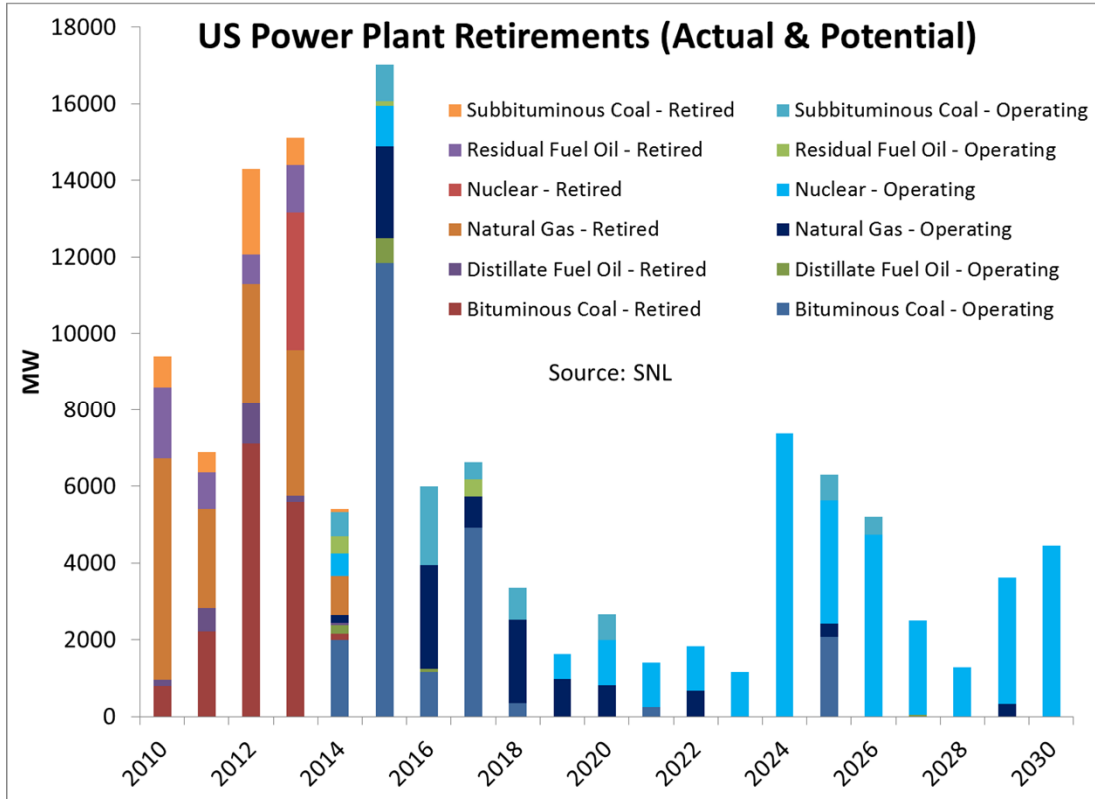


Power Plant Retirements: What, Where, Why & Implications

For a variety of reasons, including age, cheap natural gas, new environmental regulations, increasing capacity of renewables and low demand growth, significant generation capacity was retired in recent years and more retirements are **expected** (see chart below).

- 47 GW between 2010 and early 2014
 - 43% coal, 35% natural gas, 15% oil products and the rest nuclear.
 - 40 GW 40 years or older, half of which coal
- 42 (77) GW expected to retire between 2014 and 2020 (2030).
 - By 2020, 38 GW older than 40 years, of which 25 GW coal

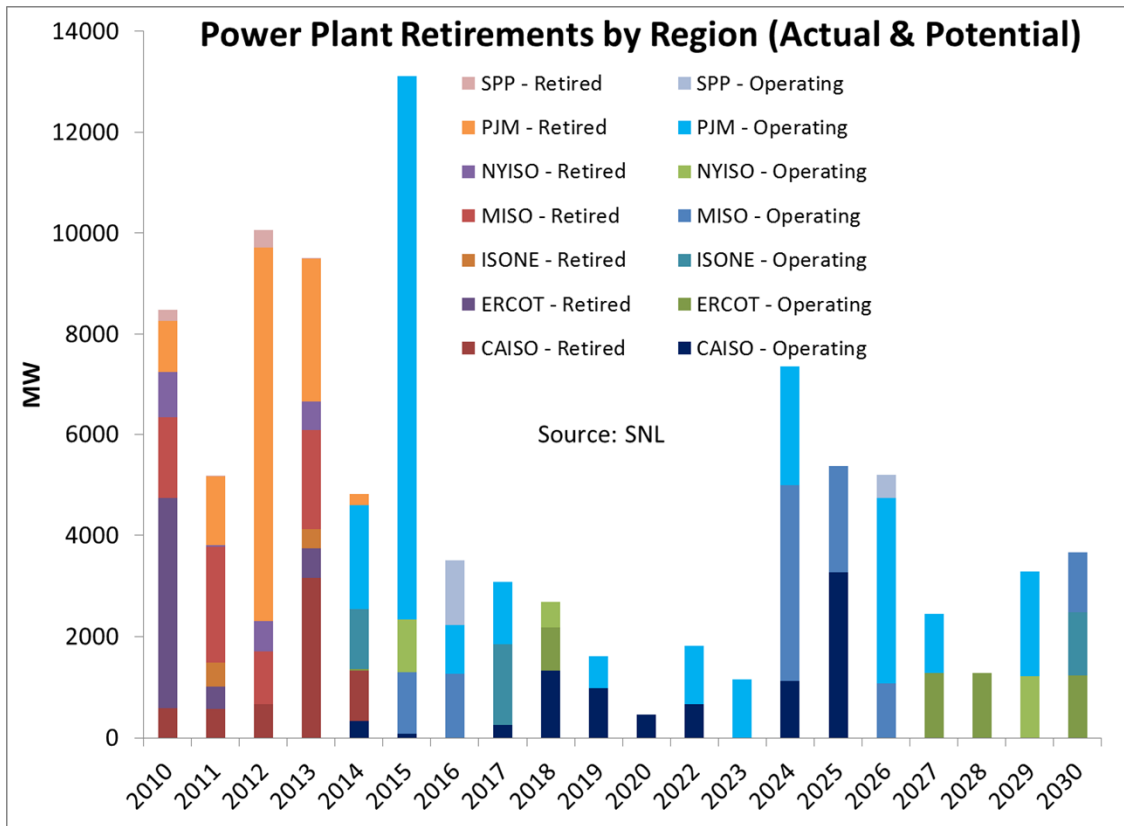


MW expected to be retired 2014-2020 by CF

	2009-13 average CF		2013 CF	
	Nuclear	Coal	Nuclear	Coal
>90%	1,649	--	2,286	417
>80%	1,814	589	1,177	0
>70%	0	3,361	0	2,407
>60%	0	2,108	0	2,341
>50%	0	5,170	0	2,814
Total	3,463	11,228	3,463	7,979

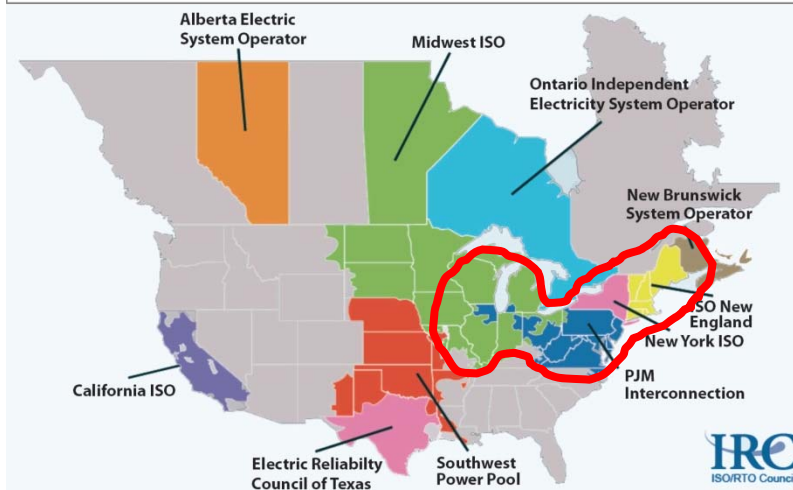
- >60% of retirements by 2020 will be coal, followed by natural gas (24%) and nuclear (8%).
 - 2015 is a key year due to MATS
- 86% of retirements in 2021-30 are nuclear.
- Roughly a third of the plants scheduled to retire in 2014-20 had capacity factors (CF) greater than 50% (see table above).
 - Nuclear >80%
 - Coal 50% - 80%
- Many coal plants' CF has declined in recent years: >3 GW of coal fell below 50% CF between 2009 and 2013.

Overall, for the most part, older plants with relatively lower CF are being retired, leading to higher CF for remaining gas plants but regional considerations are warranted.



During the extremely cold winter of early 2014, coal-fired generation increased in response to high natural gas prices (mostly due to pipeline bottlenecks) in the Northeast and Midwest, defying the trend of switching from coal to gas.

- Such coal flexibility might not be possible going forward given retirements (see chart).
 - 15.7 GW in PJM, 2.8 GW in New England, 2.5 GW in MISO, 1.6 GW in New York to retire in 2014-20.
 - 15 GW of coal, mostly in PJM
 - 12.8 GW in PJM, 6.9 GW in MISO, 2.1 GW in New York and 0.8 GW in New England retired since 2010.
 - 13.6 GW of coal, mostly in PJM
- Significant peaking capacity also retiring.
 - 2.4 GW of liquid fuels to retire in 2014-20
 - 3.7 GW of liquid fuels retired since 2010
- Coal deliverability via rail, liquid fuel storage and emissions from burning liquid fuels in urban areas are additional challenges.



- As a result, Northeast and Midwest will experience gas and electricity price volatility next several years, especially if the winter of 2014 replays; and longer ***unless new infrastructure is built to enhance natural gas deliverability.***
 - Electric system reliability will be tested.
- Competition for Marcellus gas is rising with reversal of pipelines to the Gulf and Southeast markets for LNG exports and power generation.
 - 14 GW retired since 2010 & 11 GW expected to retire by 2020 in Southeast
 - Significant gas builds in Southeast to replace retiring units and meet growing demand