

Power Generation – Risks and Opportunities for Gas Use

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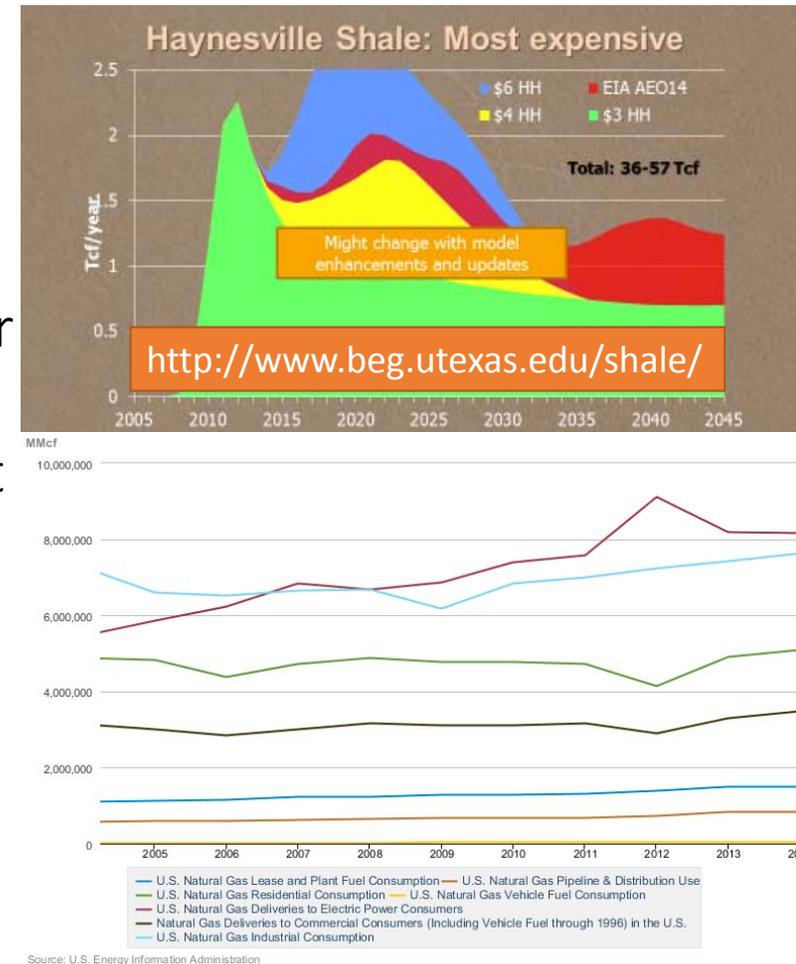
2016 Gas/Electric Partnership Conference

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Power Sector to Burn More Natural Gas?

- Gas producers have been “too successful”
- Demand growth has been “too slow” to provide price relief
 - Power generation has been the primary driver
 - 2015 (~9.5 Tcf) > 2012 (~9.1 Tcf)
 - Industrial consumption back to 2002 level but still below 8 Tcf (flat 2014 to 2015)
 - CEE projects database: ~1 Tcf by 2018 but low oil price changes dynamics
 - The rest (C&R) is not very exciting...
 - LNG exports started but...

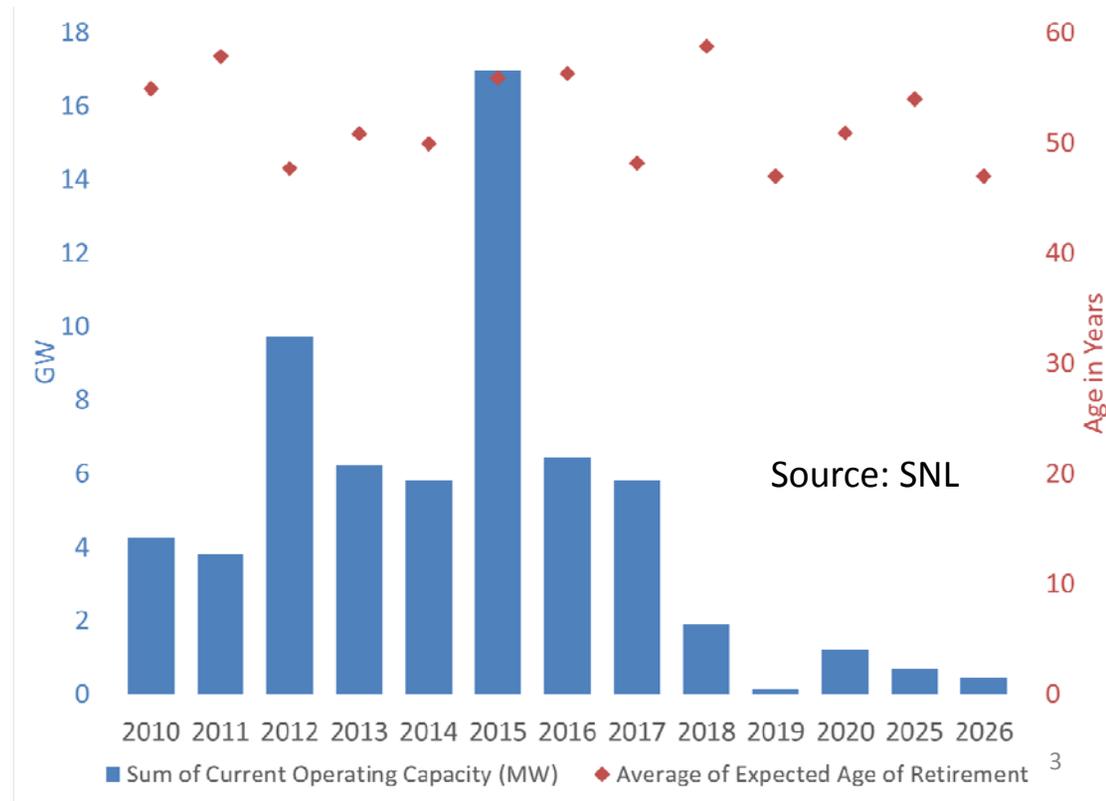
<http://www.beg.utexas.edu/energyecon/documents/Industrial%20Gas%20Demand%20052215.pdf>



Coal Retirements and Conversions Helped

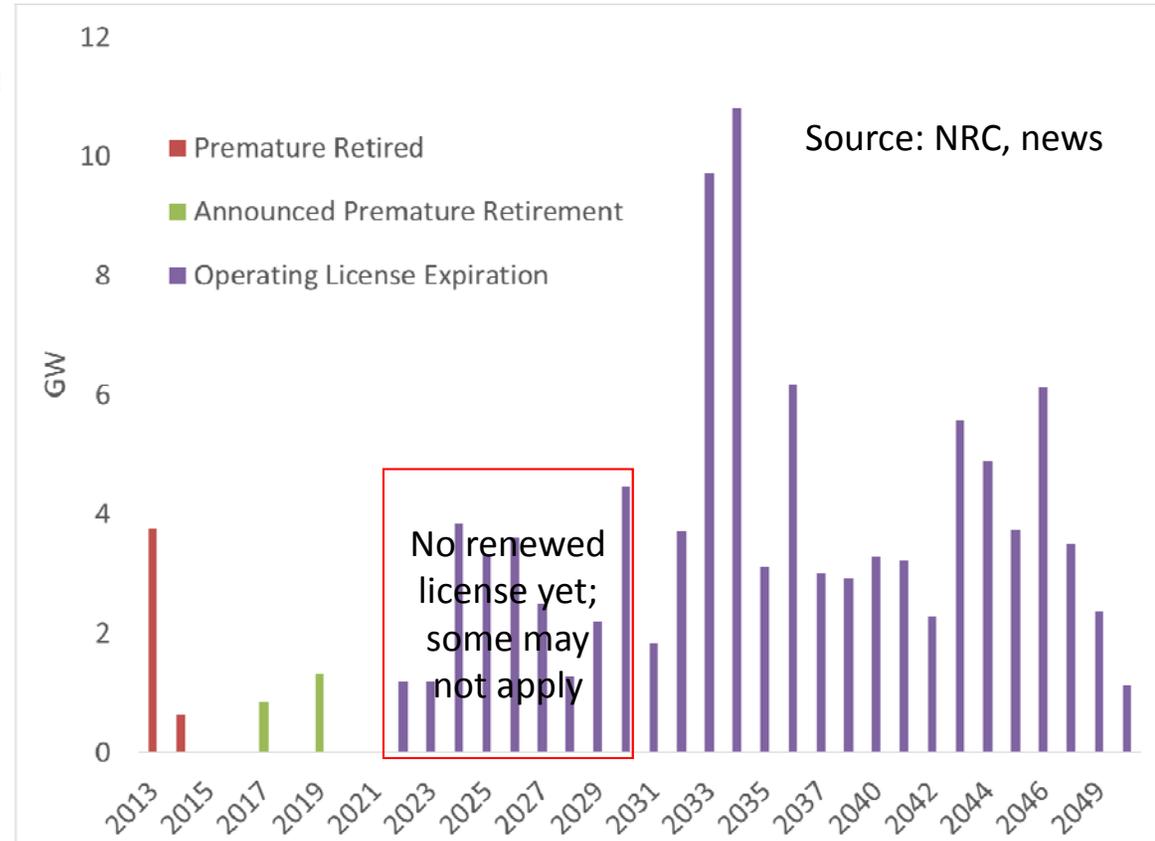


- Environmental regulations (combined with low prices) have been forcing coal retirements and conversions
 - Almost 47 GW retired in 2010-15
 - ~14 GW (2016-18)
 - Average age of retired units: 53
 - Declining utilization but still many with >50%
 - ~ 3GW converted to natural gas in recent years
 - ~7 GW of conversion expected in 2016-17



Uncertainty of Nuclear

- 4 retirements (4.4 GW)
- 3 with renewed licenses (2029+) announced ret. (2.2 GW)
- Indian Point (2.1 GW) license expired; operating with special permit
- Up to 9 GW more at risk (mostly single units)
- 5,500 MW in 3 plants under construction
 - Cost overruns and delays



Renewables, DER, DR, Market Rules & Storage



- ~114 GW of wind and ~38 GW of solar (including announced without a target date)
 - Extension of PTC & ITC (BNEF: \$73B increase in investment)
 - Long-term PPAs offered by utilities
 - Declining cost of renewables, especially of utility-scale PV
- Interest in community-power and DER
- FERC Order 745 on DR
- Changing price-formation rules (both energy & capacity markets)
- Storage is probably not the “game-changer” many believe— at least, not any time soon; but can still facilitate DER

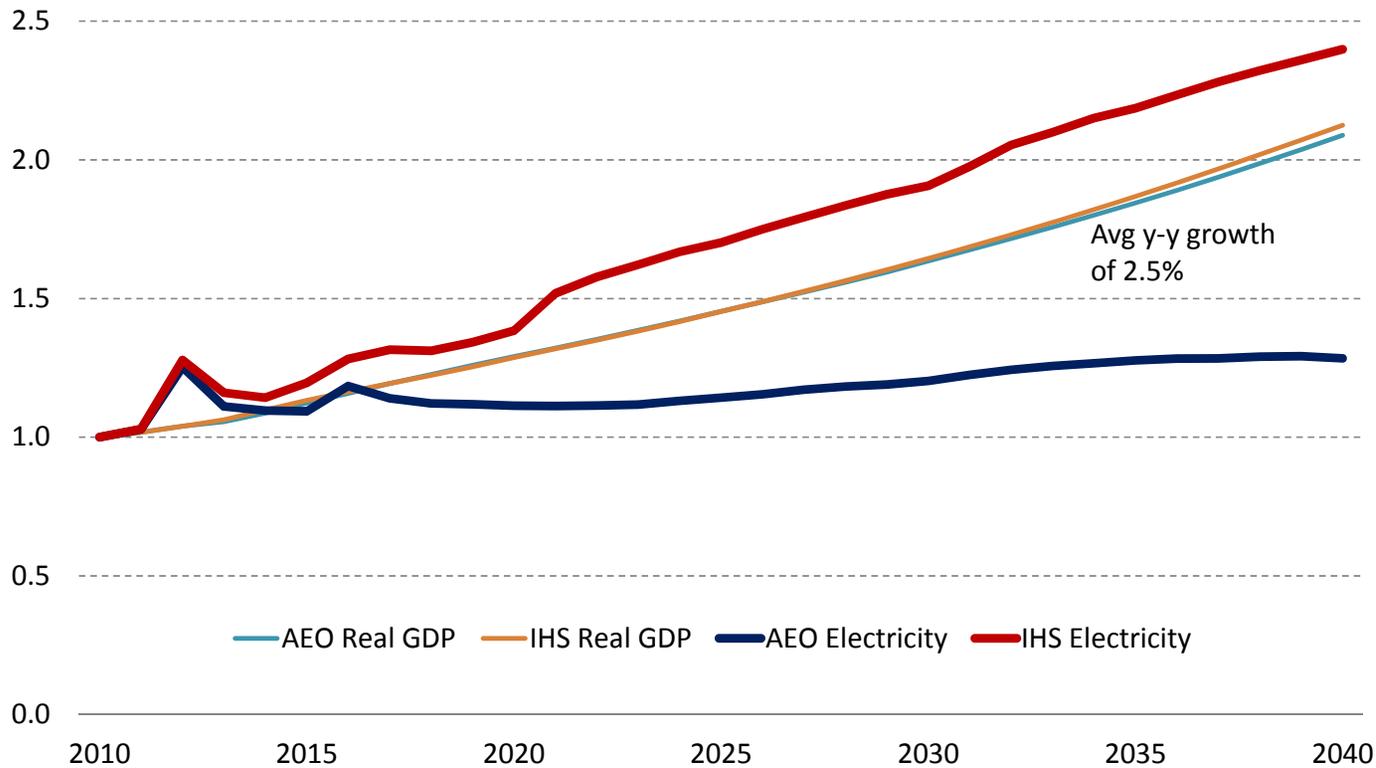
“The Times They Are A-Changin’” – Creative Destruction?



- Shutting down units → reliability concerns:
 - Increased out-of-market payments
 - Some utilities are asking regulators for out-of-market PPAs to keep units online
 - Some regulators are requiring utilities to sign long-term PPAs with new plants
- Losing customers / sales to “competing” DER reduces revenues
 - Rates for remaining customers increase
 - Fixed charges to customers with DER are raised → customer interest in DER decrease
 - DR and EE might have similar impacts if they are provided by non-utility competitors

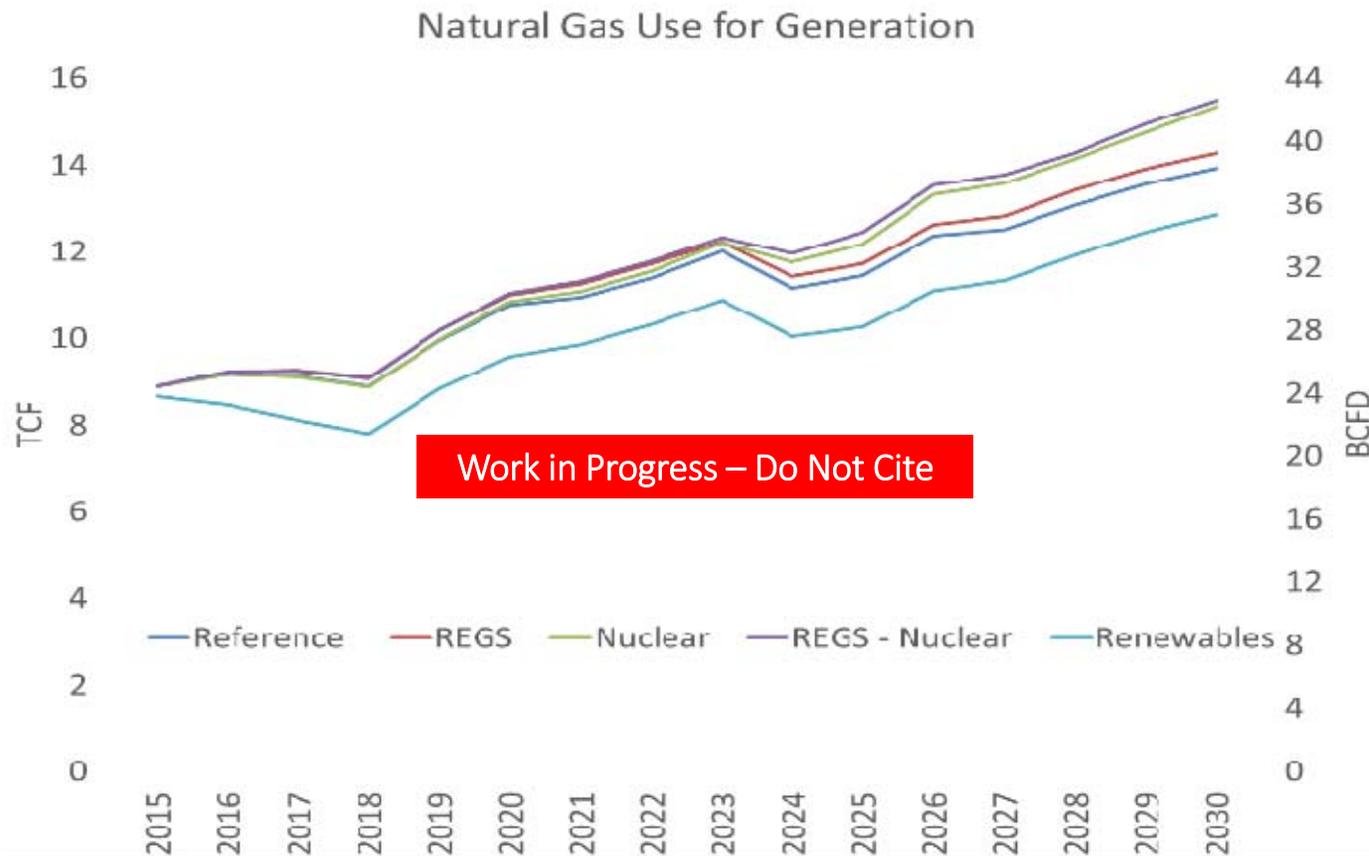
So, What Future do you Expect?

Consumption of Natural Gas in Power Generation (Index, 2010 = 1)



- More energy efficiency and conservation (AEO reference scenario 0.8% annual growth in electricity use)
- More renewables
- More generation from nuclear (?)

CEE Dispatch Modeling: NG Burn Increases Significantly Even With More Renewables



- REGS: MATS, CAIR/CSAPR, 316(b). *We did not model CPP.*
- The model builds CT primarily, partially because natural gas price remains low
- ~12 GW of CC under construction or in advanced development were added for all scenarios as well as 5.5 GW of nuclear
- Renewables: ~58 GW of wind and ~27 GW of solar

Must-Have Sensitivities and Updates

- Natural gas prices
 - Increased gas utilization and declining production might render gas burn less attractive
- Cost of wind and solar
 - Some claim utility-scale PV is already below \$2,000/kW and closer to \$1,500/kW
- Electricity demand growth
 - Even from 2014 to now, some ISO/RTO forecasts declined: perhaps DER, DR, and/or EE are having a bigger impact...
- Changes to market rules



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