

Air Pollution Control Equipment Table of Contents

| | |
|--|------------|
| 1. TOTAL AIR QUALITY MARKET OVERVIEW | 12 |
| 1.1. Air Pollution Control Equipment | 13 |
| 1.2. Consulting & Engineering..... | 16 |
| 1.2.1. Historical Development of Air Quality Consulting & Engineering Markets..... | 18 |
| 1.2.2. Trends in Air C&E Markets and Market Drivers..... | 20 |
| 1.2.3. 2003 Compliance Drivers for C&E Firms | 22 |
| 1.3. Environmental Instrumentation | 23 |
| 1.4. Mobile Sources..... | 27 |
| 1.4.1. Historical Development of Mobile APC Markets: California Leads the Way..... | 27 |
| 1.4.2. Mobile Update: Diesel Rules Lead New Regulatory Drivers for Mobile Emission Controls ... | 29 |
| 1.5. Indoor Air Quality | 34 |
| 1.5.1. 2005 Update: Growth Continues in Indoor Air Quality, but “Toxic” Mold Segment Stumbles | 35 |
| 1.5.2. 2002 Update: Mounting Toxic Mold Concern Puts Engine in Indoor Air Quality Market..... | 38 |
| 1.6. Emissions Credit Trading..... | 42 |
| 2. MARKETS FOR STATIONARY SOURCE APC EQUIPMENT | 48 |
| 2.1. Historical Development of Stationary Source APC Markets | 48 |
| 2.2. Historical Context for APC Markets in the 90s..... | 49 |
| 2.3. Market Trend Analysis in 2007..... | 52 |
| 2.4. Market Trend Analysis in 2005: Air Market Rides on Power Industry’s Thirst for Coal; Lags on New Regulations | 58 |
| 2.5. Market Trend Analysis in 2002: Air Pollution Control Market Zeroes In on Electric Utilities | 65 |
| 2.6. APC Equipment Market by Equipment Type..... | 72 |
| 2.7. APC Equipment Market by Pollutant..... | 76 |
| 2.8. APC Equipment Market by Customer Type..... | 80 |
| 2.8.1. 2007 Utility Review | 84 |
| 2.8.2. 2003 Utility Review | 91 |
| 2.9. Geographic Distribution of APC Equipment Markets..... | 95 |
| 2.10. APC Equipment Market Industry Structure | 97 |
| 2.11. Top APC Equipment Companies | 99 |
| 2.12. Top APC Equipment Companies by Equipment Type..... | 102 |
| 2.12.1. Top APC Equipment Companies by Equipment Type 2004 | 102 |
| 2.12.2. Top APC Equipment Companies by Equipment Type 1997 | 104 |
| 2.13. Top APC Equipment Companies by Pollutant Type | 107 |
| 2.13.1. Top APC Equipment Companies by Pollutant Type 2004..... | 107 |
| 2.13.2. Top APC Equipment Companies by Pollutant Type 1997..... | 109 |
| 3. APC REGULATIONS AND GROWTH AREAS | 111 |
| 3.1. Historical Context of The Clean Air Act..... | 111 |
| 3.2. Major Long-Term CAAA Business Opportunities | 114 |
| 3.2.1. Title I Non-Attainment..... | 116 |
| 3.2.2. Title II Mobile Sources | 116 |
| 3.2.3. Title III Air Toxics | 116 |
| 3.2.4. Title IV Acid Rain..... | 117 |
| 3.2.5. Title VI Stratospheric Ozone | 117 |
| 3.2.6. Title V Operating Permits..... | 117 |
| 3.3. Review of Air Quality Policy & Market Drivers..... | 118 |
| 3.4. Air Quality Policy Update | 126 |
| 3.4.1. Invalidation Of Epa’s Mercury Rule Brings Uncertainty To Control Market..... | 126 |
| 3.4.2. 2005: With “Clear Skies” Stalled, White House Pushes Interstate and Mercury Rules..... | 132 |
| 3.4.3. Bush’s Enforcement Record | 140 |
| 3.4.4. Pollution Taxes..... | 149 |

| | |
|--|------------|
| 4. APC SERVICES AND TECHNOLOGIES..... | 154 |
| 4.1. Multi-Pollutant Control Approach..... | 154 |
| 4.2. NOx Prevention and Control..... | 156 |
| 4.2.1. Background..... | 156 |
| 4.2.2. Material Problems..... | 156 |
| 4.2.3. Low NOx Burner..... | 157 |
| 4.2.4. NOx Removal..... | 157 |
| 4.2.5. Carbon Fibers..... | 159 |
| 4.2.6. Summary of NOx Control..... | 159 |
| 4.3. VOC Control Market..... | 160 |
| 4.3.1. Market Background..... | 160 |
| 4.3.2. VOC Emissions Volumes..... | 161 |
| 4.3.3. VOC Emissions by Geographical Region..... | 162 |
| 4.3.4. VOC Abatement Technologies..... | 163 |
| 4.4. Mercury Technology..... | 165 |
| 4.5. Post-Combustion CO ₂ Capture..... | 167 |
| 5. FORECAST OF FUTURE TRENDS AND GROWTH SCENARIOS FOR THE AIR QUALITY INDUSTRY..... | 170 |
| 6. PROFILES OF LEADING APC EQUIPMENT COMPANIES..... | 174 |
| 6.1. CECO (2008)..... | 174 |
| 6.2. Anguil Environmental Systems (2008)..... | 177 |
| 6.3. Peerless Mfg. Co..... | 180 |
| 6.4. GE Energy (2005)..... | 183 |
| 6.5. Rentar (2005)..... | 186 |
| 6.6. Anguil Environmental (2005)..... | 189 |
| 6.7. John Zink (2005)..... | 192 |
| 6.8. Horiba Group (2005)..... | 195 |
| 6.9. Alstom Power and Environmental Control Systems (2002)..... | 197 |
| 6.10. Anguil Environmental Systems, Inc. (2002)..... | 200 |
| 6.11. Fuel Tech Inc. (2002)..... | 203 |
| 6.12. Hamon Research-Cottrell, Inc. (2002)..... | 206 |
| 6.13. Environmental Elements Corp. (2002)..... | 208 |
| 6.14. Croll-Reynolds Clean Air Technologies (2002)..... | 211 |
| 6.15. KleenAir Systems Inc. (2002)..... | 214 |
| 6.16. Thermatrix, Inc. (2002)..... | 217 |
| 6.17. GE Power Systems (2002)..... | 219 |
| 6.18. ABB Environmental Systems (1998)..... | 222 |
| 6.19. Babcock & Wilcox Power Generation Group (1998)..... | 224 |
| 6.20. Wheelabrator Air Pollution Control, Inc. (1998)..... | 228 |
| 6.21. Belco Technologies Corp. (1998)..... | 231 |
| 6.22. Durr Environmental Inc. (1998)..... | 232 |
| 6.23. Johnson Matthey (1998)..... | 236 |
| 7. PROFILES OF LEADING APC CONSULTING & ENGINEERING FIRMS..... | 240 |
| 7.1. Burns & McDonnell Engineering (2008)..... | 240 |
| 7.2. Barr Engineering (2008)..... | 243 |
| 7.3. Black & Veatch (2008)..... | 246 |
| 7.4. Trinity Consultants Inc. (2008)..... | 249 |
| 7.5. Black & Veatch (2005)..... | 253 |
| 7.6. Environ Corp. (2005)..... | 256 |
| 7.7. Earth Tech (2005)..... | 259 |
| 7.8. Trinity Consultants (2005)..... | 262 |
| 7.9. ETS Inc. (2005)..... | 264 |
| 7.10. Minnich and Scotto Inc. (2005)..... | 267 |
| 7.11. 2001 Air Consulting Review with TRC, ERM, ENSR and Trinity (2002)..... | 269 |
| 7.12. Radian International (now URS; 1998)..... | 274 |

| | |
|---|------------|
| 7.13. ENSR Consulting & Engineering (1998)..... | 277 |
| 7.14. TRC Environmental (1998)..... | 281 |
| 7.15. Trinity Consultants, Inc. (1998)..... | 284 |
| 8. ASIA REVIEW | 287 |
| 8.1. Market Overview..... | 287 |
| 8.2. Japan, Australia/New Zealand..... | 290 |
| 8.3. South Korea and Taiwan | 291 |
| 8.4. Long-Term Markets..... | 292 |

Air Pollution Control Equipment List of Exhibits

| | | |
|--------------|--|----|
| Exhibit 1-1 | Air Quality Business Segments | 13 |
| Exhibit 1-2 | Mobile Source vs. Stationary Source, 2001 - 2007 | 14 |
| Exhibit 1-3 | Historical and Projected Growth in the U.S. APC Segment: Stationary Source Equipment and Mobile..... | 15 |
| Exhibit 1-4 | Components of the Air Consulting Market..... | 16 |
| Exhibit 1-5 | Top 30 Environmental Consulting & Engineering Firms in Air Quality Consulting, 2001 | 17 |
| Exhibit 1-6 | Top 30 Environmental Consulting & Engineering Firms in Air Quality Consulting, 2003 | 18 |
| Exhibit 1-7 | Historical and Projected Growth in the U.S. Air Quality Consulting & Engineering Services Segment (in \$million)..... | 19 |
| Exhibit 1-8 | Percent of Air Quality Revenues in the US C&E Market, 1970 to 2003 | 20 |
| Exhibit 1-9 | Top Environmental Instrument Companies in 2005..... | 24 |
| Exhibit 1-10 | Historical and Projected Growth in the U.S. Air Quality Instruments Segment..... | 24 |
| Exhibit 1-11 | Primary Monitoring Strategies Expected Under CAM..... | 25 |
| Exhibit 1-12 | Top Mobile Source Emission Control Systems Manufacturers in the U.S..... | 27 |
| Exhibit 1-13 | Historical and Projected Growth in the California Mobile Source APC Equipment Segment, 1970 - 2010 | 29 |
| Exhibit 1-14 | Historical and Projected Growth in the U.S. Mobile Source APC Equipment Segment, 1970 - 2010 | 29 |
| Exhibit 1-15 | Watched Markets, March 18 2005..... | 43 |
| Exhibit 1-16 | EU Markets, March 21 2005..... | 44 |
| Exhibit 2-1 | Historical and Projected Growth in the U.S. Stationary Source APC Equipment Segment, 1970 - 2010 | 49 |
| Exhibit 2-2 | Electrostatic Precipitator Market Leaders, 2005..... | 61 |
| Exhibit 2-3 | APC Equipment Purchases in China, 2005..... | 63 |
| Exhibit 2-4 | APC Equipment Market by Equipment Type, 1994..... | 73 |
| Exhibit 2-5 | APC Equipment Market by Equipment Type, 1997..... | 73 |
| Exhibit 2-6 | APC Equipment Market by Equipment Type, 2001 | 74 |
| Exhibit 2-7 | APC Equipment Market by Equipment Type, 2004..... | 75 |
| Exhibit 2-8 | APC Equipment Market by Equipment Type, 1998 - 2007..... | 76 |
| Exhibit 2-9 | APC Equipment Market by Pollutant, 1994 | 77 |
| Exhibit 2-10 | APC Equipment Market by Pollutant, 1997 | 77 |
| Exhibit 2-11 | APC Equipment Market by Pollutant, 2001 | 78 |
| Exhibit 2-12 | APC Equipment Market by Pollutant, 2004 | 78 |
| Exhibit 2-12 | APC Equipment Market by Pollutant, 2007 | 79 |
| Exhibit 2-13 | APC Equipment Market by Pollutant, 1998 - 2007..... | 79 |
| Exhibit 2-15 | Share of APC Equipment Market by Power Utilities, 1990 - 2004..... | 80 |
| Exhibit 2-16 | APC Equipment Market by Customer Type, 1994..... | 81 |
| Exhibit 2-17 | APC Equipment Market by Customer Type, 1997..... | 81 |
| Exhibit 2-18 | APC Equipment Market by Customer Type, 2001 | 82 |
| Exhibit 2-19 | APC Equipment Market by Customer Type, 2004..... | 82 |
| Exhibit 2-19 | APC Equipment Market by Customer Type, 2007..... | 83 |
| Exhibit 2-20 | APC Equipment Market by Customer Type, 2000-2007..... | 84 |
| Exhibit 2-21 | Emissions Control Projects at U.S. Coal-Fired Power Plants..... | 93 |
| Exhibit 2-22 | APC Equipment Market by State..... | 96 |
| Exhibit 2-23 | APC Equipment Markets by State | 97 |
| Exhibit 2-24 | U.S. Stationary Source APC Equipment Industry, 2003 | 98 |
| Exhibit 2-25 | U.S. Stationary Source APC Equipment Industry, 2001 | 98 |
| Exhibit 2-26 | APC Equipment Market Industry Structure, 1997..... | 98 |

| | | |
|--------------|---|-----|
| Exhibit 2-27 | The Top APC Equipment Companies in the U.S. Market, 2004 | 99 |
| Exhibit 2-28 | The Top APC Equipment Companies in the U.S. Market, 2001 | 100 |
| Exhibit 2-29 | The Top APC Equipment Companies in the U.S. Market, 1997 | 101 |
| Exhibit 2-30 | The Top APC Equipment Companies - Flue Gas Desulphurization, 2004..... | 102 |
| Exhibit 2-31 | The Top APC Equipment Companies - Electrostatic Precipitators, 2004..... | 103 |
| Exhibit 2-32 | The Top APC Equipment Companies - Fabric Filters & Baghouse Equipment, 2004..... | 103 |
| Exhibit 2-33 | The Top APC Equipment Companies - Oxidation Systems, 2004 | 103 |
| Exhibit 2-34 | The Top APC Equipment Companies - NOx Control, 2004..... | 104 |
| Exhibit 2-35 | The Top APC Equipment Companies - Flue Gas Desulphurization, 1997..... | 104 |
| Exhibit 2-36 | The Top APC Equipment Companies - Electrostatic Precipitators, 1997..... | 105 |
| Exhibit 2-37 | The Top APC Equipment Companies - Fabric Filters & Baghouse Equipment, 1997..... | 105 |
| Exhibit 2-38 | The Top APC Equipment Companies - Oxidation Systems, 1997 | 106 |
| Exhibit 2-39 | The Top APC Equipment Companies - NOx Control, 1997..... | 106 |
| Exhibit 2-40 | The Top APC Equipment Companies - Carbon Absorption, 1997..... | 106 |
| Exhibit 2-41 | The Top APC Equipment Companies - Particulates, 2004 | 107 |
| Exhibit 2-42 | The Top APC Equipment Companies - Sulfur Oxides, 2004 | 107 |
| Exhibit 2-43 | The Top APC Equipment Companies - VOCs, 2004..... | 108 |
| Exhibit 2-44 | The Top APC Equipment Companies - HAPs, 2004 | 108 |
| Exhibit 2-45 | The Top APC Equipment Companies - NOx & CO, 2004 | 108 |
| Exhibit 2-46 | The Top APC Equipment Companies - Particulates, 1997 | 109 |
| Exhibit 2-47 | The Top APC Equipment Companies - Sulfur Oxides, 1997 | 109 |
| Exhibit 2-48 | The Top APC Equipment Companies - VOCs, 1997..... | 110 |
| Exhibit 2-49 | The Top APC Equipment Companies - HAPs, 1997..... | 110 |
| Exhibit 2-50 | The Top APC Equipment Companies - NOx & CO, 1997 | 110 |
| Exhibit 3-1 | Summary of Clean Air Act Amendment Sections | 112 |
| Exhibit 3-2 | Summary of CAAA Business Opportunities | 115 |
| Exhibit 3-3 | Key Multipollutant Proposals | 124 |
| Exhibit 3-4 | 2003-2005 Air-Related Enforcement Accomplishments | 144 |
| Exhibit 4-1 | U.S. NOx Control Market Equipment Sales, 2002 | 157 |
| Exhibit 4-2 | Suppliers of Combustion Systems | 157 |
| Exhibit 4-3 | Selected Processes and Companies in SOx and NOx Control | 159 |
| Exhibit 4-4 | Emissions of Nonmethane VOCs from Industrial Processes | 162 |
| Exhibit 4-5 | Regional Emission Estimates of Nonmethane VOCs (million metric tons) | 163 |
| Exhibit 4-6 | Summary of VOC Abatement Technologies..... | 164 |
| Exhibit 5-1 | Projected Growth in the California ‘Core APC’ and the Clean Air Products Segments (\$mil)..... | 172 |
| Exhibit 5-2 | Percentage of the Air Quality Market Represented by the ‘Core APC’ versus the Clean Air Products Segments, 1970-2010..... | 173 |