

Generation numbers (EIA) (table 7.2b
<http://www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf>)

	2008	2009 GWh	TWh		2010	2011 GWh	TWh				change in % mix 2008-2011
Coal	1968838	1741123	-227715	-227.715	1827738	1714870	-112868	-112.868	% 2008 mix	% 2011 mix	
Gas	802372	841006	38634	38.634	901389	930568	29179	29.179	49.54	43.36	-6.18
Renewable	350180	387984	37804	37.804	397338	489026	91688	91.688	20.19	23.53	3.34
Oil	42881	35811	-7070	-7.07	34679	26223	-8456	-8.456	8.81	12.36	3.55
Nuclear	806208	798855	-7353	-7.353	806968	790225	-16743	-16.743	1.08	0.66	-0.42
Total	3974349	3809837	-164512	-164.512	3972386	3955056	-17330	-17.33	20.29	19.98	-0.31

% share	Change in share			% share in 2010	% share in 2011	Change in share
Coal	49.53862884	45.70072158	-3.837907263	46.01108754	43.35893095	-2.652156595
Gas	20.18876551	22.07459269	1.885827187	22.69137491	23.52856698	0.837192072
Renewable	8.811002758	10.18374277	1.372740011	10.00250227	12.3645784	2.362076128
Oil	1.078943998	0.939961473	-0.138982525	0.873001768	0.663024746	-0.209977022
Nuclear	20.28528446	20.9682199	0.682935442	20.31444074	19.98012165	-0.334319095

% Change in total power demand	-4.139344582	-0.436261733
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Emissions numbers (MMT CO2) (EIA) (Table 12.6)	2008 total	2009 total	Change	% change	2010 total	2011 total	Change	% change
	2374	2159	215	-9.056444819	2271	2166	105	-4.623513871

Key assumptions:

Part 1: To calculate the impact of changes in electricity mix on emissions you need to examine yearly changes in output relative to what would have happened if %'s had remained the same (McElroy et al)

Part 2: To calculate impact of changes in energy mix on emissions multiply by Co2 savings from change e.g. coal to gas per MWh

Part 3: All new gas assumed to replace coal (McElroy et al)
"Existing US coal fired power plants are responsible on average for emissions of 0.968 tons of CO2 per MWh of electricity in contrast to the much lower emission of 0.400 tons per MWh for the existing NGCC system"

Part 4: Therefore each MWh of gas generates a saving of 0.968-0.4= 0.568 tons of CO2 per MWh

Part 5: Renewables do not only replace coal, so emissions reductions relative to total energy mix. EPA calculates 0.68956 tons of CO2 per MWh. <http://www.epa.gov/cleanenergy/energy-resources/refs.html>

Calculation:

	2009 output as reported (MWh)	2009 output if mix remained constant (GWh)	Change due to switching in mix (GWh)	Impact of change on emissions (MMT) 2009	Emissions change as % of total emissions change	2011 output as reported (Gwh)	2011 output if mix had remained constant	Change due to switching in mix (GWh)	Impact on emissions (MMT) (2011)	Emissions change as % of total emissions change
Coal	1968838	1887341.011	-146218.0109	-141.5390346	-18.98095954	1714870	1819764.279	-104894.2785	-101.5376616	-17.91169893
Gas	802372	769159.0581	71846.94191	-40.809063	-16.77367749	930568	897456.5847	33111.41527	-18.80728387	-61.35207979
Renewable	350180	335684.8431	52299.15686	-36.0634066		489026	395604.5664	93421.43364	-64.41968378	
Oil	42881	41106.00765	-5295.00765	Not calculated		26223	34527.70879	-8304.708794	Not calculated	
Nuclear	806208	772836.2728	26018.72717	Not calculated		790225	803447.5074	-13222.50742	Not calculated	
Total change in emissions (MMT)	3970479			215		3950912			105	

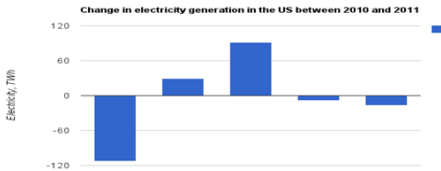
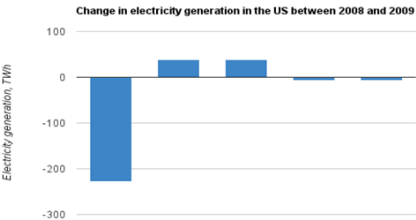
Conclusion

2008-2009: Switching away from coal power had a major impact on emissions even relative to the fall in demand, however only a portion of this came from the switch to gas the rest being due to other factors. Overall, therefore, the single largest factor explaining 2009's fall in emissions remained the recession and fall in demand

2010-11: Switching away from coal accounted for almost all the fall in emissions from the power sector however the majority of it came from the switch from coal to Renewables, not the switch to gas

2010/11 calculation broken down

	2010 output (Gwh)	2010 share of mix %	2011 output (Gwh)	Change from 2010 output (Gwh)	2011 output at 2010 shares (GWh)	Change due to switching normalised for demand (GWh)	Impact on emissions (MMT CO2)
Gas	901389	22.69137491	930856	29469	897456.5847	33401.41527	18.97200387
Wind	94636	2.382346529	119704	25068	94223.13935	25480.86065	17.57058227
Hydro	258455	6.506291181	323141	64686	257327.4597	65813.54026	45.38238482



2007-2012 calculation

	2007 output as reported	2012 output as reported	2007 figure as % of 2012 output if mix remains the same	Change due to switch in emissions (MMT) 2009	Impact of change on emissions (MMT) 2009
Coal	1998390	554506	0.498931053	764478.6239	209972.6239
Gas	814752	442371	0.203416287	311681.1472	-130689.8528
Renewable	320547	208487	0.08002985	122624.3774	-85862.62265
Oil	61306	7656	0.015306055	23452.44247	15796.44247
Nuclear	806425	315914	0.201337314	308495.6762	-7418.323843
Total	4005343	1532233			