

CIBO Estimated Capital Costs For Air Pollution Control Equipment For Gas 2-Fired Industrial Boilers and Process Heatersⁱ

Pollutant	Particulate Matter (PM)	Hydrogen Chloride (HCl)	Carbon Monoxide (CO)	Dioxin/Mercury (Hg)
Likely Additional Control Required	Fabric Filter (FF)	Scrubber (e.g., spray dryer or wet scrubber)	Catalytic Oxidation (CATOX)	Carbon Injection (CI)
# of Gas 2-Fired Boilers and Process Heaters	183 of the 193 gas 2-fired units will need a new FF (almost none of these boilers have any HAP APCD controls installed).	193 of the 193 gas 2-fired units will need scrubbers	162 of the 193 gas 2-fired units need CATOX	192 of the 193 gas 2-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 fixed cost of \$2 million was assumed for CO controls (installation of a CO catalyst). 	<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 fixed cost of \$1 million was assumed for installation of a carbon adsorption system for Hg and/or dioxin control, as these systems do not vary much in cost by boiler size.
Total Capital Cost to Gas 2-Fired Units: \$2.75 billion	\$1.0 billion	\$1.2 billion	\$324 million	\$192 million
Capital Cost Per Unit	<ul style="list-style-type: none"> • Range of Costs Per Unit: \$1 to 13.7MM • Average Per Unit Cost: \$5.5MM^{iv} 	<ul style="list-style-type: none"> • Range of Costs Per Unit: \$1.2 to 15.6MM • Average Per Unit Cost: \$6.4MM 	<ul style="list-style-type: none"> • \$1 million per unit 	<ul style="list-style-type: none"> • \$2 million per unit

ⁱ The chart includes data for 193 gas 2-fired units >10 MMBtu/hr (gas 2 category is gas-fired boilers that burn more than 10% of gases other than natural gas/refinery gas). The units are derived from 193 units in the gas 2 MACT subcategory in EPA's Boiler MACT survey database (except where members indicated their unit was not correctly categorized – there were units burning petcoke that EPA categorized as Gas 2 because they thought they were burning coke oven gas, but these boilers belong in the coal subcategory) 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.