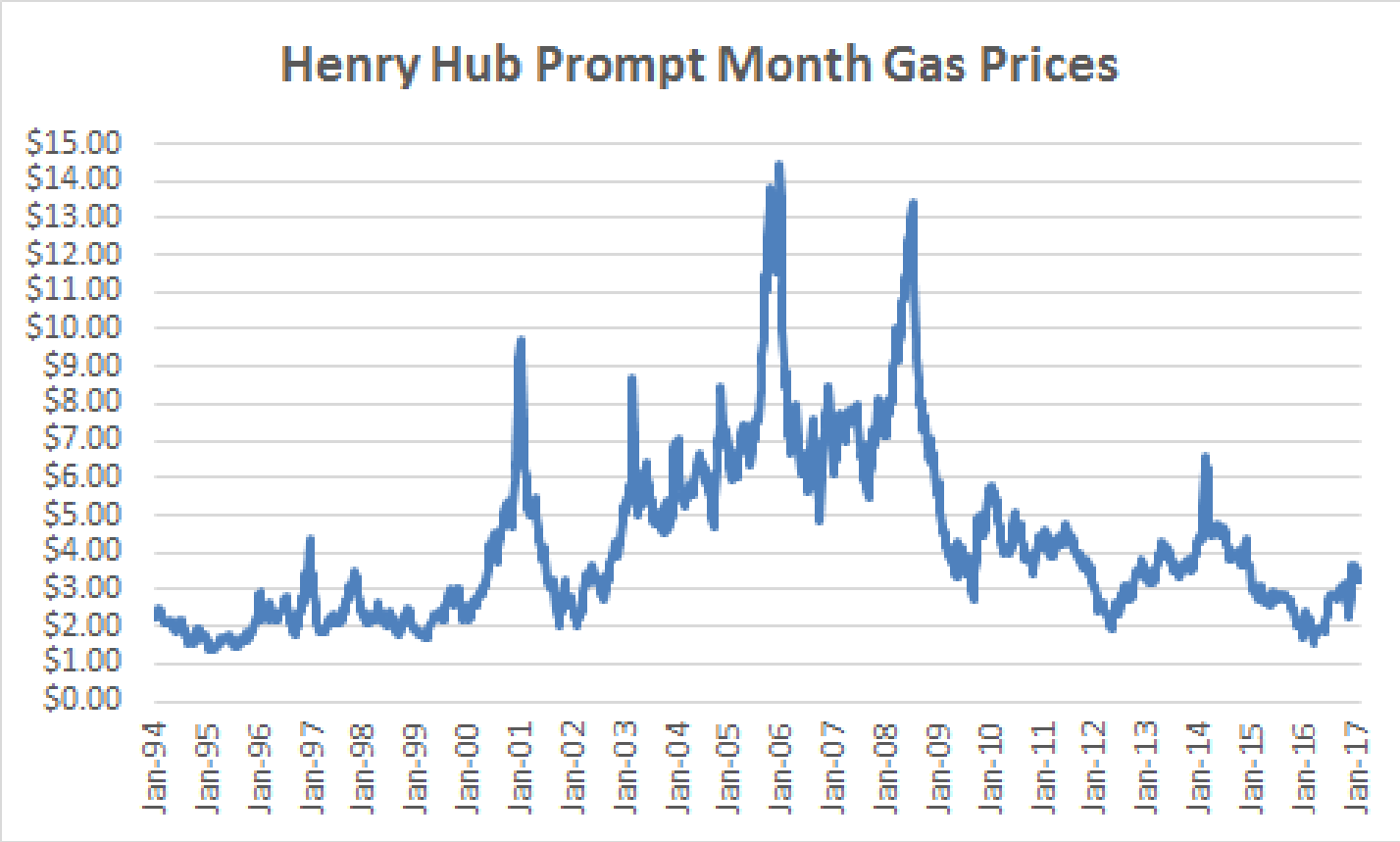
COAL-FIRED POWER PLANT RETIREMENT ANNOUNCEMENTS CONTINUE

- **Retirement of coal-fired plants is due to a combination of low prices and new EPA rules**
  - If power & gas prices were high, power companies would invest to comply with new EPA rules, just as they did from 2005 – 2010 to meet the CAIR rule
  - If there were no new EPA regulations mandating capital to continue operating, coal plants would run at lower rates but would stay open and operate when prices increased
    - A free option on future gas prices
- **The latest rules driving coal retirements are ELG and regional haze**



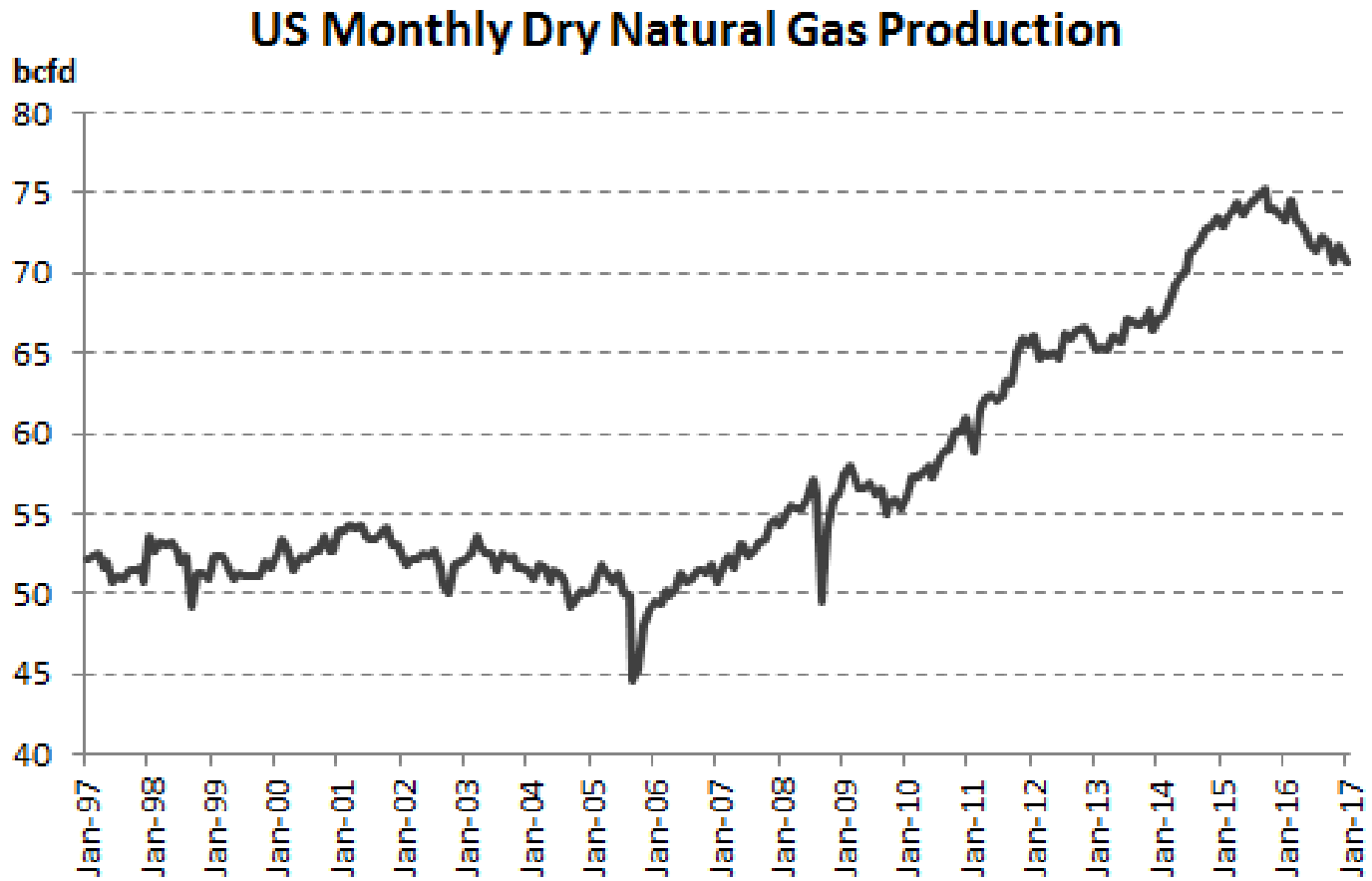
WILL NATURAL GAS STAY CHEAP AND ABUNDANT FOREVER?

- **A brief history of natural gas prices**
  - 1986 – 1999: Deregulation created excess capacity and kept prices about $2.00
  - 2000 – 2008: Growing demand from new CCGT plants consumed supply and pushed prices over $6.00
  - 2009 – 2017: The Shale Gas Era; growing supply from hydraulic fracturing kept prices at $4.00
    - Prices slumped below $3.00 in mild winters of 2012, 2015 and 2016; Polar Vortex pushed prices over $6.00



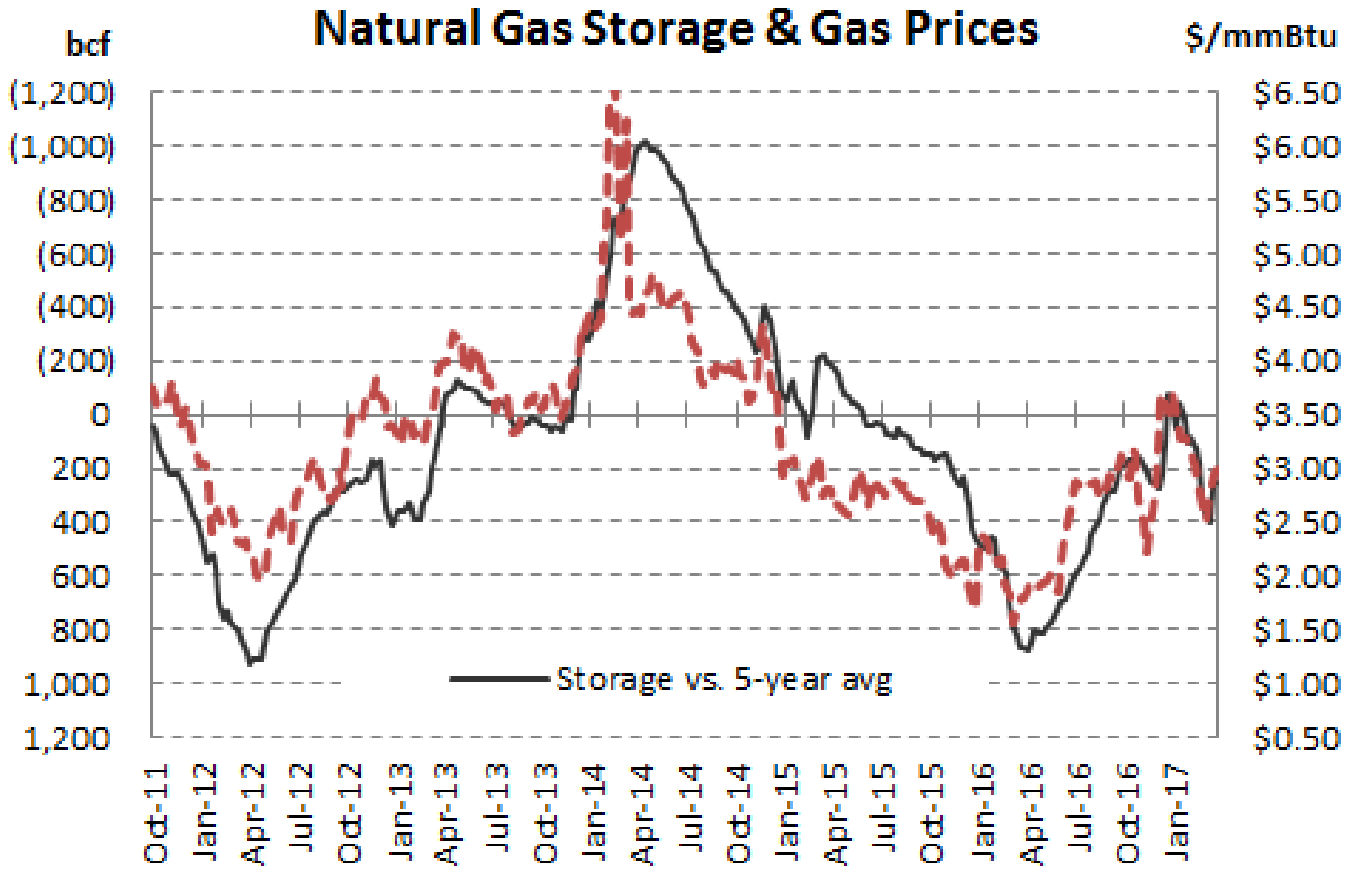
NATURAL GAS SUPPLY FELL IN 2016

- **After huge growth in 2014 and 2015, gas supply peaked in Sept. 2015 and has fallen since**
  - 2016 gas production was down almost 3 bcfd as drilling slowed and wells aged
  - Lack of pipeline capacity to deliver gas from the Marcellus Shale is restricting production
- **Surplus gas in winter 2016-17 was caused by weak demand, not growing supply**



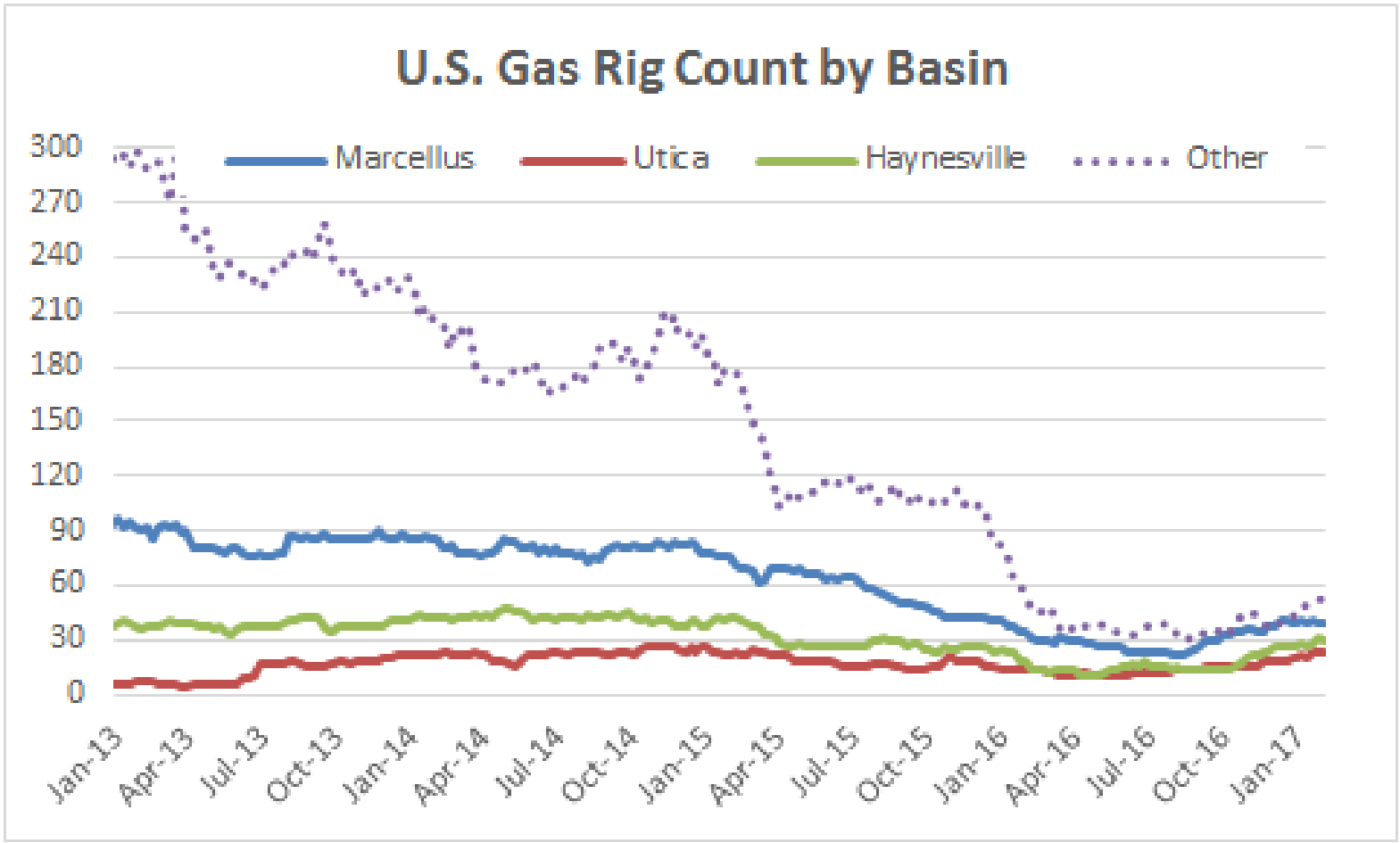
EXCESS GAS INVENTORIES FELL BACK TO NORMAL AND GAS PRICES RECOVERED

- **Excess gas storage drove spot prices below $2.00 in spring 2016, just as it did in 2012**
  - Floor gas price set by level needed to displace enough coal to burn off excess gas
- **As storage returned to normal levels, gas prices approached $3.50 level**
  - Coal burn responded in H2 2016 to normal load and higher gas prices



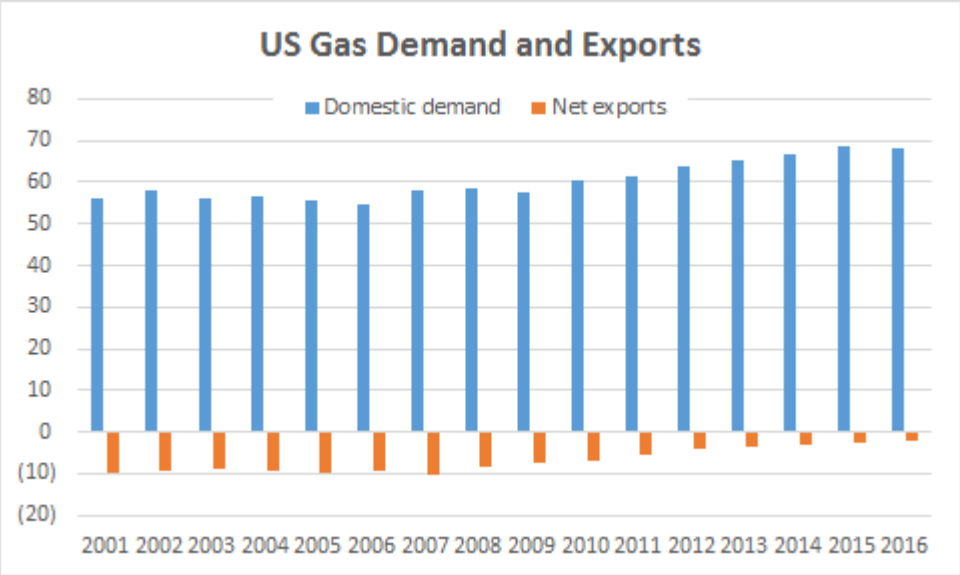
GAS DRILLING RIG COUNT IS BEGINNING TO RECOVER

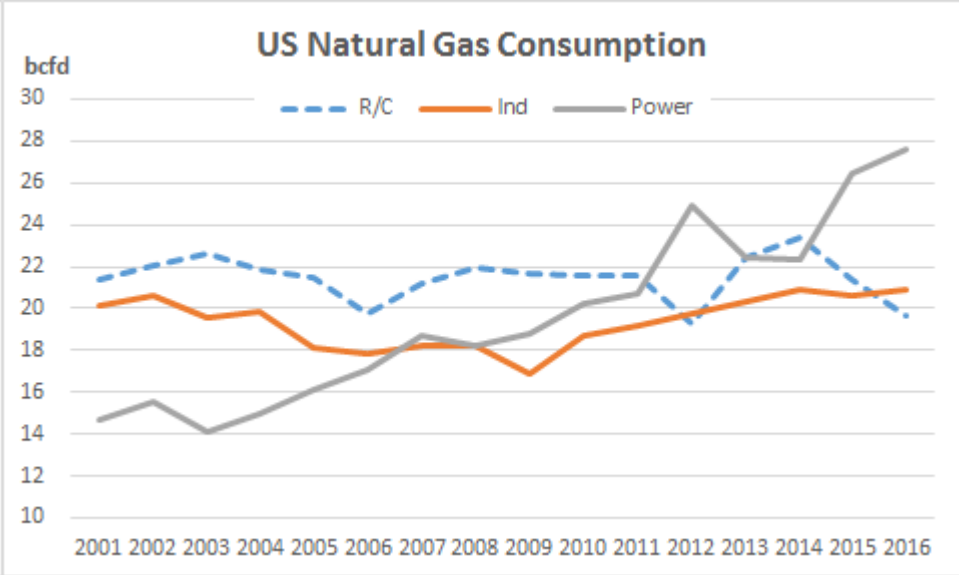
- **Total active gas rigs fell from 900 in 2011 to just 81 in August 2016**
  - However, drilling has been concentrated in the prolific shale plays
- **Rig counts have recovered up 79% by February 2017, responding to higher gas prices**



US NATURAL GAS DEMAND IS GROWING

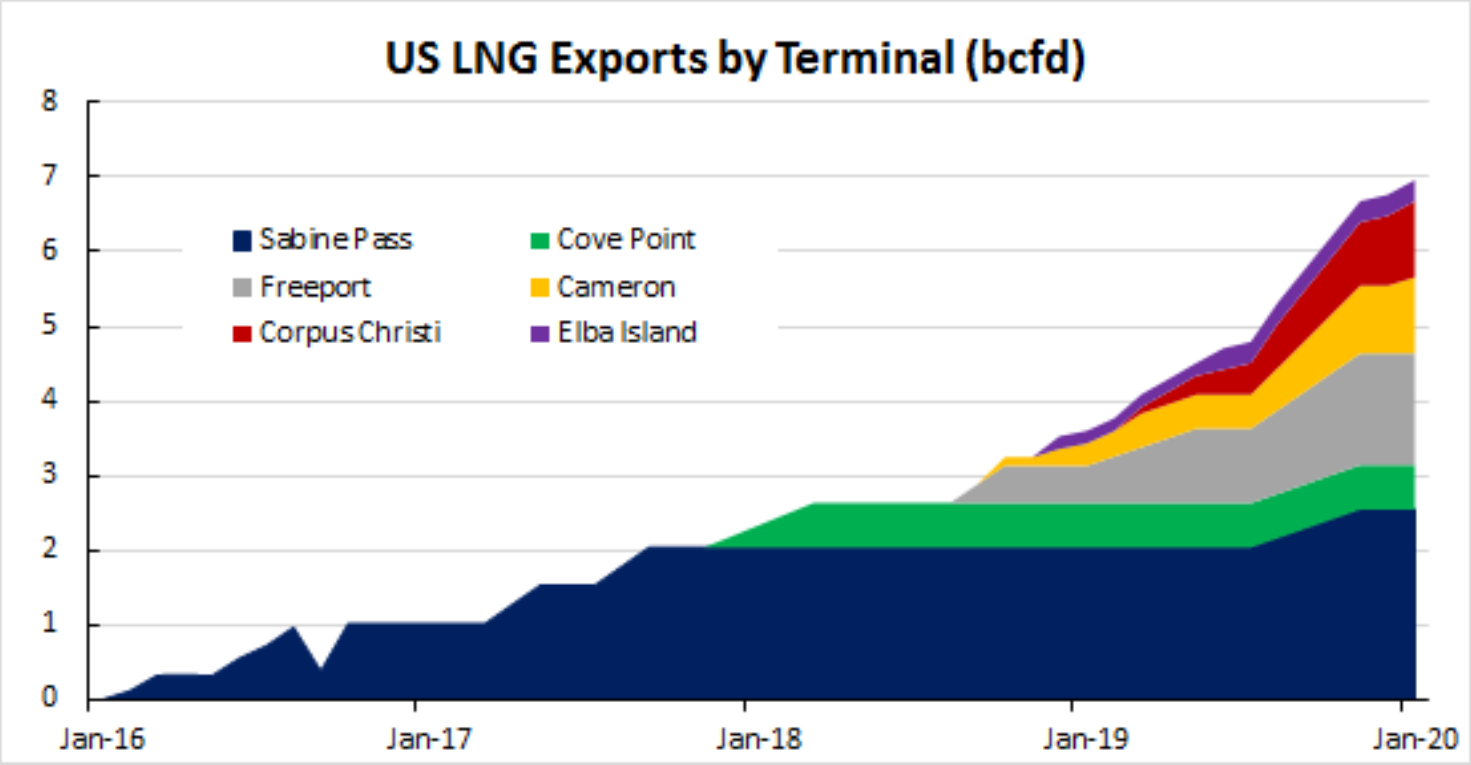
- **Demand growth has been led by power, but industrial demand is responding to price**
- **Imports from Canada have fallen while exports to Mexico are growing – LNG is starting**
- **Changes in US gas demand from 2008 to 2016 (bcf per day)**
  - Power +9.4; Industrial +2.7; Residential/commercial -2.3 due to weather
  - Imports from Canada -2.5; Exports to Mexico +2.8; LNG exports +1.0
- **EVA projects continued growth in LNG exports, exports to Mexico and industrial demand**





US LIQUEFIED NATURAL GAS EXPORTS WILL BECOME A LARGE DEMAND

- **New Sabine Pass terminal is shipping 1.0 bcfd and will expand to 2.0 bcfd**
- **Cove Point will start in early 2018, followed by Freeport in Texas**
- **LNG terminals have fixed contracts to pay for capacity**
- **Future volumes depend upon spread between world price and US price**
  - Spot price spread needs to be +$1.30 to Europe and Asia to cover variable costs



THE 2016 COAL MARKET WAS A ROLLER COASTER

- **Early 2016 saw market demand and prices hit decade-low levels**
- **Domestic markets were roiled by the mild winter of 2015-16**
  - Mild weather caused a large drop in demand for power and natural gas for home heating
  - Excess gas forced into power generation, plus impact of low power demand, destroyed coal burn in first half of 2016 and caused customer stocks to soar
  - Low demand forced coal prices below production costs, driving mines to close to balance market
- **World coal markets piled on as CIF ARA hit lowest level since 2003**
  - Spot market bottomed at $43.50 per tonne in January
    - Netback equivalent CAPP price was <$25/ton FOB mine for 12,500 Btu
  - Forward prices were backwardated to only $38 per tonne in 2018
- **The markets overreacted to short-term factors in early 2016**
  - Low gas prices were caused by mild weather, not increasing gas supply as in prior years
  - The recovery in market prices was inevitable once excess gas and coal inventories were worked off
- **Meanwhile, international markets were driven by imports to China**
  - Excess production in China reduced coal imports, causing low world prices in early 2016
  - Chinese government reversed policy in May, restricting mine production and spurring higher imports
  - World prices jumped on increased demand in Asia for both met and thermal coals
  - China eased its mine restrictions in late 2016, and prices declined from the peak

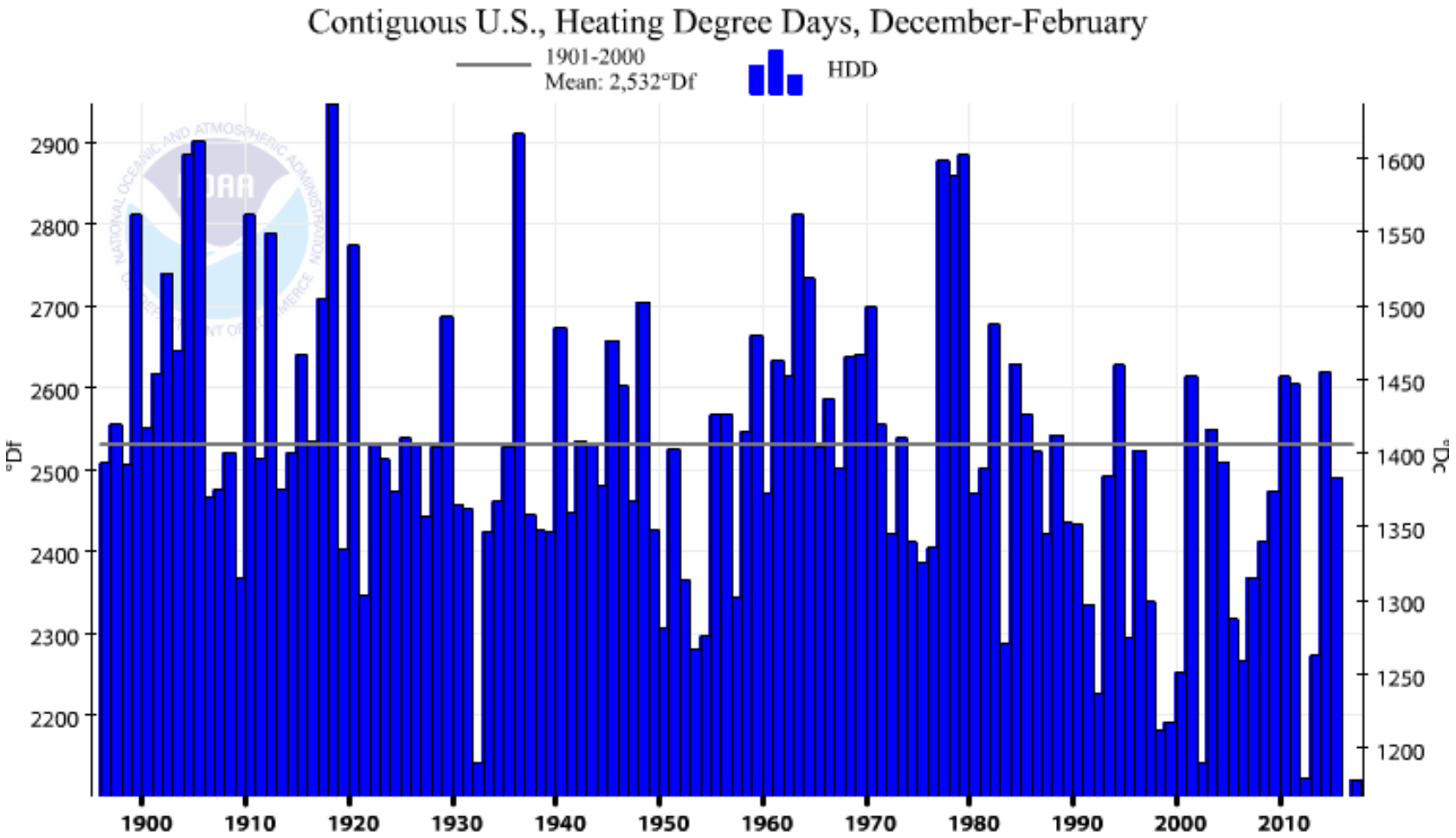
WHERE IS THE MARKET HEADED?

- **Coal demand will be higher in 2017 with an increase in coal burn in power markets**
  - Purchases will continue to grow in 2018 as inventory destocking ends, even with no burn growth
- **Export shipments will be much stronger in 2017**
  - Metallurgical prices are much higher than 2016 and steam export sales are already committed
- **Coal supply will be tighter with higher demand**
  - Producers are reluctant to add production after recent slump

mm tons	2014	2015	2016	2017	2018	2019
U. S. Coal Total						
Electric Power Burn	850.3	736.6	677.7	748.0	734.9	703.5
Consumer stock change	*(4.1)*	*40.2*	*(33.9)*	*(43.0)*	*(6.0)*	*0.0*
Electric Power Receipts	846.3	776.8	643.8	705.0	728.9	703.5
Coke Ovens	21.7	19.5	16.5	17.0	16.7	16.7
Industrial/Commercial	45.3	40.3	34.1	32.7	31.9	31.5
Domestic Demand	**913.3**	**836.6**	**694.4**	**754.7**	**777.5**	**751.6**
Export metallurgical	57.6	44.6	40.5	48.0	45.3	42.7
Export steam	44.4	35.4	25.9	35.6	36.3	36.9
Total Exports	**102.0**	**80.0**	**66.4**	**83.6**	**81.6**	**79.6**
Total Demand	**1,015.3**	**916.6**	**760.7**	**838.3**	**859.1**	**831.2**

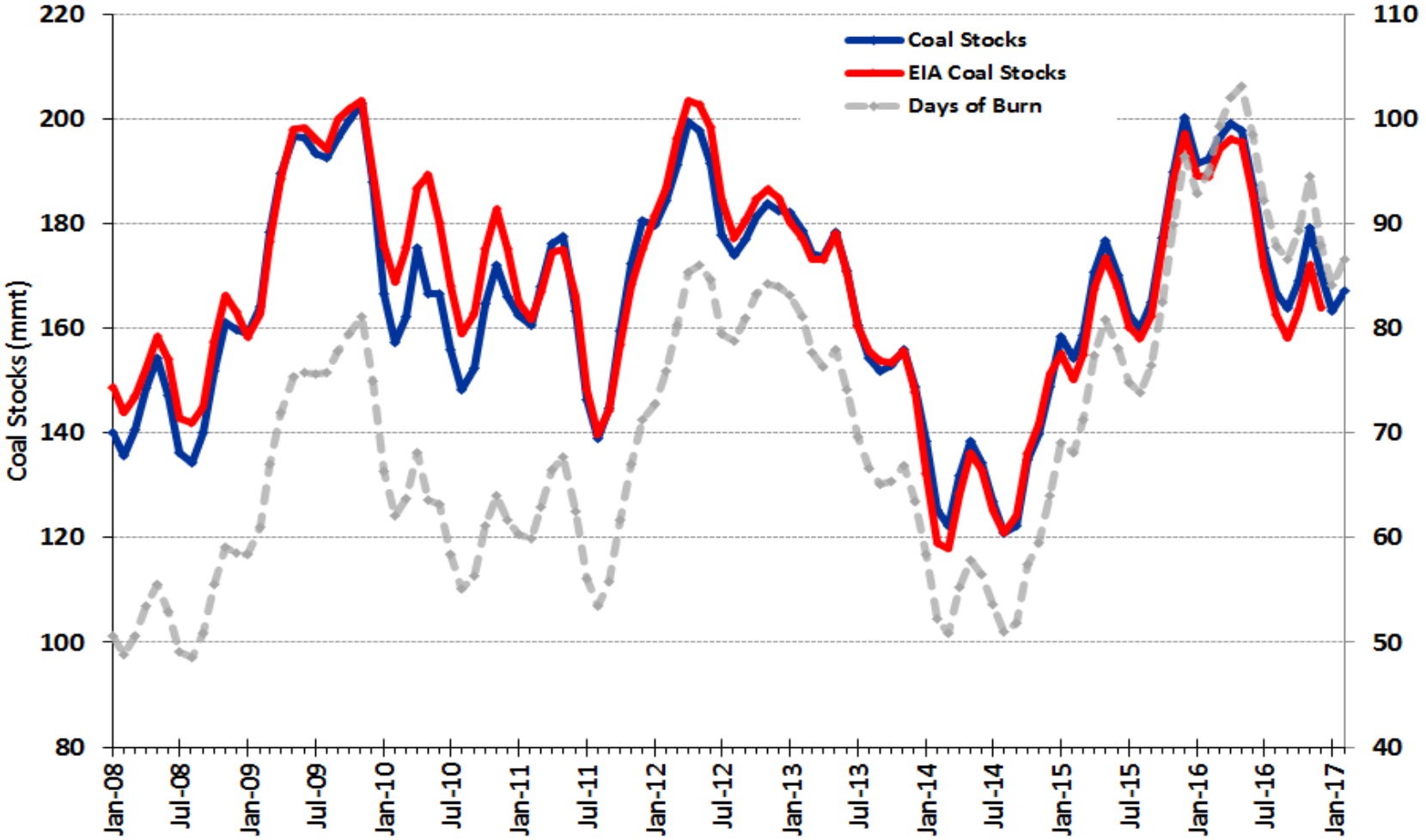
THE MILD WINTER WEATHER LIMITED THE MARKET RALLY

- **December – February 3-month average temperatures were the 2nd warmest on record**
  - The impact of mild weather on gas inventory and prices is the key effect on coal demand in 2017



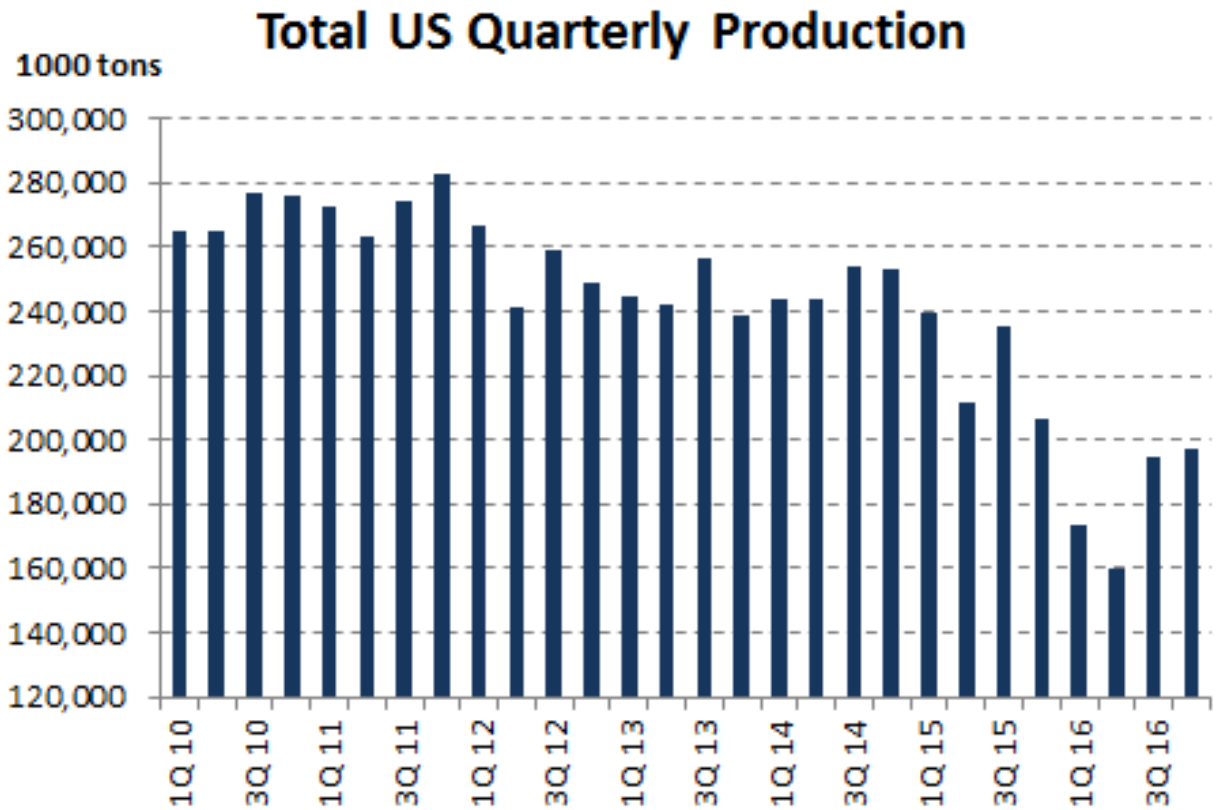
COAL STOCKPILES HIT ALL-TIME HIGH IN DAYS OF BURN IN EARLY 2016

- **Measured in days of average 12-month burn, stocks hit record 103 days in May 2016**
  - Well above 2012 peak of 86 days of burn; "normal" customer stocks are about 60 days of average burn
- **Total stocks peaked about 200 mm tons; new target is about 120 mm tons**



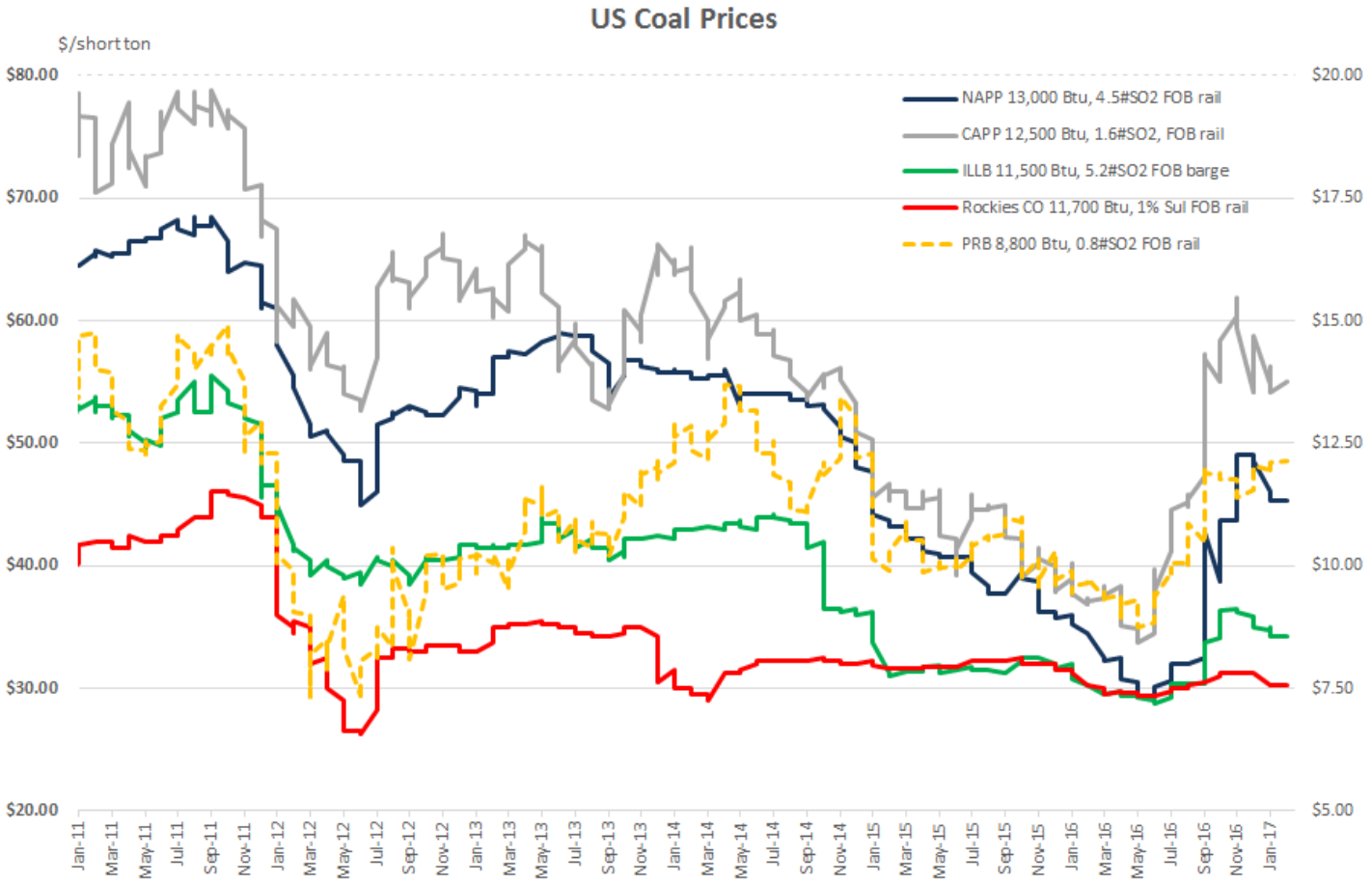
US COAL SUPPLY WAS CUT IN RESPONSE TO LOW DEMAND IN EARLY 2016

- **US coal producers had no choice but to cut production as customers stopped taking coal**
- **Total US coal production fell from 240 mm tons per quarter to just 160 mm tons in early 2016**
  - Mines laid off workers, reduced shifts, idled or closed permanently
  - Some major companies filed for bankruptcy restructuring
  - Production partially recovered with higher demand in the second half of 2016



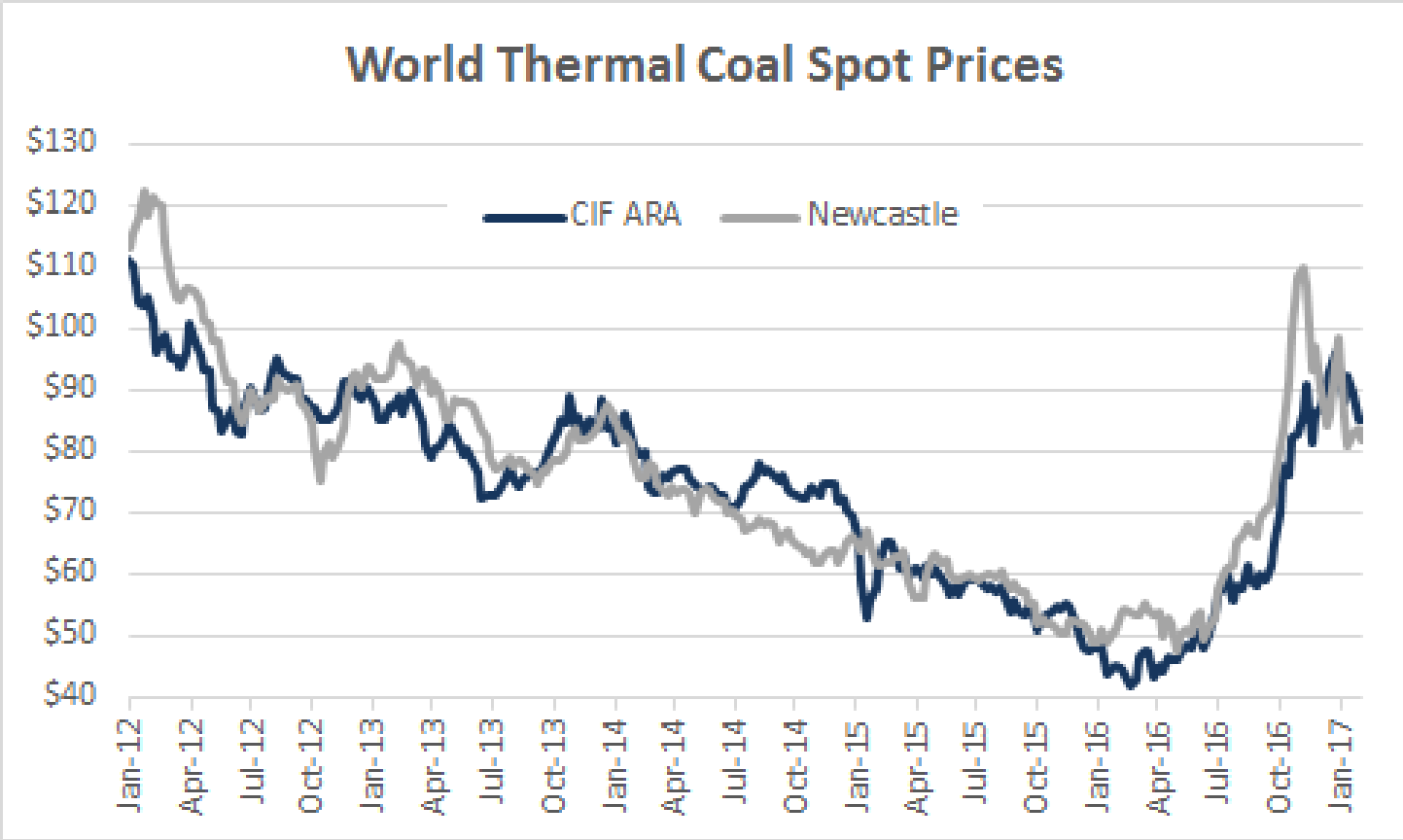
US THERMAL COAL PRICES RALLIED IN LATE 2016

- **Customers increased purchases as summer burn brought down stockpiles**
  - International coal markets piled on as China cut production and spurred imports
- **Spot price rally started in CAPP as supply fell**
  - Spread to NAPP as customers switched coal; moved to ILB later



INTERNATIONAL COAL PRICES MOVED DRAMATICALLY IN LATE 2016

- **After sliding to unsustainably low levels, spot prices in Europe doubled from March to Nov**
  - The rise was not due to European coal demand; it was a supply reduction
- **World market was led by reduced Chinese coal production in May 2016**
  - Reduced local production caused imports to rise and Pacific Basin pricing to jump to 4-year highs
  - Coal has been sucked out of the Atlantic into the Pacific market to fill the gap



WORLD COKING COAL PRICES ARE DRIVEN BY CHANGE IN CHINA IMPORTS

- **Like thermal coal, coking coal prices in 2015 and early 2016 fell to levels which were driving producers out of business**
- **Two years of world production cuts, followed by reduced Chinese coal production and increased imports, caused spot prices to rise starting in July 2016**
  - Spot prices peaked in December 2016 pushing the quarterly benchmark to $285, the highest since 2011
  - China changed policy to allow increased production in November 2016 and prices have trended down