

NO_x RECLAIM NON-REFINERY PRELIMINARY COST EFFECTIVENESS

All cases assume installation of SCR, unless otherwise specified

CEMENT KILNS

| | | | |
|--|-----------------|-----------------|-----------------|
| Vendor 1: SCR system installed between waste heat boiler and baghouse. NO _x removal only. | | | |
| Vendor 2: Dry scrubbing and ceramic filter system installed after the waste heat boiler and replacing the baghouse. NO _x , SO _x , and PM removal. | | | |
| Vendor 3: Wet gas scrubber and SCR system with heat exchanger installed after the waste heat boiler and replacing the baghouse. NO _x , SO _x , and PM removal. | | | |
| | Vendor 1 | Vendor 2 | Vendor 3 |
| Capital Costs (\$) | 14,950,000 | 30,000,000 | 31,938,838 |
| Annual Costs (\$) | 1,220,500 | 1,000,000 | 4,818,537 |
| Present Worth Value (\$) | 34,016,651 | 45,622,000 | 107,214,017 |
| Emission reductions (tpd) | 1.287 | 1.287 | 1.287 |
| DCF Cost Effectiveness (\$/ton) | 2,897 | 3,885 | 9,130 |
| LCF Cost Effectiveness (\$/ton) | 4,635 | 6,216 | 14,609 |

SODIUM SILICATE FURNACE

| Control Technology | TIC (\$) | AC (\$) | PWV (\$) | ER (tpd) | DCF C.E. (\$/ton) | LCF C.E. (\$/ton) |
|---------------------------|-----------------|----------------|-----------------|-----------------|--------------------------|--------------------------|
| SCR | 1,600,000 | 76,315 | 2,792,193 | 0.09 | 3,470 | 5,600 |
| Ultra Cat | 1,986,161 | 166,016 | 4,579,663 | 0.09 | 5,691 | 9,100 |

FURNACES ABOVE 150 MMBTU/HR

| Control Technology | TIC (\$) | AC (\$) | PWV (\$) | ER (tpd) | DCF C.E. (\$/ton) | LCF C.E. (\$/ton) |
|---------------------------------|-----------------|----------------|-----------------|-----------------|--------------------------|--------------------------|
| Vendor-based | 2,800,152 | 440,631 | 9,683,684 | 0.28 | 3,800 | 4,800 |
| Existing equipment-based | 3,732,800 | 255,600 | 7,725,783 | 0.28 | 3,000 | 6,100 |

CONTAINER GLASS MELTING FURNACES

| | | | | | |
|--|-----------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <i>Vendor 1:</i> Dry scrubbing and ceramic filter system installed after the furnaces, replacing the dry scrubber and ESP. NO _x , SO _x , and PM removal. | | | | | |
| <i>Vendor 2:</i> SCR system installed post ESP. NO _x removal only. Option 1: single chamber. Option 2: three chambers. | | | | | |
| <i>Vendor 3:</i> SCR system installed post ESP using costs provided by facility per EPA cost manual. NO _x removal only. Option 1: two chambers. Option 2: three chambers. | | | | | |
| | Vendor 1 | Vendor 2 Option 1 | Vendor 2 Option 2 | Vendor 3 Option 1 | Vendor 3 Option 2 |
| Capital Costs (\$) | 5,134,891 | 2,070,000 | 5,000,000 | 4,096,959 | 6,145,439 |
| Annual Costs (\$) | 567,686 | 132,500 | 180,750 | 560,123 | 840,185 |
| Present Worth Value (\$) | 14,003,287 | 4,139,195 | 7,823,677 | 12,847,207 | 19,270,811 |
| Emission reductions (tpd) | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |
| DCF Cost Effectiveness (\$/ton) | 6,442 | 1,904 | 3,599 | 5,910 | 8,865 |
| LCF Cost Effectiveness (\$/ton) | 10,308 | 3,047 | 5,759 | 9,457 | 14,186 |

INTERNAL COMBUSTION ENGINES (LEAN-BURN, NON-OCS)

| Unit | TIC (\$) | AC (\$) | PWV (\$) | ER (tpd) | DCF C.E. (\$/ton) | LCF C.E. (\$/ton) |
|-------------|-----------------|----------------|-----------------|-----------------|--------------------------|--------------------------|
| 1 | 890,182 | 36,625 | 1,462,338 | 0.036 | 4,500 | 7,200 |
| 2 | 890,182 | 36,625 | 1,462,338 | 0.033 | 4,900 | 7,800 |
| 3 | 890,182 | 36,625 | 1,462,338 | 0.033 | 4,800 | 7,800 |
| 4 | 890,182 | 36,625 | 1,462,338 | 0.034 | 4,700 | 7,500 |
| 5 | 890,182 | 36,625 | 1,462,338 | 0.035 | 4,600 | 7,300 |
| 6 | 1,386,291 | 82,640 | 2,677,289 | 0.043 | 6,900 | 11,000 |
| 7 | 485,628 | 25,696 | 887,048 | 0.019 | 5,000 | 8,000 |
| 8 | 485,628 | 25,696 | 887,048 | 0.019 | 5,000 | 8,000 |
| 9 | 1,307,772 | 77,475 | 2,518,084 | 0.038 | 7,300 | 11,700 |
| 10 | 485,628 | 25,696 | 887,048 | 0.019 | 5,100 | 8,200 |
| 11 | 1,307,772 | 77,475 | 2,518,084 | 0.037 | 7,500 | 12,000 |
| 12 | 2,319,249 | 100,719 | 3,892,680 | 0.084 | 5,000 | 8,100 |
| 13 | 2,319,249 | 100,719 | 3,892,680 | 0.084 | 5,000 | 8,100 |
| 14 | 2,319,249 | 100,719 | 3,892,680 | 0.085 | 5,000 | 8,000 |
| 15 | 2,319,249 | 100,719 | 3,892,680 | 0.083 | 5,200 | 8,300 |
| 16 | 2,319,249 | 100,719 | 3,892,680 | 0.084 | 5,000 | 8,100 |

BOILERS (ABOVE 40 MMBTU/HR)

| Unit | 1 | 2 | 3 |
|--|-----------|-----------|-----------|
| PWV (Based on Similar Sized Furnaces) | 3,000,000 | 3,000,000 | 3,000,000 |
| ER (tpd) | 0.001 | 0.002 | 0.0002 |
| Incremental C.E. (\$/ton) | 237,389 | 200,669 | 1,680,934 |

GAS TURBINES (NON-POWER PLANT)

| Unit | TIC (\$) | AC (\$) | PWV (\$) | ER (tpd) | DCF C.E. (\$/ton) | LCF C.E. (\$/ton) |
|-------------|-----------------|----------------|-----------------|-----------------|------------------------------|------------------------------|
| 1 | 2,786,139 | 707,847 | 13,844,125 | 0.081 | 18,716 | 30,000 |
| 2 | 2,858,592 | 687,666 | 13,601,308 | 0.085 | 17,537 | 28,100 |
| 3 | 2,780,064 | 727,308 | 14,142,076 | 0.084 | 18,518 | 29,600 |
| 4 | 2,583,085 | 297,613 | 7,232,403 | 0.015 | 52,748 | 84,400 |
| 5 | 2,604,485 | 352,643 | 8,113,472 | 0.015 | 59,174 | 94,700 |
| 6 | 2,608,400 | 329,730 | 7,759,450 | 0.015 | 56,592 | 90,600 |
| 7 | 2,252,960 | 68,133 | 3,317,340 | 0.007 | 51,422 | 82,300 |
| 8 | 2,259,305 | 75,832 | 3,443,960 | 0.007 | 53,384 | 85,400 |
| 9 | 2,269,455 | 68,955 | 3,346,666 | 0.007 | 51,876 | 83,000 |
| 10 | 1,517,898 | 68,321 | 2,585,211 | 0.009 | 33,250 | 53,200 |
| 11 | 1,519,272 | 65,261 | 2,538,781 | 0.008 | 35,916 | 57,500 |
| 12 | 1,531,680 | 69,149 | 2,611,931 | 0.009 | 33,594 | 53,800 |
| 13 | 1,516,755 | 63,256 | 2,509,164 | 0.008 | 35,497 | 56,800 |
| 14 | 2,320,584 | 437,781 | 9,159,602 | 0.156 | 6,478 | 10,300 |
| 15 | 1,443,846 | 80,740 | 2,705,163 | 0.025 | 11,658 | 18,700 |
| 16 | 1,442,694 | 92,373 | 2,885,744 | 0.016 | 19,823 | 31,700 |
| 17 | 2,765,694 | 555,222 | 11,439,367 | 0.269 | 4,666 | 7,500 |
| 18 | 2,438,727 | 389,347 | 8,521,114 | 0.128 | 7,310 | 11,700 |
| 19 | 2,432,730 | 397,575 | 8,643,648 | 0.135 | 7,019 | 11,200 |