



## TABLE OF CONTENTS

TOPIC	PAGE NO.
CHAPTER 1 INTRODUCTION	2
STUDY GOALS AND OBJECTIVES	2
REASONS FOR DOING THE STUDY	2
SCOPE OF REPORT	2
INTENDED AUDIENCE	3
INFORMATION SOURCES	3
ANALYST'S CREDENTIALS	4
RELATED BCC RESEARCH REPORTS	4
BCC RESEARCH WEBSITE	4
DISCLAIMER	5
CHAPTER 2 EXECUTIVE SUMMARY	7
<i>SUMMARY TABLE U.S. AND EUROPEAN EMISSION CONTROL MARKET BY PRODUCT SEGMENT, THROUGH 2019 (\$ MILLIONS)</i>	9
<i>SUMMARY FIGURE U.S. AND EUROPEAN EMISSION CONTROL MARKET BY PRODUCT SEGMENT, 2004-2019 (\$ MILLIONS)</i>	9
CHAPTER 3 OVERVIEW	11
EMISSIONS	11
<i>TABLE 1 MAJOR EMISSION POLLUTANTS AND THEIR NEGATIVE EFFECTS</i>	11
<i>TABLE 2 MAIN SOURCES OF HYDROCARBON EMISSIONS (%)</i>	12
<i>TABLE 3 U.S. GREENHOUSE GAS EMISSIONS, 2012 (%)</i>	13
<i>FIGURE 1 U.S. GREENHOUSE GAS EMISSIONS, 2012</i>	13
EMISSION CONTROL	14
INDUSTRY HISTORY	14
<i>TABLE 4 HISTORY OF MAJOR EMISSION CONTROL REGULATORY FACTORS WORLDWIDE</i>	14
<i>TABLE 5 MAJOR EMISSION CONTROL TECHNOLOGIES AND SYSTEMS TIMELINE</i>	15
PRODUCT SEGMENTATION	16
MARKET SEGMENTATION	16
GOVERNMENT REGULATIONS	16
<i>TABLE 6 U.S. AUTOMOBILE EMISSION STANDARDS (G/MILE)</i>	17
<i>TABLE 7 EUROPEAN EMISSION STANDARDS FOR PASSENGER CARS (G/KM)</i>	18
<i>TABLE 8 EUROPEAN EMISSION STANDARDS FOR LIGHT COMMERCIAL VEHICLES 1,305 KG TO 1,760 KG (G/KM)</i>	18
<i>TABLE 9 EUROPEAN EMISSION STANDARDS FOR LIGHT COMMERCIAL VEHICLES &gt; 1,760 KG TO MAX 3,500 KG (G/KM)</i>	19
<i>TABLE 10 EUROPEAN EMISSION STANDARDS FOR HEAVY-DUTY DIESEL ENGINES (G/KWH, SMOKE IN M-1)</i>	19
INDUSTRY TRENDS AND FORECASTS	20
ENVIRONMENTAL ASPECTS	21
GENERAL ECONOMIC INDICATORS AND COMPARISONS	21
<i>TABLE 11 U.S. ECONOMIC GROWTH, ANNUAL PERCENTAGE, 2007-2016 (%)</i>	22
<i>TABLE 12 EUROPE ECONOMIC GROWTH, ANNUAL PERCENTAGE CHANGE, 2007-2015 (GDP GROWTH-INFLATION-ADJUSTED)</i>	23
<i>TABLE 13 LIGHT-DUTY VEHICLE PRODUCTION AND SALES BY REGION, 2013 AND 2014 (MILLIONS/% CHANGE)</i>	24

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 14 HEAVY-DUTY DIESEL TRUCK PRODUCTION AND SALES BY REGION, 2013 AND 2014 (THOUSANDS/% CHANGE)</i>	24
CHAPTER 4 MARKETS BY REGION	26
OVERVIEW OF THE GLOBAL MARKET	26
<i>TABLE 15 GDP BASED ON PURCHASING POWER PARITY VALUATION BY COUNTRY, THROUGH 2019 (\$ BILLIONS)</i>	26
<i>TABLE 16 TOTAL MARKET FOR EMISSION CONTROL PRODUCTS, THROUGH 2019 (\$ MILLIONS)</i>	27
UNITED STATES	27
<i>TABLE 17 KEY INDICATORS FOR EMISSION CONTROL PRODUCTS DEMAND IN U.S., THROUGH 2019</i>	28
U.S. TIER 3 STANDARDS AND IMPACTS	28
<i>FIGURE 2 PROGRESSIVE DEMANDS IN THE U.S.-EMISSION CONTROL PRODUCTS MARKET AND FORECAST, 2004-2019 (\$ MILLIONS)</i>	30
EUROPE	30
<i>TABLE 18 KEY INDICATORS FOR EMISSION CONTROL PRODUCTS DEMAND IN EUROPE, THROUGH 2019</i>	31
COMPARISON OF U.S. AND E.U. EMISSION CONTROL FACTORS	31
Different Diesel Penetration	31
<i>FIGURE 3 COMPARISON OF U.S. AND EU DIESEL CARS MARKET SHARE, 1990-2013 (%)</i>	31
<i>TABLE 19 WESTERN EUROPE: DIESEL SHARE OF NEW CAR REGISTRATIONS BY COUNTRY, 2009-2013 (%)</i>	32
Different Coal-Fired Electricity Generating Capacity	33
<i>FIGURE 4 SOURCES FOR NET ELECTRICITY GENERATION, EU-28, 2012 (%)</i>	33
<i>TABLE 20 COAL-FIRED ELECTRICITY GENERATING CAPACITY BY COUNTRY, 2010 AND 2020 (GW)</i>	34
Comparison of Emission Standards	34
<i>FIGURE 5 COMPARING U.S. AND E.U. CURRENT EMISSION REGULATIONS (G/MI)</i>	35
<i>FIGURE 6 PROGRESSIVE DEMANDS IN EUROPE: EMISSION CONTROL PRODUCTS MARKET AND FORECAST, 2004-2019 (\$ MILLIONS)</i>	36
<i>TABLE 21 TIMELINES OF EURO 5 AND EURO 6 EMISSION REGULATIONS IN EUROPE</i>	37
EUROPEAN MARKETS BY COUNTRY	38
Germany	38
<i>TABLE 22 NEW CAR REGISTRATIONS IN MAJOR EUROPEAN COUNTRIES, 2012 AND 2013 (MILLIONS/% CHANGE)</i>	39
France	39
United Kingdom	40
Italy	41
Spain	41
Rest of Europe	42
<i>TABLE 23 EUROPEAN MARKET FOR EMISSION CONTROL PRODUCTS BY COUNTRY, 2013 (\$ MILLIONS)</i>	42
REST OF THE WORLD	42
CHAPTER 5 MARKETS BY APPLICATION	45
GENERAL OVERVIEW	45
<i>TABLE 24 SOURCES OF GREENHOUSE GAS EMISSIONS IN THE U.S., 2012 (%)</i>	45
<i>FIGURE 7 SOURCES OF GREENHOUSE GAS EMISSIONS IN THE U.S., 2012 (%)</i>	45

<b>TOPIC</b>	<b>PAGE NO.</b>
TRANSPORTATION MARKET	46
DEMAND FOR EMISSION CONTROL PRODUCTS	46
Light-duty Vehicles (LDV)	46
<i>TABLE 25 LIGHT-DUTY VEHICLE PRODUCTION BY REGION, THROUGH 2019 (MILLIONS)</i>	47
Medium-duty and Heavy-duty Vehicles (MHDV)	48
<i>TABLE 26 HEAVY-DUTY DIESEL VEHICLE PRODUCTION OUTLOOK (REGULATED ENGINES) BY REGION, THROUGH 2019 (THOUSANDS)</i>	49
<i>TABLE 27 HEAVY-DUTY DIESEL VEHICLE SALES OUTLOOK (REGULATED ENGINES) BY REGION, THROUGH 2019 (THOUSANDS)</i>	49
Motorcycles	49
<i>TABLE 28 U.S. MOTORCYCLE SALES BY YEAR, 2004-2013 (THOUSANDS/% CHANGE)</i>	50
<i>TABLE 29 U.S. MOTORCYCLE SALES YEAR-OVER-YEAR, 2012-2014 (THOUSAND UNITS/%)</i>	50
Marine	51
MANUFACTURING MARKET	51
<i>TABLE 30 POLLUTANTS EMITTED FROM PETROLEUM REFINERIES</i>	52
<i>TABLE 31 GLOBAL OIL REFINERY CAPACITY BY REGION, 2009-2013 (1,000 BARRELS/DAY)</i>	52
UTILITY MARKETS	54
<i>TABLE 32 MANMADE SOURCES OF NITROGEN OXIDES (%)</i>	54
REGULATIONS AND RULES	55
DEMAND FOR EMISSION CONTROL PRODUCTS	55
<i>TABLE 33 GLOBAL COAL-FIRED ELECTRICITY PRODUCTION BY COUNTRY, 2010-2013 (1,000 GWH)</i>	55
OTHER MARKETS	56
CONSUMER AND COMMERCIAL	56
BIOMASS INDUSTRY	57
MINING	57
MARKET SIZE BY APPLICATION	58
THE U.S. MARKETS	58
<i>TABLE 34 HISTORICAL DEMAND FOR EMISSION CONTROL PRODUCTS IN THE U.S. BY MARKET, THROUGH 2014 (\$ MILLIONS)</i>	59
Transportation Market	59
Manufacturing Market	59
Utilities Market	60
Other Markets	60
THE EUROPEAN MARKETS	60
<i>TABLE 35 HISTORICAL DEMAND FOR EMISSION CONTROL PRODUCTS IN EUROPE BY MARKET, THROUGH 2014 (\$ MILLIONS)</i>	60
Transportation Market	61
Manufacturing Market	62
Utilities Market	62
Other Markets	62
MARKET FORECASTS BY APPLICATION	62
THE U.S. MARKETS	62
<i>TABLE 36 U.S. MARKET FOR EMISSION CONTROL PRODUCTS BY SEGMENT, THROUGH 2019 (\$ MILLIONS)</i>	63
Transportation Market	63

<b>TOPIC</b>	<b>PAGE NO.</b>
Manufacturing Market	63
Utilities Market	63
Other Markets	64
THE EUROPEAN MARKETS	64
Transportation Market	64
Manufacturing Market	64
Utilities Market	65
Other Markets	65
<i>TABLE 37 EUROPE MARKET FOR EMISSION CONTROL PRODUCTS BY SEGMENT, THROUGH 2019 (\$ MILLIONS)</i>	65
CHAPTER 6 MARKETS BY PRODUCTS	67
FILTERS	67
FILTER TYPE BY MATERIALS	67
Fabric	67
Sintered Metal Fiber	67
Glass Fiber	67
Ceramic Monolithic Cell Fiber	68
Paper	68
FILTER TYPE BY APPLICATIONS	68
Diesel Particulate Filters	68
General Remarks	68
Diesel Particulate Matter (DPM) and Health	69
History	70
<i>TABLE 38 JURISDICTIONS AND DIESEL EXHAUST CONTROL PROGRAMS</i>	70
Design and Regeneration of DPF	71
Active Regeneration	71
Products and Suppliers	72
Cordierite Wall Flow Filters	72
Silicon Carbide Wall Flow Filters	72
Ceramic Fiber or Foam Filters	72
Metal Fiber Flow Through Filters	73
Multi-stage Combination Filters	73
Typical DPF Characteristics	74
<i>TABLE 39 TYPICAL DPF CHARACTERISTICS</i>	74
Demand for Diesel Particulate Filters	74
<i>TABLE 40 MARKET SUMMARY: DIESEL PARTICULATE FILTERS, 2013-2019 (\$ MILLIONS)</i>	75
Filters for Hot Process Gases	75
Filter Type	76
<i>TABLE 41 TYPICAL PROCESSES THAT USE HIGH-TEMPERATURE GAS FILTERS</i>	76
Hot Process Gas Filter Markets	77
Other	78
FILTER SUPPLIERS	78
CATALYSTS	78
MOBILE CATALYSTS	78
Automotive Three-Way Catalysts	79
Automotive Four-Way Catalysts	79

<b>TOPIC</b>	<b>PAGE NO.</b>
Diesel Oxidation Catalysts	80
Diesel De-NOx Catalysts	80
Lean NOx Catalyst	81
Lean operation	82
Regeneration	82
Demand Factors	82
<i>TABLE 42 EVOLUTION OF EUROPEAN LIMITS FOR DIESEL PASSENGER CARS REGULATING NITROGEN OXIDE EMISSIONS (G/KM)</i>	83
Mobile Catalyst Suppliers	83
STATIONARY CATALYSTS	84
Demand Factors	86
Stationary Catalysts Suppliers	87
SENSORS	88
NITROGEN OXIDE SENSORS	88
OXYGEN SENSORS	89
CARBON MONOXIDE SENSORS	90
CARBON DIOXIDE SENSORS	90
SENSORS SUPPLIERS	91
OTHER PRODUCTS	92
SORBENTS	92
Activated Carbon	93
Dry Sorbent Injection	94
<i>TABLE 43 SORBENT SELECTIONS FOR ACID GAS CONTROL FROM FLUE GAS</i>	94
<i>FIGURE 8 DRY SORBENT INJECTION PROCESS</i>	94
MEMBRANES	95
Membrane Systems	96
Membrane Fouling	96
CHEMICALS	96
SUPPLIERS OF SORBENTS, MEMBRANES AND CHEMICALS	97
<i>TABLE 44 EXAMPLES OF SUPPLIERS OF EMISSION CONTROL MEMBRANES</i>	97
PRODUCTS MARKET SIZE	98
THE U.S. MARKET	98
<i>TABLE 45 HISTORICAL DEMAND FOR EMISSION CONTROL PRODUCTS IN THE U.S. BY TYPE, THROUGH 2014 (\$ MILLIONS)</i>	98
Filters	99
Catalysts	99
Sensors	99
Other Products	99
THE E.U. MARKET	100
<i>TABLE 46 HISTORICAL DEMAND FOR EMISSION CONTROL PRODUCTS IN EUROPE BY TYPE, THROUGH 2014 (\$ MILLIONS)</i>	100
Filters	100
Catalysts	100
Sensors	100
Other Products	101
PRODUCTS MARKET FORECASTS	101
THE U.S. MARKET	101

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 47 U.S. MARKET FOR EMISSION CONTROL BY PRODUCT SEGMENT, THROUGH 2019 (\$ MILLIONS)</i>	101
Filters	101
Catalysts	102
Sensors	102
Other Products	102
THE EUROPEAN MARKETS	103
<i>TABLE 48 EUROPEAN MARKET FOR EMISSION CONTROL BY PRODUCT SEGMENT, THROUGH 2019 (\$ MILLIONS)</i>	103
Filters	103
Catalysts	104
Sensors	104
Other Products	104
CHAPTER 7 TECHNOLOGIES	106
TECHNOLOGIES FOR GASOLINE ENGINES	106
<i>TABLE 49 COMMON WASH-COATING OXIDES</i>	107
TECHNOLOGIES FOR DIESEL ENGINES	107
CATALYSTS	107
FILTERS	108
ADSORBERS	109
DIESEL RETROFIT TECHNOLOGIES	109
<i>TABLE 50 DIESEL RETROFIT TECHNOLOGIES (%/\$)</i>	111
NEW DEVELOPMENTS AND EMERGING TECHNOLOGIES	111
COMPANY R&D AND EXPERTISE	112
<i>TABLE 51 BASF TECHNOLOGIES FOR MOBILE EMISSIONS CATALYSTS</i>	113
SIGNIFICANCE OF PATENTS	113
<i>TABLE 52 SIGNIFICANT EMISSION CONTROL TECHNOLOGY DEVELOPMENT, 1970-2013</i>	113
PATENT ANALYSIS	114
<i>TABLE 53 NUMBER OF EMISSION CONTROL PATENTS BY COMPANY, 2012-2014</i>	115
PATENTS BY YEAR	115
<i>TABLE 54 PARTIAL LIST OF RECENT DEVELOPMENTS OF EMISSION CONTROL CATALYSTS SINCE 2012</i>	115
<i>TABLE 55 PARTIAL LIST OF RECENT DEVELOPMENTS OF EMISSION CONTROL FILTERS AND SUBSTRATES SINCE 2012</i>	116
<i>TABLE 56 TOP PATENT HITS ABOUT PARTICULATE FILTERS ON THE USPTO WEB</i>	116
<i>TABLE 57 PARTIAL LIST OF RECENT DEVELOPMENTS OF OTHER EMISSION CONTROL PRODUCTS SINCE 2012</i>	117
CHAPTER 8 INDUSTRY STRUCTURE, COMPETITIVE ANALYSIS AND TRENDS	119
INDUSTRY STRUCTURE	119
INDUSTRY COMPOSITION	119
<i>TABLE 58 JOINT VENTURES IN THE EMISSION CONTROL COMPONENTS AND MATERIALS INDUSTRY</i>	120
INDUSTRY LEADERS	121
COMPETITIVE ANALYSES	123
SUPPLIERS AND MARKET SHARE BY PRODUCT	123
Heavy-Duty Diesel Catalyst	123

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 59 MARKET SHARE BY GLOBAL HDD CATALYST COMPANIES, 2013 (\$ MILLIONS/%)</i>	124
Light-Duty Vehicle Catalyst	124
<i>TABLE 60 MARKET SHARE BY GLOBAL LDV CATALYST COMPANIES, 2013 (\$ MILLIONS/%)</i>	125
Automotive Catalysts in the U.S. and Europe	125
<i>TABLE 61 MARKET SHARE BY GLOBAL AUTOMOTIVE CATALYST COMPANIES, 2013 (\$ MILLIONS/%)</i>	125
<i>TABLE 62 TOP SUPPLIERS OF AUTOMOTIVE CATALYSTS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)</i>	126
Stationary Catalysts in the U.S. and Europe	126
<i>TABLE 63 TOP SUPPLIERS OF STATIONARY CATALYSTS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)</i>	127
Catalyst Supports	127
<i>TABLE 64 TOP SUPPLIERS OF CATALYST SUPPORTS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)</i>	128
Diesel Particulate Filters	128
<i>TABLE 65 PARTIAL LIST DIESEL ENGINE PARTICLE FILTERS SUPPLIERS</i>	129
<i>TABLE 66 TOP SUPPLIERS OF DIESEL PARTICULATE FILTERS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)</i>	129
Hot Gas Filters	130
<i>TABLE 67 PARTIAL LIST OF SUPPLIERS OF FILTERS FOR HOT PROCESS GASES</i>	130
<i>TABLE 68 TOP SUPPLIERS OF HOT GAS FILTERS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)</i>	130
Emission Control Sensors	131
<i>TABLE 69 TOP SUPPLIERS OF EMISSION CONTROL SENSORS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)</i>	132
COMPANY STRATEGIES AND ACTIVITIES	132
Market Positioning or Repositioning	132
Joint Development or Joint Venture	133
Utilizing New Technology	133
Changing Product Mix	133
Expansion and Acquisition	134
Cutting Costs	134
Pursuit of Superior Growth	135
INDUSTRY TRENDS, MARKET DRIVERS AND RESTRAINTS	135
CHAPTER 9 COMPANY PROFILES	139
3M CO.	139
ADA-ES INC.	139
ADVANCED CERAMETRICS INC	139
ADVANCED EMISSIONS SOLUTIONS INC.	140
ATECH INNOVATIONS GMBH	140
BASF SE	140
BASF/ENGELHARD	141
BCSI LLC	141
BIENES TURGON/KATCON	142
KATCON-U.S.	142
BLASCH PRECISION CERAMICS INC	142



TOPIC	PAGE NO.
BOSCH (ROBERT) GMBH	143
BOSCH IN THE U.S.	143
BWF OFFERMANN SCHMID & CO KG	143
BWF ENVIROTEC - U.S.	144
CATALER	144
CATALER NORTH AMERICA CORP.	144
CLARCOR INC.	145
CLEAN COAL SOLUTIONS LLC	145
COALOGIX	145
CORMETECH INC	146
CORMETECH INC. - EUROPE	146
CORNING INCORPORATED	147
CUMMINS	147
DCL INTERNATIONAL INC.	148
DCL AMERICA INC.	148
DCL EUROPE GMBH	148
DELPHI AUTOMOTIVE PLC	148
DELPHI - U.S.	149
DENSO	149
DONALDSON CO. INC.	150
ELMARCO	150
EMITEC	151
EMITEC-U.S.	151
FAIREY INDUSTRIAL CERAMICS LTD	151
GRACE (WR) & COMPANY	152
HALDORTOPSOE A/S	152
HALDORTOPSOE INC. - U.S.	152
HJS EMISSION TECHNOLOGY GMBH & CO. KG	153
HONEYWELL INTERNATIONAL INCORPORATED	153
HORIBA LIMITED	154
HUSS	154
IBIDEN	155
IBIDEN DPF FRANCE SAS	155
ICT INC. (UMICORE)	155
INDUSTRIAL FILTER	156
JOHNSON MATTHEY PLC	156
JOHNSON MATTHEY INC. - U.S.	156
ARGILLON/JOHNSON MATTHEY - GERMANY	157
KEMIRA OF FINLAND	157
KERAFOL	158
LENNTECH BV	158
LIQTECH	159
LIQTECH - U.S.	159
MITSUBISHI HEAVY INDUSTRIES	159
N.E. CHEMCAT	160
NGK INSULATORS	160
NGK CERAMICS USA INC	160

<b>TOPIC</b>	<b>PAGE NO.</b>
NGK AUTOMOTIVE CERAMICS, U.S.A. INC.	160
NGK CERAMICS EUROPE SA	161
NGK SPARK PLUG	161
NGK SPARK PLUG - U.S.	161
NGK SPARK PLUG EUROPE GMBH	162
NOTOX CERAMIC FILTERS A/S	162
NOVASEP	162
PALL CORP	163
PALL EXEKIA	163
PALL GMBH	163
PALL/SCHUMACHER	164
PIRELLI	164
PORVAIR PLC	164
SUBSIDIARY: SELEE - U.S.	165
RATH GMBH	165
RATH-GERMANY	166
RATH-U.S.	166
REFRACTRON	166
RHODIA	166
RHODIA INC.	167
SAINT-GOBAIN	167
SAINT-GOBAIN CERAMIC MATERIALS	167
SAINT GOBAIN CERACLEAN	167
SIEMENS AG	168
SIEMENS CORP., U.S. SUBSIDIARY OF SIEMENS AG	168
SPECTRASENSORS INCORPORATED	169
SUD-CHEMIE	169
TAMI INDUSTRIES	170
TENMAT LTD	170
TENNECO	170
TENNECO EUROPE	171
TENNECO GMBH - EUROPE CLEAN AIR	171
TENNECO - NORTH AMERICA CLEAN AIR	171
TOKYO ROKI	171
UMICORE GROUP	172
VEOLIA -U.S.	172
OTHER COMPANIES MENTIONED IN REPORT	173
CHAPTER 10 APPENDIX	175
ABBREVIATIONS AND CHEMICAL FORMULAS	175
LIST OF GOVERNMENT AGENCIES AND REGULATIONS FOR EMISSION CONTROL	176

**LIST OF TABLES**

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
SUMMARY TABLE U.S. AND EUROPEAN EMISSION CONTROL MARKET BY PRODUCT SEGMENT, THROUGH 2019 (\$ MILLIONS)	9
TABLE 1 MAJOR EMISSION POLLUTANTS AND THEIR NEGATIVE EFFECTS	11
TABLE 2 MAIN SOURCES OF HYDROCARBON EMISSIONS (%)	12
TABLE 3 U.S. GREENHOUSE GAS EMISSIONS, 2012 (%)	13
TABLE 4 HISTORY OF MAJOR EMISSION CONTROL REGULATORY FACTORS WORLDWIDE	14
TABLE 5 MAJOR EMISSION CONTROL TECHNOLOGIES AND SYSTEMS TIMELINE	15
TABLE 6 U.S. AUTOMOBILE EMISSION STANDARDS (G/MILE)	17
TABLE 7 EUROPEAN EMISSION STANDARDS FOR PASSENGER CARS (G/KM)	18
TABLE 8 EUROPEAN EMISSION STANDARDS FOR LIGHT COMMERCIAL VEHICLES 1,305 KG TO 1,760 KG (G/KM)	18
TABLE 9 EUROPEAN EMISSION STANDARDS FOR LIGHT COMMERCIAL VEHICLES > 1,760 KG TO MAX 3,500 KG (G/KM)	19
TABLE 10 EUROPEAN EMISSION STANDARDS FOR HEAVY-DUTY DIESEL ENGINES (G/KWH, SMOKE IN M-1)	19
TABLE 11 U.S. ECONOMIC GROWTH, ANNUAL PERCENTAGE, 2007-2016 (%)	22
TABLE 12 EUROPE ECONOMIC GROWTH, ANNUAL PERCENTAGE CHANGE, 2007-2015 (GDP GROWTH-INFLATION-ADJUSTED)	23
TABLE 13 LIGHT-DUTY VEHICLE PRODUCTION AND SALES BY REGION, 2013 AND 2014 (MILLIONS/% CHANGE)	24
TABLE 14 HEAVY-DUTY DIESEL TRUCK PRODUCTION AND SALES BY REGION, 2013 AND 2014 (THOUSANDS/% CHANGE)	24
TABLE 15 GDP BASED ON PURCHASING POWER PARITY VALUATION BY COUNTRY, THROUGH 2019 (\$ BILLIONS)	26
TABLE 16 TOTAL MARKET FOR EMISSION CONTROL PRODUCTS, THROUGH 2019 (\$ MILLIONS)	27
TABLE 17 KEY INDICATORS FOR EMISSION CONTROL PRODUCTS DEMAND IN U.S., THROUGH 2019	28
TABLE 18 KEY INDICATORS FOR EMISSION CONTROL PRODUCTS DEMAND IN EUROPE, THROUGH 2019	31
TABLE 19 WESTERN EUROPE: DIESEL SHARE OF NEW CAR REGISTRATIONS BY COUNTRY, 2009-2013 (%)	32
TABLE 20 COAL-FIRED ELECTRICITY GENERATING CAPACITY BY COUNTRY, 2010 AND 2020 (GW)	34
TABLE 21 TIMELINES OF EURO 5 AND EURO 6 EMISSION REGULATIONS IN EUROPE	37
TABLE 22 NEW CAR REGISTRATIONS IN MAJOR EUROPEAN COUNTRIES, 2012 AND 2013 (MILLIONS/% CHANGE)	39
TABLE 23 EUROPEAN MARKET FOR EMISSION CONTROL PRODUCTS BY COUNTRY, 2013 (\$ MILLIONS)	42
TABLE 24 SOURCES OF GREENHOUSE GAS EMISSIONS IN THE U.S., 2012 (%)	45
TABLE 25 LIGHT-DUTY VEHICLE PRODUCTION BY REGION, THROUGH 2019 (MILLIONS)	47
TABLE 26 HEAVY-DUTY DIESEL VEHICLE PRODUCTION OUTLOOK (REGULATED ENGINES) BY REGION, THROUGH 2019 (THOUSANDS)	49
TABLE 27 HEAVY-DUTY DIESEL VEHICLE SALES OUTLOOK (REGULATED ENGINES) BY REGION, THROUGH 2019 (THOUSANDS)	49
TABLE 28 U.S. MOTORCYCLE SALES BY YEAR, 2004-2013 (THOUSANDS/% CHANGE)	50
TABLE 29 U.S. MOTORCYCLE SALES YEAR-OVER-YEAR, 2012-2014 (THOUSAND UNITS/%)	50

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 30 POLLUTANTS EMITTED FROM PETROLEUM REFINERIES	52
TABLE 31 GLOBAL OIL REFINERY CAPACITY BY REGION, 2009-2013 (1,000 BARRELS/DAY)	52
TABLE 32 MANMADE SOURCES OF NITROGEN OXIDES (%)	54
TABLE 33 GLOBAL COAL-FIRED ELECTRICITY PRODUCTION BY COUNTRY, 2010-2013 (1,000 GWH)	55
TABLE 34 HISTORICAL DEMAND FOR EMISSION CONTROL PRODUCTS IN THE U.S. BY MARKET, THROUGH 2014 (\$ MILLIONS)	59
TABLE 35 HISTORICAL DEMAND FOR EMISSION CONTROL PRODUCTS IN EUROPE BY MARKET, THROUGH 2014 (\$ MILLIONS)	60
TABLE 36 U.S. MARKET FOR EMISSION CONTROL PRODUCTS BY SEGMENT, THROUGH 2019 (\$ MILLIONS)	63
TABLE 37 EUROPE MARKET FOR EMISSION CONTROL PRODUCTS BY SEGMENT, THROUGH 2019 (\$ MILLIONS)	65
TABLE 38 JURISDICTIONS AND DIESEL EXHAUST CONTROL PROGRAMS	70
TABLE 39 TYPICAL DPF CHARACTERISTICS	74
TABLE 40 MARKET SUMMARY: DIESEL PARTICULATE FILTERS, 2013-2019 (\$ MILLIONS)	75
TABLE 41 TYPICAL PROCESSES THAT USE HIGH-TEMPERATURE GAS FILTERS	76
TABLE 42 EVOLUTION OF EUROPEAN LIMITS FOR DIESEL PASSENGER CARS REGULATING NITROGEN OXIDE EMISSIONS (G/KM)	83
TABLE 43 SORBENT SELECTIONS FOR ACID GAS CONTROL FROM FLUE GAS	94
TABLE 44 EXAMPLES OF SUPPLIERS OF EMISSION CONTROL MEMBRANES	97
TABLE 45 HISTORICAL DEMAND FOR EMISSION CONTROL PRODUCTS IN THE U.S. BY TYPE, THROUGH 2014 (\$ MILLIONS)	98
TABLE 46 HISTORICAL DEMAND FOR EMISSION CONTROL PRODUCTS IN EUROPE BY TYPE, THROUGH 2014 (\$ MILLIONS)	100
TABLE 47 U.S. MARKET FOR EMISSION CONTROL BY PRODUCT SEGMENT, THROUGH 2019 (\$ MILLIONS)	101
TABLE 48 EUROPEAN MARKET FOR EMISSION CONTROL BY PRODUCT SEGMENT, THROUGH 2019 (\$ MILLIONS)	103
TABLE 49 COMMON WASH-COATING OXIDES	107
TABLE 50 DIESEL RETROFIT TECHNOLOGIES (%/\$)	111
TABLE 51 BASF TECHNOLOGIES FOR MOBILE EMISSIONS CATALYSTS	113
TABLE 52 SIGNIFICANT EMISSION CONTROL TECHNOLOGY DEVELOPMENT, 1970-2013	113
TABLE 53 NUMBER OF EMISSION CONTROL PATENTS BY COMPANY, 2012-2014	115
TABLE 54 PARTIAL LIST OF RECENT DEVELOPMENTS OF EMISSION CONTROL CATALYSTS SINCE 2012	115
TABLE 55 PARTIAL LIST OF RECENT DEVELOPMENTS OF EMISSION CONTROL FILTERS AND SUBSTRATES SINCE 2012	116
TABLE 56 TOP PATENT HITS ABOUT PARTICULATE FILTERS ON THE USPTO WEB	116
TABLE 57 PARTIAL LIST OF RECENT DEVELOPMENTS OF OTHER EMISSION CONTROL PRODUCTS SINCE 2012	117
TABLE 58 JOINT VENTURES IN THE EMISSION CONTROL COMPONENTS AND MATERIALS INDUSTRY	120
TABLE 59 MARKET SHARE BY GLOBAL HDD CATALYST COMPANIES, 2013 (\$ MILLIONS/%)	124
TABLE 60 MARKET SHARE BY GLOBAL LDV CATALYST COMPANIES, 2013 (\$ MILLIONS/%)	125

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 61 MARKET SHARE BY GLOBAL AUTOMOTIVE CATALYST COMPANIES, 2013 (\$ MILLIONS/%)	125
TABLE 62 TOP SUPPLIERS OF AUTOMOTIVE CATALYSTS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)	126
TABLE 63 TOP SUPPLIERS OF STATIONARY CATALYSTS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)	127
TABLE 64 TOP SUPPLIERS OF CATALYST SUPPORTS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)	128
TABLE 65 PARTIAL LIST DIESEL ENGINE PARTICLE FILTERS SUPPLIERS	129
TABLE 66 TOP SUPPLIERS OF DIESEL PARTICULATE FILTERS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)	129
TABLE 67 PARTIAL LIST OF SUPPLIERS OF FILTERS FOR HOT PROCESS GASES	130
TABLE 68 TOP SUPPLIERS OF HOT GAS FILTERS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)	130
TABLE 69 TOP SUPPLIERS OF EMISSION CONTROL SENSORS IN THE U.S. AND EUROPE MARKETS, 2013 (\$ MILLIONS/%)	132

**LIST OF FIGURES**

<b>FIGURE TITLE</b>	<b>PAGE NO.</b>
SUMMARY FIGURE U.S. AND EUROPEAN EMISSION CONTROL MARKET BY PRODUCT SEGMENT, 2004-2019 (\$ MILLIONS)	9
FIGURE 1 U.S. GREENHOUSE GAS EMISSIONS, 2012	13
FIGURE 2 PROGRESSIVE DEMANDS IN THE U.S.-EMISSION CONTROL PRODUCTS MARKET AND FORECAST, 2004-2019 (\$ MILLIONS)	30
FIGURE 3 COMPARISON OF U.S. AND EU DIESEL CARS MARKET SHARE, 1990-2013 (%)	31
FIGURE 4 SOURCES FOR NET ELECTRICITY GENERATION, EU-28, 2012 (%)	33
FIGURE 5 COMPARING U.S. AND E.U. CURRENT EMISSION REGULATIONS (G/MI)	35
FIGURE 6 PROGRESSIVE DEMANDS IN EUROPE: EMISSION CONTROL PRODUCTS MARKET AND FORECAST, 2004-2019 (\$ MILLIONS)	36
FIGURE 7 SOURCES OF GREENHOUSE GAS EMISSIONS IN THE U.S., 2012 (%)	45
FIGURE 8 DRY SORBENT INJECTION PROCESS	94