

CHAPTER ONE: INTRODUCTION.....	1
STUDY BACKGROUND .....	1
STUDY GOALS AND OBJECTIVES.....	1
INTENDED AUDIENCE.....	1
SCOPE AND FORMAT .....	2
INFORMATION SOURCES AND METHODOLOGY.....	3
ANALYST CREDENTIALS.....	3
RELATED BCC RESEARCH REPORTS.....	4
BCC ON-LINE SERVICES.....	4
DISCLAIMER .....	5
DISCLAIMER (CONTINUED).....	5
CHAPTER TWO: EXECUTIVE SUMMARY.....	6
<i>SUMMARY TABLE GLOBAL MARKET FOR ADVANCED MATERIALS     AND DEVICES FOR RENEWABLE-ENERGY SYSTEMS, THROUGH     2016 (\$ MILLIONS)</i> .....	6
<i>SUMMARY FIGURE RENEWABLE ENERGY CONSUMPTION OF     ADVANCED MATERIALS AND DEVICES BY TYPE, 2010–2016 (%)</i> .....	7
CHAPTER THREE: OVERVIEW .....	8
GENERAL DESCRIPTION.....	8
DEFINITIONS .....	8
Renewable Energy.....	8
Renewable-energy Systems.....	8
Advanced Materials and Devices .....	8
INDUSTRY STRUCTURE .....	9
PRINCIPAL PRODUCTS .....	9
<i>FIGURE 1 RENEWABLE-ENERGY EQUIPMENT     MANUFACTURERS/SYSTEM PROVIDERS, BY TYPE OF     RENEWABLE ENERGY (% OF TOTAL COMPANIES)</i> .....	10
GEOGRAPHICAL DISTRIBUTION .....	10
<i>FIGURE 2 RENEWABLE-ENERGY EQUIPMENT     MANUFACTURERS/SYSTEM PROVIDERS, BY HEADQUARTERS     COUNTRY (% OF TOTAL COMPANIES)</i> .....	11
<i>FIGURE 3 LEADING RENEWABLE-ENERGY EQUIPMENT     MANUFACTURERS/SYSTEM PROVIDERS, BY TYPE OF     TECHNOLOGY AND HEADQUARTERS' COUNTRY (% OF TOTAL     COMPANIES)</i> .....	12
<i>FIGURE 3 (CONTINUED)</i> .....	13
PATENT ANALYSIS .....	13
<i>FIGURE 4 U.S. PATENTS RELATING TO ADVANCED MATERIALS     AND DEVICES BY TYPE OF RENEWABLE TECHNOLOGY (% OF     PATENTS ISSUED THROUGH SEPTEMBER 1, 2011)</i> .....	14

CHAPTER FOUR: SOLAR PHOTOVOLTAICS.....	15
TYPES OF PHOTOVOLTAIC DEVICES .....	15
SILICON WAFER-BASED PV CELLS .....	15
Single-Crystal Silicon PVs .....	16
<i>TABLE 1 MANUFACTURERS OF C-SI PVS</i> .....	16
Polycrystalline Silicon PVs.....	17
<i>TABLE 2 MANUFACTURERS OF MC-SI PVS</i> .....	18
Thin-Film PV Cells.....	19
Amorphous Silicon.....	20
<i>TABLE 3 MANUFACTURERS OF AMORPHOUS SILICON PV</i> <i>DEVICES</i> .....	20
Cadmium Telluride.....	21
<i>TABLE 4 SUPPLIERS OF CADMIUM TELLURIDE THIN-FILM PVS</i> .....	21
Abound .....	21
Antec Solar Energy AG.....	21
Copper Indium Gallium Selenide .....	22
<i>TABLE 5 MANUFACTURERS OF CIGS THIN-FILM PVS</i> .....	22
THIRD-GENERATION PV TECHNOLOGIES .....	23
Multi-Junction Cells.....	23
Multi-Junction Cells (Continued).....	24
<i>TABLE 6 MANUFACTURERS OF MULTI-JUNCTION AND/OR</i> <i>CONCENTRATOR PVS</i> .....	25
Dye-Sensitized Solar Cells .....	25
<i>TABLE 7 COMPANIES MANUFACTURING OR DEVELOPING DSSC</i> <i>PVS</i> .....	26
Quantum Dot PVs.....	26
Intermediate-Bandgap Solar cells.....	27
Infrared Solar Cells.....	28
Multilayered Silicon Quantum Dot Solar Cell .....	28
<i>TABLE 8 COMPANIES DEVELOPING QUANTUM DOT PVS</i> .....	28
Organic Solar Cells.....	29
Hybrid Organic-Metal PVs.....	29
Hybrid Organic-Organic PVs .....	30
<i>TABLE 9 COMPANIES MANUFACTURING OR DEVELOPING</i> <i>POLYMER PVS</i> .....	31
PHOTOVOLTAIC APPLICATIONS AND MARKETS .....	31
<i>FIGURE 5 GRID-TIED VS. OFF-GRID PV APPLICATIONS, 2010</i> <i>(PERCENT OF TOTAL INSTALLED CAPACITY)</i> .....	32
ADVANCED MATERIALS AND DEVICES FOR PHOTOVOLTAICS.....	33
PHOTOVOLTAIC MATERIALS .....	33
Crystalline Silicon .....	33
Production Processes .....	33
Polycrystalline Silicon.....	34
Monocrystalline Silicon.....	35

Producers.....	35
<i>TABLE 10 PRODUCERS OF SILICON FOR RENEWABLE-ENERGY APPLICATIONS</i> .....	35
<i>FIGURE 6 PHOTOVOLTAIC POLYCRYSTALLINE SILICON MARKET SHARES, 2010 (% OF TOTAL POLYCRYSTALLINE SILICON PRODUCED FOR SOLAR PV APPLICATIONS)</i> .....	36
Thin-film Materials .....	37
Silane.....	37
<i>TABLE 11 MAJOR SILANE SUPPLIERS FOR PV MANUFACTURING</i> .....	37
Cadmium Telluride.....	37
<i>TABLE 12 MAJOR CADMIUM TELLURIDE SUPPLIERS FOR PV MANUFACTURING</i> .....	38
CIGS .....	38
Nanomaterials.....	39
TiO <sub>2</sub> Nanoparticles.....	39
P3HT/Cadmium Selenide .....	39
MEH-PPV/PbS Nanocomposite.....	40
Other Third-Generation PV Materials .....	40
PHOTOVOLTAIC INVERTERS.....	40
Types of PV Inverter.....	41
Technology Trends.....	41
Producers .....	41
<i>TABLE 13 PRODUCERS OF PV INVERTERS</i> .....	42
Fronius .....	42
PATENT ANALYSIS .....	42
MATERIALS VS. DEVICES.....	42
<i>FIGURE 7 U.S. PATENTS AND PATENT APPLICATIONS RELATING TO ADVANCED PV MATERIALS VS. DEVICES (NUMBER AND PERCENTAGE OF PATENTS ISSUED THROUGH SEPTEMBER 1, 2011)</i> .....	43
PV GENERATIONS.....	43
<i>FIGURE 8 U.S. PATENTS AND PATENT APPLICATIONS RELATING TO PV ADVANCED MATERIALS BY TECHNOLOGY GENERATION (NUMBER AND PERCENTAGE OF PATENTS ISSUED THROUGH SEPTEMBER 1, 2011)</i> .....	44
PV MATERIALS.....	44
<i>FIGURE 9 U.S. PATENTS RELATING TO PV ADVANCED MATERIALS BY TYPE OF MATERIAL (NUMBER AND PERCENTAGE OF PATENTS ISSUED THROUGH SEPTEMBER 1, 2011)</i> .....	45
PATENT HOLDERS .....	45
<i>FIGURE 10 MAJOR IP PORTFOLIOS FOR PHOTOVOLTAIC MATERIALS AND DEVICES (NUMBER AND PERCENTAGE OF PATENTS ISSUED THROUGH SEPTEMBER 1, 2011)</i> .....	46
CHAPTER FIVE: SOLAR THERMAL COLLECTORS .....	47

TYPES OF SOLAR THERMAL POWER PLANT .....	47
PARABOLIC TROUGH COLLECTORS .....	47
<i>TABLE 14 PTC SOLAR SYSTEM PROVIDERS</i> .....	48
CONCENTRATING SOLAR TOWERS.....	48
PARABOLIC DISH COLLECTOR .....	49
SOLAR THERMAL APPLICATIONS AND MARKETS .....	50
ADVANCED MATERIALS AND DEVICES FOR SOLAR THERMAL INSTALLATIONS .....	51
REFLECTOR MATERIALS.....	51
Technology .....	51
Manufacturers .....	52
<i>TABLE 15 COMPANIES MANUFACTURING SOLAR CONCENTRATING MIRRORS</i> .....	52
SOLAR SELECTIVE COATINGS .....	52
Technology .....	52
Manufacturers .....	53
<i>TABLE 16 COMPANIES MANUFACTURING OR DEVELOPING SOLAR SELECTIVE COATINGS</i> .....	53
SOLAR TRACKERS.....	53
Technology .....	53
Single vs. Dual Axis Trackers .....	54
Active vs. Passive Trackers .....	54
Manufacturers .....	54
<i>TABLE 17 MANUFACTURERS OF SOLAR TRACKERS</i> .....	55
STIRLING ENGINES .....	55
Technology .....	55
<i>TABLE 18 COMPANIES MANUFACTURING SOLAR STIRLING ENGINES</i> .....	55
HIGH-TEMPERATURE PUMPS .....	56
Technology .....	56
Manufacturers .....	56
PATENT ANALYSIS .....	56
<i>TABLE 19 U.S. PATENTS RELATING TO ADVANCED MATERIALS AND DEVICES FOR SOLAR THERMAL POWER</i> .....	57
<i>FIGURE 11 U.S. PATENTS RELATING TO ADVANCED SOLAR THERMAL MATERIALS VS. DEVICES (NUMBER AND PERCENTAGE OF TOTAL PATENTS ISSUED THROUGH SEPTEMBER 1, 2011)</i> .....	57
<i>FIGURE 11 (CONTINUED)</i> .....	58
TYPE OF TECHNOLOGY .....	58
<i>FIGURE 12 U.S. PATENTS RELATING TO ADVANCED PV MATERIALS AND DEVICES, BY TYPE OF SOLAR THERMAL TECHNOLOGY (NUMBER AND PERCENTAGE OF TOTAL PATENTS ISSUED THROUGH SEPTEMBER 1, 2011)</i> .....	58

<i>FIGURE 12 (CONTINUED)</i> .....	59
PATENT HOLDERS .....	59
<i>FIGURE 13 MAJOR IP PORTFOLIOS FOR PHOTOVOLTAIC MATERIALS AND DEVICES (NUMBER AND PERCENTAGES OF PATENTS ISSUED THROUGH SEPTEMBER 1, 2011)</i> .....	59
<i>FIGURE 13 (CONTINUED)</i> .....	60
CHAPTER SIX: SMALL HYDROPOWER .....	61
TYPES OF SMALL HYDROPOWER INSTALLATIONS .....	61
SMALL HYDRO APPLICATIONS AND MARKETS .....	61
ADVANCED MATERIALS AND DEVICES FOR MINI- AND MICRO- HYDRO INSTALLATIONS .....	61
COMPOSITE MATERIALS .....	62
Technology .....	62
IMPROVED PICO TURBINES .....	62
Technology .....	62
Manufacturers .....	63
<i>TABLE 20 COMPANIES MANUFACTURING IMPROVED PICO- HYDRO GENERATORS</i> .....	63
COANDA SCREENS .....	64
Technology .....	64
Manufacturers .....	64
<i>TABLE 21 SUPPLIERS OF COANDA EFFECT SCREENS</i> .....	64
PATENT ANALYSIS .....	65
<i>TABLE 22 U.S. PATENTS AND PATENT APPLICATIONS RELATING TO ADVANCED MATERIALS AND DEVICES FOR SMALL HYDROPOWER</i> .....	65
CHAPTER SEVEN: WIND ENERGY .....	66
WIND TURBINES .....	66
TYPES OF WIND TURBINE .....	66
Horizontal Axis Wind Turbines .....	66
Upwind Wind Turbines .....	67
Downwind Wind Turbine .....	67
Vertical Axis Wind Turbines .....	67
Darrieus Turbines .....	68
Savonius Turbines .....	68
WIND TURBINE SIZES .....	68
WIND POWER APPLICATIONS AND MARKETS .....	68
ADVANCED MATERIALS AND DEVICES FOR WIND POWER .....	69
LIGHTWEIGHT MATERIALS .....	69
Technology .....	69
Manufacturers .....	70
<i>TABLE 23 MANUFACTURERS OF COMPOSITE MATERIALS FOR WIND TURBINE APPLICATIONS</i> .....	71

POWER ELECTRONICS.....	71
Technologies.....	71
Manufacturers .....	72
<i>TABLE 24 MANUFACTURERS OF VARIABLE-SPEED GENERATORS AND POWER ELECTRONICS FOR WIND TURBINE APPLICATIONS .....</i>	<i>72</i>
PERMANENT MAGNET GENERATORS.....	73
Technology .....	73
Manufacturers .....	73
<i>TABLE 25 SUPPLIERS OF PERMANENT MAGNET GENERATORS FOR WIND TURBINE APPLICATIONS.....</i>	<i>74</i>
PATENT ANALYSIS .....	74
<i>TABLE 26 U.S. PATENTS RELATING TO ADVANCED MATERIALS AND DEVICES FOR WIND POWER APPLICATIONS .....</i>	<i>74</i>
<i>FIGURE 14 U.S. PATENTS AND PATENT APPLICATIONS RELATING TO ADVANCED WIND POWER MATERIALS VS. DEVICES (NUMBER AND PERCENTGE OF PATENTS ISSUED THROUGH SEPTEMBER 1, 2011).....</i>	<i>75</i>
PATENT HOLDERS .....	75
CHAPTER EIGHT: GEOTHERMAL ENERGY.....	76
TECHNOLOGIES.....	76
GEOTHERMAL POWER PLANTS.....	76
Dry Steam .....	76
Flash Steam .....	76
Binary Cycle.....	77
Flash/Binary Combined Cycle.....	77
DIRECT USE OF GEOTHERMAL ENERGY.....	77
GEOTHERMAL HEAT PUMPS.....	77
APPLICATIONS AND MARKETS .....	78
ADVANCED MATERIALS AND DEVICES.....	78
ADVANCED MATERIALS .....	78
Technologies.....	78
Heat Exchanger Tube Coatings .....	79
Calcium Phosphate Well Cements .....	79
High-Temperature Polymeric Elastomers .....	79
Thermal Spray Pipe Coatings .....	80
PATENT ANALYSIS .....	80
CHAPTER NINE: OCEAN ENERGY.....	81
OCEAN ENERGY TECHNOLOGIES.....	81
TIDAL POWER .....	81
WAVE ENERGY .....	82
OCEAN THERMAL ENERGY .....	83
Ocean Thermal Energy (Continued).....	84

Ocean Thermal Energy (Continued).....	85
OCEAN ENERGY APPLICATION AND MARKETS .....	86
ADVANCED MATERIALS AND DEVICES FOR OCEAN ENERGY SYSTEMS .....	86
COLD WATER PIPE.....	86
Technology .....	86
TIDAL STREAM TURBINES.....	87
Technology .....	87
SeaGen (Marine Current Turbines).....	87
Seasnail (Robert Gordon University and Aberdeen Renewable Energy Group) .....	87
Ocean Turbine (Blue Energy).....	88
Underwater Electric Kite (UEK Corporation).....	88
EXIM (Seapower) .....	88
Gorlov Helical Turbine (GCK Technology) .....	89
Lunar System (Lunar Energy) .....	89
TidEl (SMD Hydrovision) .....	89
Manufacturers .....	90
TABLE 27 TIDAL STREAM TURBINE MANUFACTURERS.....	90
WAVE POWER DEVICES .....	91
Technology .....	91
Pelamis (Ocean Power Delivery).....	91
PowerBuoy (Ocean Power Technologies) .....	92
Wave Dragon (Wave Dragon A/S) .....	92
Limpet (Wavegen).....	93
Manufacturers .....	93
TABLE 28 WAVE ENERGY CONVERTER MANUFACTURERS.....	93
TABLE 28 (CONTINUED).....	94
PATENT ANALYSIS .....	94
TABLE 29 U.S. PATENTS AND PATENT APPLICATIONS RELATING TO ADVANCED MATERIALS AND DEVICES IN OCEAN ENERGY.....	94
CHAPTER TEN: GLOBAL MARKETS FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION .....	95
GLOBAL MARKET.....	95
FIGURE 15 TRENDS IN THE GLOBAL MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, 2010-2016 (\$ MILLIONS) .....	95
MARKET BY COUNTRY/REGION .....	95
TABLE 30 MAJOR INTERNATIONAL MARKETS FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, THROUGH 2016 (\$ MILLIONS).....	96
FIGURE 16 GLOBAL MARKET SHARES BY COUNTRY/REGION, 2010 VS. 2016 (PERCENTAGE OF TOTAL SALES) .....	97
FIGURE 16 (CONTINUED) .....	98

MARKET BY TYPE OF RENEWABLE ENERGY TECHNOLOGY .....	98
TABLE 31 GLOBAL MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, BY TYPE OF RENEWABLE ENERGY TECHNOLOGY, THROUGH 2016 (\$ MILLIONS).....	98
FIGURE 17 GLOBAL MARKET SHARES BY TYPE OF RENEWABLE ENERGY TECHNOLOGY, 2010 VS. 2016 (PERCENTAGE OF TOTAL SALES).....	99
FIGURE 17 (CONTINUED) .....	100
MARKET BY TYPE OF MATERIAL/DEVICE.....	100
TABLE 32 GLOBAL MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, BY TYPE OF MATERIAL AND DEVICE, THROUGH 2016 (\$ MILLIONS)....	100
CHAPTER ELEVEN: UNITED STATES MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION .....	
SUMMARY .....	101
TABLE 33 U.S. CONSUMPTION OF ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, THROUGH 2016 (\$ MILLIONS).....	101
FIGURE 18 U.S. CONSUMPTION OF ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, BY TYPE OF ENERGY, 2010-2016 (%).....	102
PHOTOVOLTAICS .....	102
PRODUCTION OF PHOTOVOLTAIC CELLS.....	102
FIGURE 19 U.S. PV CELL PRODUCTION BY TYPE OF TECHNOLOGY, 2010 (%/MW) .....	103
TABLE 34 PROJECTED U.S. PV CELL PRODUCTION, THROUGH 2016 (MW) .....	104
FIGURE 20 TRENDS IN U.S. PV CELL PRODUCTION, 2010-2016 (MW)....	105
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	105
TABLE 35 U.S. MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN PV SYSTEMS, THROUGH 2016 (\$ MILLIONS).....	105
Photovoltaic Materials and Precursors.....	106
TABLE 36 U.S. PV-RELATED CONSUMPTION OF PHOTOVOLTAIC MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS) .....	106
Crystalline Silicon.....	106
TABLE 37 U.S. CONSUMPTION OF PV SILICON, THROUGH 2016 (METRIC TONS/\$ MILLIONS) .....	107
Thin Film Materials.....	107
TABLE 38 U.S. CONSUMPTION OF THIN-FILM PV MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS).....	107
Silane .....	108

<i>TABLE 39 U.S. SILANE CONSUMPTION FOR THE PRODUCTION OF A-SI THIN-FILM PVS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	108
Cadmium Telluride.....	108
<i>TABLE 40 U.S. CONSUMPTION OF CDTE USED IN THE PRODUCTION OF CDTE THIN-FILM PVS, THROUGH 2016</i> .....	109
CIGS.....	109
<i>TABLE 41 U.S. CONSUMPTION OF CIGS USED IN THE PRODUCTION OF CIGS THIN-FILM PVS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	109
Third-Generation Materials.....	110
<i>TABLE 42 U.S. CONSUMPTION OF THIRD GENERATION PV PRECURSOR MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	110
Multi-Junction Materials.....	110
<i>TABLE 43 U.S. CONSUMPTION OF MULTI-JUNCTION PV MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	111
Organic Materials.....	111
<i>TABLE 44 U.S. CONSUMPTION OF HYBRID ORGANIC PV MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	112
Photovoltaic Inverters.....	112
<i>TABLE 45 U.S. MARKET FOR PV INVERTERS, THROUGH 2016 (\$ MILLIONS)</i> .....	112
SOLAR THERMAL.....	113
TOTAL PROJECT EXPENDITURES.....	113
<i>FIGURE 21 EUROPEAN CAPITAL EXPENDITURES ON SOLAR THERMAL POWER PLANTS, 2010–2016 (\$ MILLIONS)</i> .....	113
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	114
<i>TABLE 46 U.S. DEMAND FOR ADVANCED MATERIALS AND DEVICES USED IN SOLAR THERMAL SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	115
Reflector Materials.....	115
<i>TABLE 47 U.S. DEMAND FOR SOLAR CONCENTRATING MIRRORS, THROUGH 2016 (SQUARE METERS/\$ MILLIONS)</i> .....	115
Solar Selective Coatings.....	116
<i>TABLE 48 U.S. DEMAND FOR SOLAR SELECTIVE COATINGS, THROUGH 2016 (\$ MILLIONS)</i> .....	116
Solar Trackers.....	116
<i>TABLE 49 U.S. DEMAND FOR SOLAR TRACKERS, THROUGH 2016 (\$ MILLIONS)</i> .....	117
Stirling Engines.....	117
<i>TABLE 50 U.S. DEMAND FOR SOLAR STIRLING ENGINES, THROUGH 2016 (UNITS/\$ MILLIONS)</i> .....	118

High Temperature Pumps.....	118
<i>TABLE 51 U.S. DEMAND FOR HIGH-TEMPERATURE PUMPS, THROUGH 2016 (\$ MILLIONS)</i> .....	118
WIND ENERGY.....	118
PRODUCTION OF WIND TURBINES.....	118
<i>TABLE 52 U.S. WIND TURBINE PRODUCTION, THROUGH 2016 (NUMBER OF UNITS)</i> .....	119
<i>FIGURE 22 TRENDS IN U.S. WIND TURBINE PRODUCTION, 2010–2016 (NUMBER OF UNITS)</i> .....	119
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	119
<i>TABLE 53 U.S. MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN WIND ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	120
Composites.....	120
<i>TABLE 54 U.S. MARKET FOR COMPOSITES USED IN WIND TURBINE ROTOR BLADES, THROUGH 2016 (MILLION METRIC TONS/\$ MILLIONS)</i> .....	120
Power Electronics.....	121
<i>TABLE 55 U.S. MARKET FOR POWER ELECTRONICS USED IN WIND TURBINES, THROUGH 2016 (UNITS/\$ MILLIONS)</i> .....	121
Permanent Magnet Generators.....	122
<i>TABLE 56 U.S. MARKET FOR PERMANENT-MAGNET GENERATORS USED IN WIND TURBINES, THROUGH 2016 (\$ MILLIONS)</i> .....	122
GEOHERMAL ENERGY.....	122
<i>TABLE 57 ADDITIONS TO U.S. GEOHERMAL ENERGY CAPACITY, THROUGH 2016 (MW)</i> .....	123
<i>FIGURE 23 PROJECTED GROWTH OF U.S. GEOHERMAL CAPACITY, 2010-2016 (MW)</i> .....	123
<i>TABLE 58 U.S. INVESTMENTS IN NEW GEOHERMAL CAPACITY, THROUGH 2016 (\$ MILLIONS)</i> .....	124
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	124
<i>TABLE 59 U.S. MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN GEOHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	124
Calcium Phosphate Well Cement.....	125
<i>TABLE 60 U.S. MARKET FOR CALCIUM PHOSPHATE WELL CEMENT USED IN GEOHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLION)</i> .....	125
Heat Exchanger Tube Coatings.....	125
<i>TABLE 61 U.S. MARKET FOR PPS HEAT EXCHANGER COATINGS USED IN GEOHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	126

Other Advanced Materials .....	126
OCEAN ENERGY .....	126
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	126
<i>TABLE 62 U.S. MARKET FOR ADVANCED MATERIALS AND     DEVICES USED IN OCEAN ENERGY SYSTEMS, THROUGH 2016 (\$     MILLIONS)</i> .....	127
Cold Water Pipe.....	127
Tidal Stream Turbines .....	127
<i>TABLE 63 U.S. MARKET FOR TIDAL STREAM TURBINES,     THROUGH 2016 (MW/\$ MILLIONS)</i> .....	128
Wave Power Devices.....	128
<i>TABLE 64 U.S. MARKET FOR WAVE POWER DEVICES, THROUGH     2016 (MW/\$ MILLIONS)</i> .....	128
 CHAPTER TWELVE: EUROPEAN MARKETS FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION .....	129
SUMMARY.....	129
<i>TABLE 65 EUROPEAN CONSUMPTION OF ADVANCED MATERIALS     AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION,     THROUGH 2016 (\$ MILLIONS)</i> .....	129
<i>TABLE 65 (CONTINUED)</i> .....	130
<i>FIGURE 24 EUROPEAN CONSUMPTION OF ADVANCED     MATERIALS AND DEVICES USED IN RENEWABLE ENERGY     PRODUCTION, BY COUNTRY, 2010-2016 (%)</i> .....	131
<i>FIGURE 25 EUROPEAN CONSUMPTION OF ADVANCED     MATERIALS AND DEVICES USED IN RENEWABLE ENERGY     PRODUCTION, BY TYPE OF TECHNOLOGY, 2010-2016 (%)</i> .....	132
PHOTOVOLTAICS .....	133
PRODUCTION OF PHOTOVOLTAIC CELLS.....	133
<i>TABLE 66 EUROPEAN PV CELL PRODUCTION BY TYPE OF     TECHNOLOGY, 2010 (MW)</i> .....	133
<i>FIGURE 26 EUROPEAN PV CELL PRODUCTION BY TYPE OF     TECHNOLOGY, 2010 (%/MW)</i> .....	134
<i>TABLE 67 PROJECTED EUROPEAN PV CELL PRODUCTION,     THROUGH 2016 (MW)</i> .....	135
<i>FIGURE 27 TRENDS IN EUROPEAN PV CELL PRODUCTION, 2010-     2016 (MW)</i> .....	136
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	136
<i>TABLE 68 EUROPEAN MARKET FOR ADVANCED MATERIALS AND     DEVICES USED IN PV SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	137
Photovoltaic Materials.....	137

<i>TABLE 69 EUROPEAN PV-RELATED CONSUMPTION OF ADVANCED PHOTOVOLTAIC MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	138
<i>TABLE 69 (CONTINUED)</i> .....	139
Crystalline Silicon.....	139
<i>TABLE 70 EUROPEAN CONSUMPTION OF PV SILICON, THROUGH 2016 (METRIC TONS/\$)</i> .....	140
Thin Film Materials.....	140
<i>TABLE 71 EUROPEAN CONSUMPTION OF THIN-FILM PV MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	141
<i>TABLE 71 (CONTINUED)</i> .....	142
Silane .....	142
<i>TABLE 72 EUROPEAN SILANE CONSUMPTION FOR THE PRODUCTION OF A-SI THIN-FILM PVS, THROUGH 2016 SILANE CONSUMPTION (MT)/ \$ MILLIONS</i> .....	143
Cadmium Telluride.....	143
<i>TABLE 73 EUROPEAN CONSUMPTION OF CDTE USED IN THE PRODUCTION OF CDTE THIN-FILM PVS CDTE CONSUMPTION (MT)/ \$ MILLIONS</i> .....	143
<i>TABLE 73 (CONTINUED)</i> .....	144
CI(G)S.....	144
<i>TABLE 74 EUROPEAN CONSUMPTION OF CI(G)S USED IN THE PRODUCTION OF CI(G)S THIN-FILM PVS, THROUGH 2016 CI(G)S CONSUMPTION (MT)/ \$ MILLIONS</i> .....	145
Third-Generation Materials .....	145
<i>TABLE 75 EUROPEAN CONSUMPTION OF THIRD GENERATION PV PRECURSOR MATERIALS, 2010-2016 (METRIC TONS/\$ MILLIONS)</i> .....	146
Multi-Junction Materials .....	146
<i>TABLE 76 EUROPEAN CONSUMPTION OF MULTI-JUNCTION PV MATERIALS, THROUGH 2016 MULTI-JUNCTION CONSUMPTION (MT)/ \$ MILLIONS</i> .....	146
<i>TABLE 76 (CONTINUED)</i> .....	147
Other Third Generation Materials.....	147
<i>TABLE 77 EUROPEAN CONSUMPTION OF OTHER THIRD GENERATION PV MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	148
DSSCs.....	148
<i>TABLE 78 EUROPEAN CONSUMPTION OF TIO<sub>2</sub> NANOPARTICLES FOR DSSC PV, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	149
Organic PVs.....	149
<i>TABLE 79 EUROPEAN CONSUMPTION OF HYBRID ORGANIC PV MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	150
Photovoltaic Inverters .....	150

<i>TABLE 80 EUROPEAN MARKET FOR PV INVERTERS, THROUGH 2016 (\$ MILLIONS)</i> .....	151
SOLAR THERMAL.....	151
TOTAL PROJECT EXPENDITURES.....	151
<i>FIGURE 28 CAPITAL EXPENDITURES ON SOLAR THERMAL POWER PLANTS IN EUROPE (PRIMARILY SPAIN), 2010–2016 (\$ MILLIONS)</i> .....	152
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	153
<i>TABLE 81 EUROPEAN (SPANISH) DEMAND FOR ADVANCED MATERIALS AND DEVICES USED IN SOLAR THERMAL SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	153
Reflector Materials.....	153
<i>TABLE 82 EUROPEAN (SPANISH) DEMAND FOR SOLAR CONCENTRATING MIRRORS, THROUGH 2016 (SQUARE METERS/\$ MILLIONS)</i> .....	154
Solar Selective Coatings.....	154
<i>TABLE 83 EUROPEAN (SPANISH) DEMAND FOR SOLAR SELECTIVE COATINGS, THROUGH 2016 (\$ MILLIONS)</i> .....	154
Solar Trackers.....	155
<i>TABLE 84 EUROPEAN (SPANISH) DEMAND FOR SOLAR TRACKERS, THROUGH 2016 (\$ MILLIONS)</i> .....	155
Stirling Engines.....	155
<i>TABLE 85 EUROPEAN (SPANISH) DEMAND FOR SOLAR STIRLING ENGINES, THROUGH 2016 (UNITS/\$ MILLIONS)</i> .....	155
High Temperature Pumps.....	156
<i>TABLE 86 EUROPEAN (SPANISH) DEMAND FOR HIGH-TEMPERATURE PUMPS, THROUGH 2016 (\$ MILLIONS)</i> .....	156
WIND ENERGY.....	156
PRODUCTION OF WIND TURBINES.....	156
<i>TABLE 87 PROJECTED EUROPEAN WIND TURBINE PRODUCTION, THROUGH 2016 (NUMBER OF UNITS)</i> .....	157
<i>FIGURE 29 TRENDS IN EUROPEAN WIND TURBINE PRODUCTION, 2010-2016 (NUMBER OF UNITS)</i> .....	157
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	157
<i>TABLE 88 EUROPEAN MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN WIND ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	158
Composites.....	158
<i>TABLE 89 EUROPEAN MARKET FOR COMPOSITES USED IN WIND TURBINE ROTOR BLADES, THROUGH 2016 (MILLION METRIC TONS/\$ MILLIONS)</i> .....	159
Power Electronics.....	160

<i>TABLE 90 EUROPEAN MARKET FOR POWER ELECTRONICS USED IN WIND TURBINES, THROUGH 2016 (\$ MILLION)</i> .....	160
Permanent Magnet Generators .....	160
<i>TABLE 91 EUROPEAN MARKET FOR PERMANENT-MAGNET GENERATORS USED IN WIND TURBINES, THROUGH 2016 (\$ MILLIONS)</i> .....	161
GEOTHERMAL ENERGY .....	161
PROJECTED GROWTH .....	161
<i>TABLE 92 ADDITIONS TO EUROPEAN GEOTHERMAL ENERGY CAPACITY, THROUGH 2016 (MW)</i> .....	162
<i>FIGURE 30 PROJECTED GROWTH OF EUROPEAN GEOTHERMAL CAPACITY, 2010-2016 (MW)</i> .....	162
<i>TABLE 93 EUROPEAN INVESTMENTS IN NEW GEOTHERMAL CAPACITY, THROUGH 2016 (\$ MILLIONS)</i> .....	163
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	163
<i>TABLE 94 EUROPEAN MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	163
Calcium Phosphate Well Cement .....	164
<i>TABLE 95 EUROPEAN MARKET FOR CALCIUM PHOSPHATE WELL CEMENT USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	164
Heat Exchanger Tube Coatings .....	164
<i>TABLE 96 EUROPEAN MARKET FOR PPS HEAT EXCHANGER COATINGS USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	165
Other Advanced Materials .....	165
OCEAN ENERGY .....	165
<i>TABLE 97 EUROPEAN MARKET FOR MATERIALS AND DEVICES USED IN OCEAN ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	166
 CHAPTER THIRTEEN: ASIA-PACIFIC MARKETS FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION .....	
SUMMARY .....	167
<i>TABLE 98 ASIA-PACIFIC CONSUMPTION OF ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, THROUGH 2016 (\$ MILLIONS)</i> .....	167
<i>TABLE 98 (CONTINUED)</i> .....	168
<i>FIGURE 31 ASIA-PACIFIC CONSUMPTION OF ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION BY COUNTRY, 2010-2016 (%)</i> .....	169

<i>FIGURE 32 ASIA-PACIFIC CONSUMPTION OF ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, BY RENEWABLE TECHNOLOGY, 2010-2016 (%).....</i>	<i>170</i>
PHOTOVOLTAICS .....	170
PRODUCTION OF PV CELLS.....	170
<i>TABLE 99 ASIA-PACIFIC NATIONS' PV CELL PRODUCTION BY TYPE OF TECHNOLOGY, 2010 (MW).....</i>	<i>171</i>
<i>FIGURE 33 ASIA-PACIFIC PV CELL PRODUCTION BY TECHNOLOGY, 2010 (%/MW).....</i>	<i>172</i>
<i>TABLE 100 PROJECTED ASIA-PACIFIC PV CELL PRODUCTION, THROUGH 2016 (MW).....</i>	<i>173</i>
<i>TABLE 100 (CONTINUED).....</i>	<i>174</i>
<i>FIGURE 34 TRENDS IN ASIA-PACIFIC PV CELL PRODUCTION, 2010-2016 (MW) .....</i>	<i>175</i>
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	175
<i>TABLE 101 ASIA-PACIFIC MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN PV SYSTEMS, THROUGH 2016 (\$ MILLIONS).....</i>	<i>176</i>
Photovoltaic Materials.....	176
<i>TABLE 102 ASIA-PACIFIC PV-RELATED CONSUMPTION OF ADVANCED PHOTOVOLTAIC MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS).....</i>	<i>177</i>
<i>TABLE 102 (CONTINUED).....</i>	<i>178</i>
Crystalline Silicon.....	179
<i>TABLE 103 ASIA-PACIFIC CONSUMPTION OF PV SILICON, THROUGH 2016 (METRIC TONS/\$).....</i>	<i>179</i>
Thin Film Materials.....	180
<i>TABLE 104 ASIA-PACIFIC CONSUMPTION OF THIN-FILM PV MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS) .....</i>	<i>180</i>
<i>TABLE 104 (CONTINUED).....</i>	<i>181</i>
<i>TABLE 104 (CONTINUED).....</i>	<i>182</i>
Silane .....	182
<i>TABLE 105 ASIA-PACIFIC SILANE CONSUMPTION FOR THE PRODUCTION OF A-SI THIN-FILM PVS, THROUGH 2016.....</i>	<i>183</i>
Cadmium Telluride.....	183
<i>TABLE 106 ASIA-PACIFIC CONSUMPTION OF CDTE USED IN THE PRODUCTION OF CDTE THIN-FILM PVS, THROUGH 2016.....</i>	<i>184</i>
CI(G)S .....	184
<i>TABLE 107 ASIA-PACIFIC CONSUMPTION OF CI(G)S USED IN THE PRODUCTION OF CI(G)S THIN-FILM PVS, THROUGH 2016.....</i>	<i>185</i>
Third-Generation Materials .....	185

<i>TABLE 108 ASIA-PACIFIC CONSUMPTION OF THIRD GENERATION PV PRECURSOR MATERIALS, THROUGH 2016 (METRIC TONS/MILLION \$)</i> .....	186
Multi-Junction Materials .....	186
<i>TABLE 109 ASIA-PACIFIC CONSUMPTION OF MULTI-JUNCTION PV MATERIALS, THROUGH 2016</i> .....	187
Other Third Generation Materials.....	187
<i>TABLE 110 ASIA-PACIFIC CONSUMPTION OF OTHER THIRD GENERATION PV MATERIALS, THROUGH 2016 (METRIC TONS/MILLION \$)</i> .....	188
Photovoltaic Inverters .....	188
<i>TABLE 111 ASIA-PACIFIC MARKET FOR PV INVERTERS, THROUGH 2016 (\$ MILLIONS)</i> .....	189
SOLAR THERMAL POWER .....	189
TOTAL PROJECT EXPENDITURES .....	189
<i>TABLE 112 ASIA-PACIFIC CAPITAL EXPENDITURES ON SOLAR THERMAL POWER PROJECTS, THROUGH 2016 (\$ MILLIONS)</i> .....	190
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	190
<i>TABLE 113 ASIA-PACIFIC DEMAND FOR ADVANCED MATERIALS AND DEVICES USED IN SOLAR THERMAL SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	191
Reflector Materials .....	191
<i>TABLE 114 ASIA-PACIFIC DEMAND FOR SOLAR CONCENTRATING MIRRORS, THROUGH 2016 (SQUARE METERS/\$ MILLIONS)</i> .....	192
Solar Selective Coatings.....	192
<i>TABLE 115 ASIA-PACIFIC DEMAND FOR SOLAR SELECTIVE COATINGS, THROUGH 2016 (SQ. METERS/\$ MILLIONS)</i> .....	193
Solar Trackers.....	193
<i>TABLE 116 ASIA-PACIFIC DEMAND FOR SOLAR TRACKERS, THROUGH 2016 (\$ MILLIONS)</i> .....	193
Stirling Engines.....	194
High Temperature Pumps.....	194
<i>TABLE 117 ASIA-PACIFIC DEMAND FOR HIGH-TEMPERATURE PUMPS, THROUGH 2016 (\$ MILLIONS)</i> .....	194
Other/Miscellaneous Materials .....	194
<i>TABLE 118 ASIA-PACIFIC DEMAND FOR OTHER/MISCELLANEOUS ADVANCED MATERIALS AND DEVICES USED IN SOLAR THERMAL GENERATING PLANTS, THROUGH 2016 (\$ MILLIONS)</i> .....	195
WIND ENERGY.....	195
PRODUCTION OF WIND TURBINES.....	195
<i>TABLE 119 ASIA-PACIFIC WIND TURBINE PRODUCTION, THROUGH 2016 (NUMBER OF UNITS)</i> .....	195

<i>FIGURE 35 TRENDS IN ASIA-PACIFIC WIND TURBINE PRODUCTION, 2010–2016 (NUMBER OF UNITS)</i> .....	196
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	196
<i>TABLE 120 ASIA-PACIFIC MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN WIND ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	197
Composites .....	197
<i>TABLE 121 ASIA-PACIFIC MARKET FOR COMPOSITES USED IN WIND TURBINE ROTOR BLADES, THROUGH 2016 (MILLION METRIC TONS/\$ MILLION)</i> .....	197
Power Electronics .....	198
<i>TABLE 122 ASIA-PACIFIC MARKET FOR POWER ELECTRONICS USED IN WIND TURBINES, THROUGH 2016 (UNITS/\$ MILLIONS)</i> .....	198
Permanent Magnet Generators .....	199
<i>TABLE 123 ASIA-PACIFIC MARKET FOR PERMANENT-MAGNET GENERATORS USED IN WIND TURBINES, THROUGH 2016 (UNITS/\$ MILLIONS)</i> .....	199
SMALL HYDROPOWER .....	199
ADDITIONS TO SMALL HYDROPOWER CAPACITY.....	199
<i>TABLE 124 ANNUAL ADDITIONS TO ASIA-PACIFIC INSTALLED SMALL HYDRO CAPACITY, THROUGH 2016 (MW)</i> .....	200
<i>FIGURE 36 ANNUAL ADDITIONS TO ASIA-PACIFIC INSTALLED SMALL HYDRO CAPACITY, 2010-2016 (MW)</i> .....	200
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	201
<i>TABLE 125 ASIA-PACIFIC DEMAND FOR ADVANCED MATERIALS AND DEVICES USED SMALL HYDROPOWER SYSTEMS, THROUGH 2016 (UNITS/\$ MILLIONS)</i> .....	201
Composites .....	202
<i>TABLE 126 ANNUAL ADDITIONS TO ASIA-PACIFIC INSTALLED MICRO-PICO- HYDRO CAPACITY, THROUGH 2016 (MW)</i> .....	202
<i>TABLE 127 ASIA-PACIFIC CONSUMPTION OF COMPOSITES IN MICRO- HYDRO EQUIPMENT, THROUGH 2016 (TONS/\$ MILLIONS)</i> .....	203
Advanced Pico Turbines .....	203
<i>TABLE 128 CONSUMPTION OF COMPOSITES IN MICRO- HYDRO EQUIPMENT, THROUGH 2016 (UNITS/\$ MILLIONS)</i> .....	204
Coanda Screens.....	204
<i>TABLE 129 ASIA-PACIFIC MARKET FOR COANDA SCREENS IN SMALL HYDRO PROJECTS, THROUGH 2016 (UNITS/\$ MILLIONS)</i> ....	205
GEOTHERMAL ENERGY .....	205

<i>TABLE 130 ADDITIONS TO ASIA-PACIFIC GEOTHERMAL ENERGY CAPACITY, THROUGH 2016 (MW)</i> .....	206
<i>FIGURE 37 PROJECTED GROWTH OF ASIA-PACIFIC GEOTHERMAL CAPACITY, 2010-2016 (MW)</i> .....	206
<i>TABLE 131 ASIA-PACIFIC INVESTMENTS IN NEW GEOTHERMAL CAPACITY, THROUGH 2016 (\$ MILLIONS)</i> .....	207
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	207
<i>TABLE 132 ASIA-PACIFIC MARKET FOR ADVANCED MATERIALS AND DEVICES USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	207
Calcium Phosphate Well Cement .....	208
<i>TABLE 133 ASIA-PACIFIC MARKET FOR CALCIUM PHOSPHATE WELL CEMENT USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$MILLIONS)</i> .....	208
Heat Exchanger Tube Coatings .....	208
<i>TABLE 134 ASIA-PACIFIC MARKET FOR PPS HEAT EXCHANGER COATINGS USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	209
Other Advanced Materials .....	209
Ocean Energy .....	209
<i>TABLE 135 ASIA-PACIFIC MARKET FOR MATERIALS AND DEVICES USED IN OCEAN ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	210
 CHAPTER FOURTEEN: EMERGING MARKETS FOR ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION .....	
SUMMARY.....	211
<i>TABLE 136 EMERGING MARKET COUNTRIES' CONSUMPTION OF ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION (\$ MILLIONS)</i> .....	211
<i>FIGURE 38 EMERGING MARKET COUNTRIES' CONSUMPTION OF ADVANCED MATERIALS AND DEVICES USED IN RENEWABLE ENERGY PRODUCTION, BY TYPE OF RENEWABLE ENERGY, 2010-2016 (%)</i> .....	212
PHOTOVOLTAICS .....	212
PRODUCTION OF PHOTOVOLTAICS.....	212
<i>TABLE 137 PV CELL PRODUCTION IN EMERGING MARKET COUNTRIES, THROUGH 2016 (MW)</i> .....	213
<i>FIGURE 39 PV CELL PRODUCTION TRENDS IN EMERGING MARKET COUNTRIES, 2010-2016 (MW)</i> .....	213
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	214

<i>TABLE 138 EMERGING MARKET COUNTRY MARKETS FOR ADVANCED MATERIALS AND DEVICES USED IN PV SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	214
Photovoltaic Materials.....	214
<i>TABLE 139 EMERGING MARKET COUNTRIES' CONSUMPTION OF PHOTOVOLTAIC MATERIALS, THROUGH 2016 (METRIC TONS/\$ MILLIONS)</i> .....	214
INVERTERS .....	214
<i>TABLE 140 EMERGING MARKET COUNTRIES MARKET FOR PV INVERTERS, -THROUGH 2016 (\$ MILLIONS)</i> .....	215
SOLAR THERMAL POWER .....	215
TOTAL PROJECT EXPENDITURES .....	215
<i>TABLE 141 EMERGING MARKET COUNTRIES' CAPITAL EXPENDITURES ON SOLAR THERMAL POWER PROJECTS, THROUGH 2016 (\$ MILLIONS)</i> .....	216
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	216
<i>TABLE 142 EMERGING MARKET COUNTRIES' DEMAND FOR ADVANCED MATERIALS AND DEVICES USED IN SOLAR THERMAL SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	217
Reflector Materials .....	217
<i>TABLE 143 EMERGING MARKET COUNTRIES' DEMAND FOR SOLAR CONCENTRATING MIRRORS, THROUGH 2016 (SQUARE METERS/\$ MILLIONS)</i> .....	217
Solar Selective Coatings .....	218
<i>TABLE 144 EMERGING MARKET COUNTRIES' DEMAND FOR SOLAR SELECTIVE COATINGS, THROUGH 2016 (\$ MILLIONS)</i> .....	218
Solar Trackers.....	218
<i>TABLE 145 EMERGING MARKET COUNTRIES' DEMAND FOR SOLAR TRACKERS, THROUGH 2016 (\$ MILLIONS)</i> .....	218
Stirling Engines.....	219
High Temperature Pumps.....	219
Other/Miscellaneous Materials.....	219
GEOTHERMAL ENERGY .....	219
<i>TABLE 146 ADDITIONS TO EMERGING MARKET COUNTRIES' GEOTHERMAL ENERGY CAPACITY, THROUGH 2016 (MW)</i> .....	220
<i>FIGURE 40 PROJECTED GROWTH OF EMERGING MARKET COUNTRIES' GEOTHERMAL CAPACITY, 2010-2016 (MW)</i> .....	220
<i>TABLE 147 EMERGING MARKET COUNTRIES' INVESTMENTS IN NEW GEOTHERMAL CAPACITY, THROUGH 2016 (\$ MILLIONS)</i> .....	221
CONSUMPTION OF ADVANCED MATERIALS AND DEVICES.....	221

<i>TABLE 148 EMERGING MARKET COUNTRIES DEMAND FOR ADVANCED MATERIALS AND DEVICES USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	221
Calcium Phosphate Well Cement .....	222
<i>TABLE 149 EMERGING MARKET COUNTRIES MARKET FOR CALCIUM PHOSPHATE WELL CEMENT USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	222
Heat Exchanger Tube Coatings .....	222
<i>TABLE 150 EMERGING MARKET COUNTRIES MARKET FOR PPS HEAT EXCHANGER COATINGS USED IN GEOTHERMAL ENERGY SYSTEMS, THROUGH 2016 (\$ MILLIONS)</i> .....	223
Other Advanced Materials .....	223
 CHAPTER FIFTEEN VENDOR PROFILES .....	 224
ANTEC SOLAR ENERGY AG.....	224
THE BOEING COMPANY .....	224
BP SOLAR INTERNATIONAL LLC.....	225
CENTROSOLAR GLAS GMBH .....	225
CONERGY AG .....	226
DAYSTAR TECHNOLOGIES, INC. ....	226
DOW CORNING CORP. ....	227
ELKEM ASA .....	228
EMCORE CORP.....	228
ENERCON GMBH.....	228
EVERGREEN SOLAR.....	229
FIRST SOLAR LLC .....	230
FLAGSOL GMBH .....	230
G24 INNOVATIONS, LTD. ....	231
GAMESA .....	231
GE ENERGY .....	232
HELIOVOLT CORP.....	232
INABENSA SA.....	233
INFINIA CORP.....	233
INNOVALIGHT, INC. ....	233
ISOFOTON, SA.....	234
JX CRYSTALS .....	234
KONARKA TECHNOLOGIES, INC. ....	235
KYOCERA SOLAR, INC. ....	235
MARINE CURRENT TURBINES LTD. ....	236
PANASONIC ELECTRIC WORKS, LTD .....	236
MEMC ELECTRONIC MATERIALS.....	236
MIASOLE.....	237
MITSUBISHI HEAVY INDUSTRIES.....	238
NANOSOLAR, INC.....	238
NANOSYS INC. ....	238

NORDEX SE .....	239
OCEAN THERMAL ENERGY CORP.....	240
PELAMIS WAVE POWER LTD.....	240
Q-CELLS AG .....	241
REC SILICON.....	241
REPOWER SYSTEMS AG .....	242
SANYO ELECTRIC CO., LTD. ....	243
SATCON APPLIED TECHNOLOGY CORP. ....	243
SCHOTT AG.....	244
SHARP CORP. ....	244
SOLAICX.....	245
SOLARGENIX ENERGY LLC .....	245
SOLARWORLD AG .....	246
STIRLING ENERGY SYSTEMS INC.....	246
SUNPOWER CORP. ....	246
UNITED SOLAR OVONIC LLC .....	247
VESTAS WIND SYSTEMS A/S.....	247
WACKER-CHEMIE AG.....	248
WÜRTH SOLAR .....	248