

Preliminary Analysis - Refinery Boilers/Heaters

Preliminary Results:

Total units = 23 boilers + 189 heaters = 212 units

Cost-effective units = 103. Not cost-effective units = 109

Total SCRs = 87 (31 upgraded, 56 new)

Total PWVs = 254.5 millions. Total emission reductions = 1.05 tpd.

Average cost effectiveness = 26,520 \$/ton DCF or 44,288 \$/ton LCF
(Cost effectiveness threshold = \$50,000 per ton)

Fac ID	Source Type	Device ID	Device	Process Name	Max Rating for Boilers Heaters (mmbtu/hr)	2005 BARCT (lbs per mmbtu)	2014 BARCT (lbs per mmbtu)	Emission Reductions Beyond 2005 BARCT (tpd)	Emission Reductions Beyond 2005 BARCT (tpy)	PWV for 2 ppmv SCR = 1.1 * PWV of 5 ppmv SCR (\$million)	PWV for 5 ppmv SCR. PWV for other SCR = 0.8* PWV for 5 ppmv SCR. (\$million)	Increment costs (\$million)	Increment CE (\$/ton)	
1	6	Major	925	HEATER	H2 PRODUCTION	931	0.006	0.002	0.03	9.44	49.50	45.00	4.50	19,066
2	5	Major	3530	HEATER	H2 PRODUCTION	653	0.006	0.002	0.02	5.92	49.50	45.00	4.50	30,425
3	1	Major	570	HEATER	H2 PRODUCTION	650	0.006	0.002	0.02	8.66	49.50	45.00	4.50	20,782
4	1	Major	27	HEATER	CRUDE	550	0.006	0.002	0.02	6.79	33.00	30.00	3.00	17,671
5	6	Major	367	HEATER	H2 PRODUCTION	527	0.006	0.002	0.01	4.36	33.00	30.00	3.00	27,495
6	6	Major	913	HEATER	CRUDE	457	0.006	0.002	0.01	5.46	33.00	30.00	3.00	21,995
7	1	Major	1465	HEATER	H2 PRODUCTION	427	0.006	0.002	0.01	4.90	33.00	30.00	3.00	24,476
8	5	Major	641	HEATER	HYDROCRACKING	365	0.006	0.002	0.02	5.84	22.00	20.00	2.00	13,703
9	8	Major	429	BOILER	STEAM GEN/SCR09	352	0.006	0.002	0.01	3.08	22.00	20.00	2.00	25,992
10	8	Major	430	BOILER 11	STEAM GEN	352	0.006	0.002	0.01	2.87	22.00	20.00	2.00	27,891
11	8	Major	59	HEATER	CRUDE	350	0.006	0.002	0.01	4.89	22.00	20.00	2.00	16,363
12	7	Major	220	HEATER	H2 PRODUCTION	350	0.006	0.002	0.01	3.63	22.00	20.00	2.00	22,064
13	5	Major	2216	BOILER	STEAM GEN	342	0.006	0.002	0.01	3.59	22.00	20.00	2.00	22,257
14	6	Major	1236	BOILER	STEAM GEN	340	0.006	0.002	0.01	3.34	22.00	20.00	2.00	23,944
15	8	Major	210	HEATER	H2 PRODUCTION	340	0.006	0.002	0.01	3.14	22.00	20.00	2.00	25,457
16	6	Major	1239	BOILER	STEAM GEN	340	0.006	0.002	0.01	2.94	22.00	20.00	2.00	27,239
17	5	Major	82	HEATER	CRUDE	315	0.006	0.002	0.01	4.44	22.00	20.00	2.00	18,018
18	5	Major	83	HEATER	CRUDE	315	0.006	0.002	0.01	4.02	22.00	20.00	2.00	19,885
19	1	Major	535	HEATER	CAT REFORM	310	0.006	0.002	0.01	2.92	22.00	20.00	2.00	27,440
20	6	Major	803	BOILER	STEAM GEN	309	0.006	0.002	0.01	1.93	22.00	20.00	2.00	41,496
21	7	Major	686	BOILER 7	STEAM GEN	304	0.006	0.002	0.01	2.54	22.00	20.00	2.00	31,442
22	1	Major	63	HEATER	CRUDE	300	0.006	0.002	0.01	3.32	22.00	20.00	2.00	24,097
23	6	Major	805	BOILER	STEAM GEN	291	0.006	0.002	0.01	1.90	22.00	20.00	2.00	42,085
24	1	Major	532	HEATER	CAT REFORM	255	0.006	0.002	0.01	2.34	22.00	20.00	2.00	34,138

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25	7	Major	688	BOILER 6	STEAM GEN	250	0.006	0.002	0.01	1.89	22.00	20.00	2.00	42,403
26	9	Major	1550	BOILER/new	STEAM GEN	245	0.006	0.002	0.01	3.02	22.00	20.00	2.00	26,507
27	5	Major	643	HEATER	HYDROCRACKING	220	0.006	0.002	0.01	2.55	22.00	20.00	2.00	31,409
28	5	Major	84	HEATER	CRUDE	219	0.006	0.002	0.01	3.34	22.00	20.00	2.00	23,986
29	5	Major	20	HEATER	CRUDE	217	0.006	0.002	0.01	2.54	22.00	20.00	2.00	31,482
30	9	Major	430	HEATER	HYDROTREATING	200	0.006	0.002	0.01	3.17	11.00	10.00	1.00	12,602
31	5	Major	3031	HEATER	CAT REFORM	199	0.006	0.002	0.01	2.20	0.00	0.00	0.00	0
32	4	Major	9	HEATER	CRUDE	199	0.006	0.002	0.01	2.83	11.00	10.00	1.00	14,133
33	4	Major	724	BOILER	STEAM GEN	184	0.006	0.002	0.00	0.91	11.00	10.00	1.00	43,799
34	7	Major	687	BOILER 8	STEAM GEN	179	0.006	0.002	0.00	1.57	11.00	10.00	1.00	25,410
35	5	Major	471	HEATER	CAT REFORM	177	0.006	0.002	0.00	1.62	0.00	0.00	0.00	0
36	5	Major	161	HEATER	COKING	176	0.006	0.002	0.01	2.16	11.00	10.00	1.00	18,504
37	5	Major	159	HEATER	COKING	176	0.006	0.002	0.01	2.16	11.00	10.00	1.00	18,504
38	5	Major	160	HEATER	COKING	176	0.006	0.002	0.01	1.97	11.00	10.00	1.00	20,355
39	8	Major	104	HEATER	COKING	175	0.006	0.002	0.00	1.77	11.00	10.00	1.00	22,645
40	8	Major	105	HEATER	COKING	175	0.006	0.002	0.00	1.67	11.00	10.00	1.00	24,004
41	1	Major	629	HEATER	HYDROCRACKING	173	0.006	0.002	0.01	1.94	11.00	10.00	1.00	20,629
42	6	Major	914	HEATER	CRUDE	161	0.006	0.002	0.01	2.26	11.00	10.00	1.00	17,704
43	9	Major	3	HEATER	CRUDE	159	0.006	0.002	0.00	1.58	11.00	10.00	1.00	25,339
44	8	Major	78	HEATER	CRUDE	154	0.006	0.002	0.01	1.87	11.00	10.00	1.00	21,401
45	8	Major	79	HEATER	CRUDE	154	0.006	0.002	0.00	1.73	11.00	10.00	1.00	23,180
46	1	Major	29	HEATER	CRUDE	150	0.006	0.002	0.00	1.50	11.00	10.00	1.00	26,662
47	4	Major	388	HEATER	HYDROCRACKING	147	0.006	0.002	0.01	1.92	11.00	10.00	1.00	20,879
48	9	Major	12	HEATER	COKING	144	0.006	0.002	0.00	0.92	11.00	10.00	1.00	43,366

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49	4	Major	1122	BOILER	H2 PRODUCTION	140	0.006	0.002	0.00	1.53	11.00	10.00	1.00	26,106
50	9	Major	6	HEATER	CRUDE	136	0.006	0.002	0.01	1.84	11.00	10.00	1.00	21,766
51	7	Major	264	HEATER	HYDROCRACKING	135	0.006	0.002	0.00	1.13	11.00	10.00	1.00	35,517
52	1	Major	155	HEATER	COKING	130	0.006	0.002	0.00	1.20	11.00	10.00	1.00	33,211
53	1	Major	31	HEATER	CRUDE	130	0.006	0.002	0.00	1.14	11.00	10.00	1.00	35,015
54	1	Major	153	HEATER	COKING	130	0.006	0.002	0.00	1.09	11.00	10.00	1.00	36,700
55	1	Major	151	HEATER	COKING	130	0.006	0.002	0.00	1.07	11.00	10.00	1.00	37,286
56	6	Major	930	HEATER	HYDROCRACKING	129	0.006	0.002	0.00	1.11	11.00	10.00	1.00	36,151
57	9	Major	378	BOILER	STEAM GEN	128	0.006	0.002	0.01	1.93	11.00	10.00	1.00	20,725
58	4	Major	90	HEATER	FCCU	127	0.006	0.002	0.00	0.91	11.00	10.00	1.00	44,113
59	6	Major	120	HEATER	COKING	126	0.006	0.002	0.00	1.03	11.00	10.00	1.00	38,824
60	5	Major	472	HEATER	CAT REFORM	125	0.006	0.002	0.00	1.38	0.00	0.00	0.00	0
61	1	Major	67	HEATER	CRUDE	120	0.006	0.002	0.01	1.97	11.00	10.00	1.00	20,294
62	3	Major	77	BOILER	STEAM GEN	112	0.006	0.002	0.00	0.91	11.00	10.00	1.00	44,197
63	3	Major	76	BOILER	STEAM GEN	112	0.006	0.002	0.00	0.91	11.00	10.00	1.00	44,197
64	9	Major	768	HEATER	HYDROTREATING	110	0.03	0.002	0.04	13.97	11.00	8.00	3.00	8,589
65	7	Major	154	HEATER	CAT REFORM	110	0.03	0.002	0.03	10.57	11.00			41,628
66	5	Major	451	HEATER	HYDROTREATING	102	0.03	0.002	0.03	10.91	11.00			40,338
67	1	Major	33	HEATER	CRUDE	100	0.03	0.002	0.02	8.76	5.50			25,116
68	7	Major	155	HEATER	CAT REFORM	100	0.03	0.002	0.01	4.65	5.50			47,328
69	9	Major	22	HEATER	COKING	95	0.03	0.002	0.02	7.48	5.50			29,430
70	4	Major	89	HEATER	FCCU	95	0.03	0.002	0.08	28.51	5.50			7,718
71	6	Major	269	HEATER	HYDROTREATING	94	0.03	0.002	0.01	4.98	5.50			44,210

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72	6	Major	918	HEATER	COKING	91	0.03	0.002	0.02	6.39	5.50		34,411
73	6	Major	917	HEATER	COKING	91	0.03	0.002	0.02	5.78	5.50		38,067
74	1	Major	250	HEATER	FCCU	89	0.03	0.002	0.02	6.82	5.50		32,240
75	5	Major	473	HEATER	CAT REFORM	88	0.03	0.002	0.02	6.51	0.00	0.00	0
76	10	Major	30	HEATER	CRUDE	85	0.03	0.002	0.01	2.47	5.50	5.00	8,113
77	5	Major	3695	HEATER	CRUDE	83	0.03	0.002	0.03	10.24	5.50	5.00	1,953
78	4	Major	247	HEATER	CAT REFORM	82	0.03	0.002	0.01	2.62	5.50	4.00	22,921
79	5	Major	3778	HEATER	HYDROTREATING	78	0.03	0.002	0.01	3.58	5.50	5.00	5,590
80	7	Major	146	HEATER	HYDROTREATING	76	0.03	0.002	0.01	5.10	5.50		43,097
81	6	Major	85	HEATER	COKING	74	0.03	0.002	0.01	4.86	5.50		45,265
82	6	Major	931	HEATER	HYDROCRACKING	73	0.03	0.002	0.01	4.03	5.50	5.00	4,963
83	4	Major	387	HEATER	HYDROCRACKING	71	0.03	0.002	0.01	4.30	5.50	4.00	13,962
84	8	Major	174	HEATER	HYDROTREATING	70	0.03	0.002	0.02	6.21	5.50		35,422
85	4	Major	146	HEATER	HYDROTREATING	69	0.03	0.002	0.02	5.75	5.50		38,244
86	9	Major	53	HEATER	HYDROTREATING	68	0.03	0.002	0.02	6.76	5.50		32,565
87	6	Major	84	HEATER	COKING	67	0.03	0.002	0.01	4.91	5.50		44,780
88	6	Major	83	HEATER	COKING	67	0.03	0.002	0.01	4.88	5.50		45,124
89	4	Major	770	HEATER	HYDROTREATING	63	0.03	0.002	0.02	6.84	5.50	4.00	8,770
90	5	Major	625	HEATER	HYDROCRACKING	63	0.03	0.002	0.01	4.62	5.50		47,614
91	7	Major	194	HEATER	HYDROTREATING	60	0.03	0.002	0.02	5.51	5.50		39,909
92	6	Major	235	HEATER	HYDROTREATING	60	0.03	0.002	0.01	3.07	5.50	4.00	19,542
93	6	Major	231	HEATER	HYDROTREATING	60	0.03	0.002	0.01	2.96	5.50	4.00	20,301
94	6	Major	232	HEATER	HYDROTREATING	60	0.03	0.002	0.01	2.20	5.50	4.00	27,245

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95	6	Major	234	HEATER	HYDROTREATING	60	0.03	0.002	0.00	1.72	5.50	4.00	1.50	34,903
96	4	Major	218	HEATER	CAT REFORM	60	0.03	0.002	0.01	5.45	5.50			40,392
97	5	Major	617	HEATER	HYDROCRACKING	57	0.03	0.002	0.01	5.39	5.50			40,839
98	5	Major	619	HEATER	HYDROCRACKING	57	0.03	0.002	0.01	4.79	5.50			45,968
99	4	Major	214	HEATER	CAT REFORM	56	0.03	0.002	0.01	4.20	5.50	4.00	1.50	14,294
100	4	Major	248	HEATER	CAT REFORM	50	0.03	0.002	0.01	2.92	5.50	4.00	1.50	20,529
101	4	Major	384	HEATER	HYDROCRACKING	48	0.03	0.002	0.01	2.79	5.50	4.00	1.50	21,485
102	4	Major	386	HEATER	HYDROCRACKING	48	0.03	0.002	0.01	2.08	5.50	4.00	1.50	28,799
103	7	Major	1720	HEATER	HYDROTREATING	41	0.03	0.002	0.01	2.18	5.50	5.00	0.50	9,174
Sum					>110			0.47				100.50	23,580	
					40-110			0.58		132.00		22.00	28,868	