

CIBO Estimated Capital Costs For Air Pollution Control Equipment For All Gas 1-Fired Industrial Boilers and Process Heatersⁱ

Pollutant	<u>Particulate Matter (PM)</u>	<u>Hydrogen Chloride (HCl)</u>	<u>Carbon Monoxide (CO)</u>	<u>Dioxin/Mercury (Hg)</u>
Likely Additional Control Required	Fabric Filter (FF)	Scrubber (e.g., spray dryer or wet scrubber)	Catalytic Oxidation (CATOX)	Carbon Injection (CI)
# of Gas 1-Fired Boilers and Process Heaters	11,373 of the 11,532 gas 1-fired units will need a new FF (few of these boilers have any HAP APCD controls installed).	11,527 of the 11,532 gas 1-fired units will need scrubbers	11,009 of the 11,532 gas 1-fired units need CATOX	11,508 of the 11,532 gas 1-fired units need CI (cost of required PM control device included in PM column as necessary)
Comments/ Assumptions	<ul style="list-style-type: none"> • If a unit did not already have a FF or ESP and there was information in the EPA database that indicated the unit cannot meet the proposed limit or there was no emissions information, we assumed a new FF. • If the unit already had a FF or ESP and there was information in the EPA database that indicated the unit cannot meet the proposed limit we assumed an upgrade to the existing FF or ESP. • FF base capital cost \$7 MMⁱⁱ; FF/ESP base upgrade capital cost \$4 MM.ⁱⁱⁱ 	<ul style="list-style-type: none"> • If there was information in the EPA database that indicated the unit cannot meet the proposed limit or if there was no emissions information in the EPA database, we assumed either a scrubber upgrade or new scrubber depending on whether the unit currently had a scrubber. • Scrubber base capital cost \$8 million; scrubber base upgrade capital cost \$4 million.ⁱⁱ 	<ul style="list-style-type: none"> • If there was information in the EPA database that indicated the unit cannot meet the proposed limit or if there was no emissions information in the EPA database, then we assumed that capital would be necessary to install a CO catalyst. • A base capital cost of \$2 million was assumed for CO controls (installation of a CO catalyst), and then adjusted by unit size. 	<ul style="list-style-type: none"> • If there was information in the EPA database that indicated the unit cannot meet the proposed limit or if there was no emissions information in the EPA database, we added carbon injection. • A base capital cost of \$1 million was assumed for installation of a carbon adsorption system for Hg and/or dioxin control, and then adjusted by unit size.
Total Capital Cost to Gas 1-Fired Units: \$51 billion	\$19.6 billion	\$23.2 billion	\$5.2 billion	\$2.9 billion
Capital Cost Per Unit	<ul style="list-style-type: none"> • Average Per Unit Cost: \$3.5MM^{iv} 	<ul style="list-style-type: none"> • Average Per Unit Cost: \$4.0MM 	<ul style="list-style-type: none"> • Average Per Unit Cost: \$1MM 	<ul style="list-style-type: none"> • Average Per Unit Cost: \$500k

ⁱ The chart includes data for the 11,532 gas 1-fired units (gas 1 category is gas-fired boilers that burn at least 90% natural gas and/or refinery gas on an annual basis) in EPA's Boiler MACT survey database available here: <http://www.epa.gov/ttn/atw/boiler/boilerpg.html#TECH>. Capital cost estimates are not intended to represent a worst case analysis. Rather, they represent typical retrofit costs for the various scenarios based on published reports, industry information on specific project costs, EPA reports or control device fact sheets, or actual BACT or BART analyses submitted to permitting agencies. A primary resource was the document "Evaluation of Air Pollution Control Costs for the Pulp and Paper Industry," prepared by National Economic Research Associates (NERA) in May 2003.

ⁱⁱ MM stands for million

ⁱⁱⁱ The base cost assumes a size of 250 MMBtu/hr, the boiler specific cost was calculated using a 0.6 power function and the actual boiler size in MMBtu (e.g., for a 100 MMBtu/hr boiler or process heater, the cost is the base cost times $(100/250)^{0.6}$).

^{iv} Average cost was calculated by adding up the per unit cost for every unit requiring controls to get the total cost for all units and then dividing the total cost by the number of units requiring controls.