



Wind Turbines: *Technologies, Applications and Global Markets*

January 2018

Sanjana Gupta

Report Code: EGY058C

Table of Contents

- Chapter 1: Introduction 1**
- Study Goals and Objectives 1
- Reasons for Doing This Study..... 1
- Intended Audience 2
- Scope of Report..... 2
- Information Sources 3
- Methodology..... 3
- Geographic Breakdown 3
- Analyst’s Credentials 10
- Related BCC Research Reports..... 10
- Chapter 2: Summary and Highlights 12**
- Chapter 3: Market and Technology Background 15**
- Quick Facts About Wind Energy 15
- History of Wind Turbines 15
- Current Records in Wind Turbine Industry 16
- Are There Good Wind Resources? 17
- Is Wind Energy Good for the Economy? 17
- Is the Cost of Wind Power Competitive with Conventional Power Plants? 17
- Basis of Cost of Wind Energy Projects 18
- Wind Energy Project Costs..... 19
- Can Homeowners Sell Excess Electricity to the Utility?..... 19
- Wind Energy Present 19
- Wind Energy Future..... 20
- Development of the Industry..... 21
- Increased Interest in Renewable Sources of Energy 21
- Heightened Concern About Carbon Emissions 21
- Industry Adolescence 22
- Advantages of Wind Energy..... 23
- Disadvantages of Wind Energy 23
- Improving Turbine Efficiencies..... 24
- Improved Turbine Efficiencies Through Design Innovations 25
- Improved Turbine Efficiencies Using Carbon Fiber 25
- Wind Project Development Steps 26
- Certification and Testing of Wind Turbines 27
- Cost of Producing Wind Energy..... 27
- Types of Applications..... 28
 - Wind Turbine Applications – On Grid and Off Grid 28
- Types of Technologies 30
 - Types of Wind Turbines Based on Design 30
- Wind Turbine Market by Type 34
 - Utilities 34
 - Investor-owned Utilities..... 35
 - Public Power Utilities 35
 - Rural Electric Cooperatives 35
- Wind Turbine Market by Installation 35
 - Onshore Wind Turbines 35

Offshore Wind Turbines	36
Offshore Wind Projects	39
Comparison Between Onshore and Offshore Turbines	39
Developmental Hurdles for Offshore Turbines	41
Industry Structure	41
Manufacturers	41
Developers	41
Owners	41
Power Purchasers	42
Wind Turbine Components	42
Subcomponent Breakdown	42
Chapter 4: Market Breakdown by Region and Other Segments	67
Global Wind Turbine Market by Region	67
Asia-Pacific Market Analysis	70
North American Market Analysis	73
European Market Analysis	75
ROW Market Analysis	79
Global Wind Turbine Market by Technology	81
Global Wind Turbine Market by Installation	83
Global Wind Turbine Market by Application	90
Global Wind Turbine Market by Type	91
Chapter 5: Market Breakdown by Component	95
Global Wind Turbine Component Market by Region	95
Asia-Pacific Market Analysis	97
North American Market Analysis	98
European Market Analysis	98
ROW Market Analysis	98
Global Wind Tower Market by Region	99
Asia-Pacific Tower Market Analysis	101
North American Tower Market Analysis	102
European Tower Market Analysis	102
ROW Tower Market Analysis	102
Global Wind Turbine Rotor Blade Market by Region	103
Asia-Pacific Rotor Blade Market Analysis	105
North American Rotor Blade Market Analysis	106
European Rotor Blade Market Analysis	106
ROW Rotor Blade Market Analysis	106
Global Wind Turbine Gearbox Market by Region	107
Asia-Pacific Gearbox Market Analysis	109
North American Gearbox Market Analysis	110
European Gearbox Market Analysis	110
ROW Gearbox Market Analysis	110
Global Wind Turbine Generator Market by Region	111
Asia-Pacific Generator Market Analysis	113
North American Generator Market Analysis	114
European Generator Market Analysis	114
ROW Generator Market Analysis	114

Chapter 6: Competitive Landscape	117
Product Portfolio Analysis.....	117
Market Share Analysis	118
New Product Launches	120
Mergers and Acquisitions	121
Porter’s Five Forces Analysis and Supply Chain Analysis of Wind Turbine	129
Porter’s Five Forces Analysis	129
Threat of New Entrants.....	129
Threat of Substitutes.....	129
Supplier Power.....	129
Buyer Power	129
Competitive Rivalry.....	130
Supply Chain Analysis of Wind Turbine.....	132
Government Regulations, Incentives, and Technological Issues for Wind Industry	133
Incentives for Wind Energy	133
Permits and Legal Aspects.....	133
Ecological Impact of Wind Turbines.....	134
Production Tax Credit	135
Government Incentives for Construction of New Renewable Sources of Energy	136
Significance of Patents	136
Wind Turbine and Component Technology Issues	137
Chapter 7: Company Profiles	142
About BCC Research	208
About BCC Research	209
BCC Membership.....	209
BCC Custom Research.....	209

List of Tables

Summary Table: Global Wind Turbine Market Volume, by Region, Through 2022 (MW)	13
Table 1 Current Records in Wind Turbine Industry	16
Table 2 Global Wind Energy Industry and Its Attributes	20
Table 3 Subcomponent Breakdown	43
Table 4 Weights of Turbine Components for Various Vestas Turbines	57
Table 5 Global Wind Turbine Market Value, by Region, Through 2022 (\$ Millions).....	68
Table 6 Global Wind Turbine Market Volume, by Region, Through 2022 (MW).....	69
Table 7 Asia-Pacific Installed Wind Power Capacity, by Country, 2016 (MW).....	70
Table 8 North American Installed Wind Power Capacity, by Country, 2016 (MW)	73
Table 9 European Installed Wind Power Capacity, by Country, 2016 (MW)	75
Table 10 ROW Installed Wind Power Capacity, by Country, 2016 (MW)	79
Table 11 Global Wind Turbine Market Value, by Technology, Through 2022 (\$ Millions).....	81
Table 12 Global Wind Turbine Market Volume, by Technology, Through 2022 (MW).....	82
Table 13 Global Wind Turbine Market Value, by Installation, Through 2022 (\$ Millions)	83
Table 14 Global Wind Turbine Market Volume, by Installation, 2016–2022 (MW).....	84
Table 15 Global Onshore Wind Turbine Market Value, by Region, Through 2022 (\$ Millions).....	86
Table 16 Global Onshore Wind Turbine Market Volume, by Region, Through 2022 (MW).....	87
Table 17 Global Offshore Wind Turbine Market Value, by Region, Through 2022 (\$ Millions)	88
Table 18 Global Offshore Wind Turbine Market Volume, by Region, Through 2022 (MW).....	89
Table 19 Global Wind Turbine Market Value, by Application, Through 2022 (\$ Millions)	90
Table 20 Global Wind Turbine Market Volume, by Application, Through 2022 (MW).....	91
Table 21 Global Wind Turbine Market Value, by Type, Through 2022 (\$ Millions)	92
Table 22 Global Wind Turbine Market Volume, by Type, Through 2022 (MW)	93
Table 23 Global Wind Turbine Component Market Value, by Region, Through 2022 (\$ Millions).....	95
Table 24 Global Wind Turbine Component Market Volume, by Region, Through 2022 (MW).....	96
Table 25 Asia-Pacific Wind Turbine Component Market, Through 2022 (\$ Millions and MW).....	97
Table 26 North American Wind Turbine Component Market, Through 2022 (\$ Millions and MW)	98
Table 27 European Wind Turbine Component Market, Through 2022 (\$ Millions and MW)	98
Table 28 ROW Wind Turbine Component Market, Through 2022 (\$ Millions and MW)	99
Table 29 Global Wind Tower Market Value, by Region, Through 2022 (\$ Millions).....	99
Table 30 Global Wind Tower Market Volume, by Region, Through 2022 (MW)	100
Table 31 Asia-Pacific Wind Tower Market, Through 2022 (\$ Millions and MW)	101
Table 32 North American Wind Tower Market, Through 2022 (\$ Millions and MW).....	102
Table 33 European Wind Tower Market, Through 2022 (\$ Millions and MW).....	102
Table 34 ROW Wind Tower Market, Through 2022 (\$ Millions and MW)	103
Table 35 Global Wind Turbine Rotor Blade Market Value, by Region, Through 2022 (\$ Millions).....	103
Table 36 Global Wind Turbine Rotor Blade Market Volume, by Region, Through 2022 (MW).....	104
Table 37 Asia-Pacific Wind Turbine Rotor Blade Market, 2016–2022 (\$ Millions and MW).....	105
Table 38 North American Wind Turbine Rotor Blade Market, Through 2022 (\$ Millions and MW)	106
Table 39 European Wind Turbine Rotor Blade Market, Through 2022 (\$ Millions and MW)	106
Table 40 ROW Wind Turbine Rotor Blade Market, Through 2022 (\$ Millions and MW)	107
Table 41 Global Wind Turbine Gearbox Market Value, by Region, Through 2022 (\$ Millions).....	107
Table 42 Global Wind Turbine Gearbox Market Volume, by Region, Through 2022 (MW).....	108
Table 43 Asia-Pacific Wind Turbine Gearbox Market, Through 2022 (\$ Millions and MW).....	109
Table 44 North American Wind Turbine Gearbox Market, Through 2022 (\$ Millions and MW).....	110
Table 45 European Wind Turbine Gearbox Market, Through 2022 (\$ Millions and MW)	110
Table 46 ROW Wind Turbine Gearbox Market, Through 2022 (\$ Millions and MW)	111

Table 47 Global Wind Turbine Generator Market Value, by Region, Through 2022 (\$ Millions)	111
Table 48 Global Wind Turbine Generator Market Volume, by Region, Through 2022 (MW)	112
Table 49 Asia-Pacific Wind Turbine Generator Market, Through 2022 (\$ Millions and MW)	113
Table 50 North American Wind Turbine Generator Market, Through 2022 (\$ Millions and MW)	114
Table 51 European Wind Turbine Generator Market, Through 2022 (\$ Millions and MW)	114
Table 52 ROW Wind Turbine Generator Market, Through 2022 (\$ Millions and MW)	115
Table 53 Product Portfolio Analysis	117
Table 54 Global Wind Turbine Top Players Market Share in Value, 2016 (\$ Billions)	118
Table 55 Global Turbine Top Players Market Share in Volume, 2016 (GW)	119
Table 56 New Launches in Wind Turbine Industry	120
Table 57 Mergers and Acquisitions in Wind Industry, 2016 and 2017	121

List of Figures

Summary Figure: Global Wind Turbine Market Volume, by Region, 2016-2022 (MW).....	13
Figure 1 Cost of Wind-generated Electricity, 1995–2018 (\$/MWh).....	28
Figure 2 Off-grid Wind Turbines.....	29
Figure 3 On-grid Wind Turbines.....	30
Figure 4 Horizontal-axis and Vertical-axis Wind Turbines.....	31
Figure 5 Downwind Machine.....	32
Figure 6 Vertical-axis Wind Turbine.....	33
Figure 7 Onshore Wind Turbine.....	36
Figure 8 Offshore Wind Turbine.....	37
Figure 9 Standard Blade Lengths for Various Turbine Capacities (m/MW).....	45
Figure 10 Effect of Blade Length on the Weight of a Blade (lb./m).....	46
Figure 11 Blade Design with Rectangular Spar.....	47
Figure 12 Blade Design Where Blade Surfaces Work as Structural Shells.....	48
Figure 13 Tower Manufacturing.....	50
Figure 14 Wind Tower.....	51
Figure 15 Wind Lattice Tower.....	52
Figure 16 Wind Tubular Steel Tower.....	53
Figure 17 Wind Concrete Tower.....	54
Figure 18 Wind Guyed Tower.....	55
Figure 19 Wind Hybrid Tower.....	56
Figure 20 Nacelle of Wind Turbine.....	57
Figure 21 Hub of Wind Turbine.....	60
Figure 22 Gearbox of Wind Turbine.....	61
Figure 23 Generator of Wind Turbine.....	62
Figure 24 Global Wind Turbine Market Value, by Region, 2016–2022 (\$ Millions).....	68
Figure 25 Global Wind Turbine Market Volume, by Region, 2016–2022 (MW).....	69
Figure 26 Global Wind Turbine Market Value, by Technology, 2016–2022 (\$ Millions).....	82
Figure 27 Global Wind Turbine Market Volume, by Technology, 2016–2022 (MW).....	83
Figure 28 Global Wind Turbine Market Value, by Installation, 2016–2022 (\$ Millions).....	84
Figure 29 Global Wind Turbine Market Volume, by Installation, 2016–2022 (MW).....	85
Figure 30 Global Onshore Wind Turbine Market Value, by Region, 2016–2022 (\$ Millions).....	86
Figure 31 Global Onshore Wind Turbine Market Volume, by Region, 2016–2022 (MW).....	87
Figure 32 Global Offshore Wind Turbine Market Value, by Region, 2016–2022 (\$ Millions).....	88
Figure 33 Global Offshore Wind Turbine Market Volume, by Region, 2016–2022 (MW).....	89
Figure 34 Global Wind Turbine Market Value, by Application, 2016–2022 (\$ Millions).....	90
Figure 35 Global Wind Turbine Market Volume, by Application, 2016–2022 (MW).....	91
Figure 36 Global Wind Turbine Market Value, by Type, 2016–2022 (\$ Millions).....	92
Figure 37 Global Wind Turbine Market Volume, by Type, 2016–2022 (MW).....	93
Figure 38 Global Wind Turbine Component Market Value, by Region, 2016–2022 (\$ Millions).....	96
Figure 39 Global Wind Turbine Component Market Volume, by Region, 2016–2022 (MW).....	97
Figure 40 Global Wind Tower Market Value, by Region, 2016–2022 (\$ Millions).....	100
Figure 41 Global Wind Tower Market Volume, by Region, 2016–2022 (MW).....	101
Figure 42 Global Wind Turbine Rotor Blade Market Value, by Region, 2016–2022 (\$ Millions).....	104
Figure 43 Global Wind Turbine Rotor Blade Market Volume, by Region, 2016–2022 (MW).....	105
Figure 44 Global Wind Turbine Gearbox Market Value, by Region, 2016–2022 (\$ Millions).....	108
Figure 45 Global Wind Turbine Gearbox Market Volume, by Region, 2016–2022 (MW).....	109
Figure 46 Global Wind Turbine Generator Market Value, by Region, 2016–2022 (\$ Millions).....	112

Figure 47 Global Wind Turbine Generator Market Volume, by Region, 2016–2022 (MW)	113
Figure 48 Global Wind Turbine Top Players Market Share in Value, 2016 (%)	119
Figure 49 Porter’s Five Forces Analysis of Wind Turbine	131
Figure 50 Supply Chain Analysis of Wind Turbine	132



About BCC Research

About BCC Research

With our unparalleled 45-year history, BCC Research provides comprehensive analysis of global market sizing, forecasting and industry intelligence, covering markets where advances in science and technology are improving the quality, standard and sustainability of businesses, economies and lives.

BCC Membership

From market sizing and forecasts, to opportunity assessments and competitive analyses, our ever-expanding library gives you the data, insights and intelligence required to ensure your project is a success. Members benefit from ongoing, unlimited access to the category or collections of their choice, and most membership packages pay for themselves within two to three reports being accessed.

Did you buy this report? You may qualify to apply your purchase price towards a full membership. Call 866/285-7215 or email info@bccresearch.com to request a demo.

BCC Custom Research

Our experts provide custom research projects to those working to identify new markets, introduce new products, validate existing market share, analyze competition and assess the potential for products to impact existing markets. With impressive academic credentials and broad and deep knowledge of global industrial markets, our independent analysts and consultants develop the facts, figures, analysis and assessments to inform the decisions that will move your company ahead. Confidential inquiries to: custom@bccresearch.com or 781/205-2429.

DISCLAIMER

The information developed in this report is intended to be as reliable as possible at the time of publication and is of a professional nature. This information does not constitute managerial, legal or accounting advice, nor should it be considered as a corporate policy guide, laboratory manual or an endorsement of any product, as much of the information is speculative in nature. BCC Research and the author assume no responsibility for any loss or damage that might result from reliance on the reported information or from its use.

ISBN: 978-1-62296-626-4
January 2018