

EMISSIONS FACTORS

Comparative Emissions Rates of Key Pollutants for Various Energy Technologies

Technology	Facility Size (MW)	Typical Emissions (tons/year) ^{(1) (4)}									Emissions in tons per year per thousand households ⁽¹⁸⁾								
		CO	CO ₂	NO _x	PM	VOC	SO ₂	HCl	NH ₃ ⁽⁵⁾	Hg ⁽²⁰⁾	CO	CO ₂	NO _x	PM	VOC	SO ₂	HCl	NH ₃ ⁽⁵⁾	Hg ⁽²⁰⁾
Coal - APC	650	3,006	4,128,833	1,203	200	60	2,004	160	140	0.03	7.3	10,007	2.9	0.5	0.1	4.9	0.39	0.34	0.0001
Coal - New Technology (APC with CCS)	650	-	544,255	1,585	264	79	528	211	185	0.04	-	1,319	3.8	0.6	0.2	1.3	0.51	0.45	0.0001
Natural Gas - Combined Cycle	540	867	1,268,108	81	108	54	11	-	-	-	3.1	4,553	0.3	0.4	0.2	0.0	-	-	-
Advanced Nuclear	2200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydro	500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Geothermal	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biomass - MSW	50	-	630,720	851	95	-	221	-	-	0.2	-	19,872	26.8	3.0	-	7.0	-	-	0.01
Biomass - BFB	50	333	-	177	22	4	22	13	-	-	11.2	-	6.0	0.7	0.1	0.7	0.45	-	-
Solar - PV	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wind - Onshore	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:

1. Approximate, using typical applicable facility availabilities and capacity factors.
2. On the basis of facility size indicated.
3. On the basis of electric power generation.
4. Sources: various industry and proprietary database sources.
5. On the basis of expected regulatory limit.
6. Geothermal can range in CO₂ output between negligible to 0.7 ton/MWh depending on the trapped gases and technology type.
7. Biomass CO₂ output varies depending on the fuel. However, since biomass is considered renewable, it can be considered CO₂ neutral.
8. Assuming 0.5% sulfur biomass at 5,000 btu/lb and a 99.5% sulfur removal rate
9. Assuming 2 ppmvd corrected to 15% O₂ for F-Class engine. Assumes development of SCR for IGCC with CCS
10. From DOE Voluntary GHG Reporting
11. Reported as pounds per MWh and as H₂S - actual will vary with resource
12. Reported as pounds per MWh - actual will vary with resource
13. Based on 30 ppmvd @ 7% Oxygen - 5,000 Btu per pound HHV of MSW
14. Based on 150 ppmvd @ 7% Oxygen - 5,000 Btu per pound HHV of MSW
15. Assumes solar operation only - operations will vary with use of fossil fuels as supplemental fuel
16. Based on 24 mg/dscm @ 7% Oxygen - 5,000 Btu per pound of HHV of MSW
17. Based on 0.080 mg/dscm @ 7% Oxygen - 5,000 Btu per pound of HHV of MSW
18. Based on 11,040 KWh of electricity consumed per household in the United States in 2008
19. Assuming the CO₂ emissions from burning wood is neutral due to the lifecycle emissions
20. In natural gas, mercury exists almost exclusively in its elemental form and at concentrations far below saturation suggesting that no liquid mercury phase exists in most reservoirs.