

Natural gas impacts from upcoming coal retirements

By Jesse Gilbert

The future is looking bright for natural gas as shale-driven future production estimates remain bullish and a variety of factors are coming together to bolster demand. The increasingly uncertain environment for coal-fired power generation in particular has set the stage for natural gas to play a more prominent role in the nation's fuel mix.

The displacement of coal by natural gas generation has been twofold. Relatively stable and low natural gas prices since 2009 has fueled [coal-to-gas switching](#) in many areas of the U.S. In this scenario, older, less efficient coal units, primarily in the eastern parts of the country, have seen lower utilization as economics has favored natural gas combined-cycle units in the dispatch curve.

In the coal-to-gas switching scenario, coal units remain operational but at times are able to economically be displaced by combined-cycle generation. A confluence of factors including a string of new EPA regulations also is driving the potential for increased natural gas demand through the permanent retirement of coal units.

SNL Energy has been closely following coal unit retirements over the past two years. In its latest [report](#), SNL found that nearly 26,000 MW of coal capacity has been announced to retire between 2011 and 2020. Since the report was released at the end of September, retirements have continued to build, including [Ameren Corp.](#)'s recently [announced](#) plan to retire two coal-fired power plants.

Ameren attributed its decision to the expected cost of compliance with the EPA's Cross-State Air Pollution Rule, issued in July and scheduled to take effect Jan. 1, 2012. While most announced coal retirements appear to be at older, less-efficient units within the range of typical retirement ages, some see the Ameren retirements as a harbinger. A recent report from UBS Investment Research [sees](#) Ameren's recent move as a sign that other companies may accelerate planned retirements of facilities with similar profiles.

SNL's up-to-date figure for coal retirements between 2011 and 2020 puts the capacity of retiring units at nearly 26,500 MW. To the extent that these retiring units are replaced with natural gas generation, gas demand could get a significant boost in the coming years, though the amount of additional gas demand may not be as high as some might anticipate.

Units retiring in 2011 to 2020 have seen lower utilization over the past couple of years compared to the average coal plant. Average 2010 heat rates for units retiring in 2011 through 2020 were higher than the average for all coal plants of approximately 10,500 Btu/kWh with the exception of units retiring in 2018 and 2020, which actually saw lower-than-average heat rates. Utilization

of these units was also much lower than the average for all coal plants. The average capacity factor of all coal units was approximately 66% in 2010, compared to an average capacity factor below 66% for units retiring in all years except 2018 and 2020.

SNL Energy analyzed the 2010 generation trends of retiring units to determine the potential impact on natural gas demand if this generation is replaced by generation from a CCGT plant. Not all units retiring in each year between 2011 and 2020 reported net generation, so an adjusted net generation figure was calculated by assuming that nonreporting units operated at the average 2010 capacity factor for other units retiring in the specified year.

Natural gas Impacts from US coal unit retirements 2011-2020										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average age at retirement (years)	53	55	51	54	58	56	59	43	66	44
Units retired/retiring	29	25	18	49	29	12	7	4	6	2
Capacity of retiring units (MW)	3,151	2,973	2,536	8,543	3,739	1,875	1,038	963	341	1,273
Units retiring with available heat rate	24	25	16	44	29	12	7	4	6	2
Weighted average heat rate (Btu/kWh)	12,800	11,370	11,275	10,728	10,796	10,608	12,525	10,465	12,363	10,424
Units retiring reporting 2010 capacity factor	18	22	14	40	25	12	7	4	6	2
2010 capacity factor of units (%)	30.63	44.82	43.47	48.50	50.74	60.97	62.12	71.25	39.47	76.94
2010 net generation of retiring units (MWh)	6,466,931	11,448,674	9,128,076	33,222,708	15,558,333	10,013,564	5,648,488	6,010,649	1,178,963	8,579,680
% of capacity represented in generation	76.49	98.08	94.53	91.53	93.63	100.00	100.00	100.00	100.00	100.00
Net gen.adj. for non-reporting units (MWh)*	8,454,073	11,673,078	9,656,644	36,296,485	16,617,007	10,013,564	5,648,488	6,010,649	1,178,963	8,579,680
Gas required for replacement (MMBtu)**	63,405,546	87,548,086	72,424,828	272,223,638	124,627,554	75,101,730	42,363,660	45,079,868	8,842,223	64,347,600
Incremental addition in gas demand Bcf/d	0.1687	0.2322	0.1926	0.7241	0.3315	0.1992	0.1127	0.1199	0.0235	0.1707
Cumulative addition in gas demand Bcf/d	0.1687	0.4009	0.5935	1.3176	1.6491	1.8483	1.9610	2.0809	2.1045	2.2752
Cumulative % of 2010 daily nat. gas consumption	0.26	0.61	0.90	2.00	2.50	2.80	2.97	3.15	3.19	3.45

As of Oct. 6, 2011
* Net generation reported for units retiring in the specified year was added to a 2010 net generation figure for nonreporting units. Nonreporting units were assumed to operate at the average 2010 capacity factor of other units retiring in the specified year.
** A figure for the amount of natural gas required to replace retiring units was calculated using an assumption of replacement by a CCGT plant operating at a heat rate of 7,500 Btu/kWh.
Source: SNL Energy

Units retiring through 2020 had an estimated total 2010 net generation of 107,256,066 MWh, between 5% and 6% of 2010 national coal generation. This can be further translated into 855,964,732 MMBtu of natural gas if the generation is replaced by a typical CCGT plant with a 7,500 Btu/kWh heat rate. Estimated daily additional gas demand created by retiring coal units ranged from a low of 0.0235 Bcf/d from units retiring in 2019 to a high of 0.7241 Bcf/d for units retiring in 2014.

The estimated cumulative increase in daily natural gas demand through 2015 is 1.6491 Bcf/d, roughly 2.5% of total U.S. natural gas consumption of about 66 Bcf/d. Through 2020, the cumulative additional gas demand required to replace retiring coal units was found to be 2.2752 Bcf/d, nearly 3.5% of total 2010 consumption. These figures are within the ranges reported in other studies.

Speaking recently at the North America Gas Summit in Washington, D.C., Matthew Most, a vice president of environmental policy with [Encana Corp.](#), said his team has tallied about 27.5 GW of coal units announcing retirements through 2025. Most said, "If you were to replace that generation, not capacity but the actual megawatt-hours the facilities would be producing, with existing or new natural gas units ... it's in the ballpark of 2.5 Bcf per day in additional gas demand."

SNL Energy also analyzed the impacts of coal retirements on natural gas demand within the nation's various ISO markets. [PJM Interconnection LLC](#), which has just over 8,100 MW of coal capacity retiring from 2011 to 2020, leads all ISO regions for expected cumulative increased natural gas demand from coal retirements. Increased natural gas demand from retiring units could reach 0.5652 Bcf/d in PJM by the end of 2020. The vast majority of this impact would probably be felt by the end of 2014, when nearly 0.5 Bcf/d of additional gas demand would be required to replace retiring units.

The [Midwest ISO](#) follows PJM with 0.3547 Bcf/d of expected additional natural gas demand to replace retiring coal units through 2020. Most of this impact would occur through 2015, when the vast majority of retirements are expected to take place. MISO currently has 3,645 MW of coal capacity retired or retiring between 2011 and 2015.

The [California ISO](#) takes the third spot, with 0.2005 Bcf/d expected additional gas demand from coal retirements. Though the region is expecting to see just under 1,500 MW of retirements through 2020, the retiring units produced a significant volume of power in 2010 operating at relatively high capacity factors.

Areas of the country outside ISO regions could see 11,067 MW of coal retirements from 2011 to 2020, resulting in 0.9276 Bcf/d of additional gas demand through 2020, if the retired units are replaced with CCGT capacity. Roughly two-thirds of this additional demand comes from retirements through 2015.

ISO summary of natural gas impacts from US coal unit retirements 2011-2020										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CAISO										
Capacity of retiring units (MW)	0	0	0	560	0	330	0	0	0	585
2010 net generation of retiring units (MWh)	0	0	0	4,214,060	0	1,722,615	0	0	0	4,129,756
% of capacity represented in generation	NA	NA	NA	100.00	NA	100.00	NA	NA	NA	100.00
2010 capacity factor of units (%)	NA	NA	NA	85.90	NA	59.59	NA	NA	NA	80.59
Net gen. adj. for non-reporting units (MWh)*	NA	NA	NA	4,214,060	NA	1,722,615	NA	NA	NA	4,129,756
Incremental addition in gas demand Bcf/d**	0.0000	0.0000	0.0000	0.0841	0.0000	0.0343	0.0000	0.0000	0.0000	0.0822
Cumulative addition in gas demand Bcf/d	0.0000	0.0000	0.0000	0.0841	0.0841	0.1183	0.1183	0.1183	0.1183	0.2005
MISO										
Capacity of retiring units (MW)	645	34	293	1,793	257	282	0	0	341	0
2010 net generation of retiring units (MWh)	915,331	0	2,252,919	6,652,479	1,142,899	1,217,293	0	0	1,178,963	0
% of capacity represented in generation	51.94	0.00	100.00	67.60	74.61	100.00	NA	NA	100.00	NA
2010 capacity factor of units (%)	31.19	NA	87.78	62.66	68.09	49.28	NA	NA	39.47	NA
Net gen. adj. for non-reporting units (MWh)*	1,762,354	NA	2,252,919	9,841,497	1,531,819	1,217,293	NA	NA	1,178,963	NA
Incremental addition in gas demand Bcf/d**	0.0352	0.0000	0.0449	0.1963	0.0306	0.0242	0.0000	0.0000	0.0235	0.0000
Cumulative addition in gas demand Bcf/d	0.0352	0.0352	0.0801	0.2764	0.3070	0.3312	0.3312	0.3312	0.3547	0.3547
ERCOT										
Capacity of retiring units (MW)	0	0	0	0	0	0	0	871	0	0
2010 net generation of retiring units (MWh)	0	0	0	0	0	0	0	5,557,492	0	0
% of capacity represented in generation	NA	NA	NA	NA	NA	NA	NA	100.00	NA	NA
2010 capacity factor of units (%)	NA	NA	NA	NA	NA	NA	NA	72.84	NA	NA
Net gen. adj. for non-reporting units (MWh)*	NA	NA	NA	NA	NA	NA	NA	5,557,492	NA	NA
Incremental addition in gas demand Bcf/d**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1109	0.0000	0.0000
Cumulative addition in gas demand Bcf/d	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1109	0.1109	0.1109
SPP										
Capacity of retiring units (MW)	0	0	0	528	0	0	0	92	0	0
2010 net generation of retiring units (MWh)	0	0	0	3,657,448	0	0	0	453,157	0	0
% of capacity represented in generation	NA	NA	NA	100.00	NA	NA	NA	100.00	NA	NA
2010 capacity factor of units (%)	NA	NA	NA	79.08	NA	NA	NA	56.23	NA	NA
Net gen. adj. for non-reporting units (MWh)*	NA	NA	NA	3,657,448	NA	NA	NA	453,157	NA	NA
Incremental addition in gas demand Bcf/d**	0.0000	0.0000	0.0000	0.0730	0.0000	0.0000	0.0000	0.0090	0.0000	0.0000
Cumulative addition in gas demand Bcf/d	0.0000	0.0000	0.0000	0.0730	0.0730	0.0730	0.0730	0.0820	0.0820	0.0820
PJM										
Capacity of retiring units (MW)	1,270	1,331	165	4,772	222	383	0	0	0	0
2010 net generation of retiring units (MWh)	2,222,248	5,180,913	557,050	16,349,462	1,238,206	2,109,148	0	0	0	0
% of capacity represented in generation	89.76	98.27	100.00	97.90	100.00	100.00	NA	NA	NA	NA
2010 capacity factor of units (%)	22.25	45.22	38.54	39.95	63.67	62.86	NA	NA	NA	NA
Net gen. adj. for non-reporting units (MWh)*	2,475,662	5,272,264	557,050	16,699,408	1,238,206	2,109,148	NA	NA	NA	NA
Incremental addition in gas demand Bcf/d**	0.0494	0.1049	0.0111	0.3331	0.0247	0.0420	0.0000	0.0000	0.0000	0.0000
Cumulative addition in gas demand Bcf/d	0.0494	0.1543	0.1654	0.4985	0.5232	0.5652	0.5652	0.5652	0.5652	0.5652
ISO-NE										
Capacity of retiring units (MW)	269	0	0	150	0	0	0	0	0	0
2010 net generation of retiring units (MWh)	567,062	0	0	688,296	0	0	0	0	0	0
% of capacity represented in generation	59.49	NA	NA	100.00	NA	NA	NA	NA	NA	NA

