

VISIBLE LIGHT COMMUNICATION (VLC)/Li-Fi TECHNOLOGY & FREE SPACE OPTICS (FSO) MARKET (2013 – 2018)

By Component (LED, IR Emitters Image Sensor, Opto-couplers), Application (Indoor Networking, Underwater Communication, Location Based Service, ITS) & Geography

[Report Description](#)

[Table of Contents](#)

[List of Tables](#)

[Sample Tables](#)

[Related Reports](#)

[About Markets and Markets](#)



MarketsandMarkets

TX, Dallas North - Dominion Plaza,
17304, Preston Road,
Suite 800, Dallas 75252.

Tel. No.: 1-888-600-6441

Email: sales@marketsandmarkets.com



MARKETSANDMARKETS

Report Description

Key Take-Aways

- Visible Light Communication (VLC/Li-Fi) market statistics with detailed classifications and split-ups by revenue
- FSO market segmentation by application and by geography
- FSO applications analysis and market forecasting of each application
- VLC/Li-Fi R&D trends, and the major regions involved in such developments
- Impact analysis of the market dynamics with factors currently driving and restraining the growth of the VLC/Li-Fi market, along with their impact in the short, medium, and long term landscapes
- To Identify and analyze the burning issues and winning imperatives of the VLC/Li-Fi market
- Extensive global and individual market estimates and forecasts with growth rates, CAGRs, and detailed analysis
- Illustrative segmentation, analysis, and forecast of the major geographical markets to give an overall view of the market
- VLC/Li-Fi market size and revenue in 2012 and forecasts till 2018 with growth rates, CAGRs, and detailed analysis
- Detailed segmentation of VLC/Li-Fi market by components, applications, and geographies
- Identifying segments with high growth potential; also understanding the future application segments
- Key trends related to the product technology, prices, and applications that shape and influence the wireless communication market
- Gain competitive intelligence from the company profiles, competitive landscape, and market share analysis, devise revenue-growth strategies from the market size and forecast statistics

Report Description

This report describes optical wireless communication technologies that are already commercialized and technologies that are going to penetrate the market in the next few years. The report covers commercialized FSO technology and the emerging VLC/Li-Fi technology. The report is mainly focused on the visible light communication technology, with small coverage to FSO technology. This report presents the revenue forecast of VLC/Li-Fi and FSO for the period of 2013 to 2018.

This report describes the market dynamics of the VLC/Li-Fi market, which includes drivers and restraints of the market and their impact on the market for the next 5 years. Within market dynamics, this report also identifies the opportunities of visible light communication technology in a number of applications.

This report segments the VLC/Li-Fi market by components, by applications, and by geographies. Within this segmentation, each component type has been forecasted. The forecasting of applications has been provided with respect to each region.

The market is segmented into four major geographical regions: North America; Europe; Asia-Pacific (APAC); and Rest of the World (ROW), which include Middle East and Africa. The current and future trends for each region have been analyzed in this report. Porter's five-force model and competitive landscaping are also included in the report.

Markets Covered

In this report, optical wireless communication technology - VLC is considered as a part of Li-Fi technology. VLC/Li-Fi market is further segmented based on components, applications and geographies.

VLC/Li-Fi market by components:

- LED
- *LED Lamp*
- *White LED*
- *RGB LED*
- Infrared emitter
- Opto-coupler
- Image sensor

Report Description

VLC/Li-Fi market by application:

- Intelligent traffic management system (ITS)
 - *Advanced traffic management system*
 - *Advanced traveler information system*
 - *Advanced public transportation system*
- Indoor networking system
- In-flight entertainment and communication
- Underwater communication
- Location based services (LBS)
 - *Location based advertisement*
 - *Location based shopping*
 - *Location based social networking*
 - *Location based search*
 - *Navigation*

VLC/Li-Fi market by geography:

- North America
- Europe
- Asia-Pacific (APAC)
- Rest of the world (ROW)

The report also gives market forecast of FSO market for the period 2013 to 2018. The FSO market is segmented based on its applications as follow:

On the basis of organization size:

- Enterprise Application
 - *Enterprise connectivity*
 - *Healthcare*
 - *Engineering and design*
 - *Security*
- Mobile carrier backhaul
- Military

Stakeholders

The intended audience of this report includes:

- Research Institutes
- Research organizations/centers
- VLC Consortiums
- Optical wireless communication technology providers
- Network providers
- Smart home/city service providers
- LED manufacturers
- Original equipment manufacturers (OEMs)
- System Integrators
- Electronic device (mobile, TV, Laptop, PDA, tablets, notebooks etc.) manufacturers
- VLC technology providers

Research Methodology

We have used various secondary sources, directories, and databases such as Factiva and OneSource to identify and collect extensive technical and commercial information to study the VLC/Li-Fi and FSO market. The primary sources – experts from related industries, researchers and preferred suppliers have been interviewed to obtain and verify critical information as well as assess the future prospects. The following illustrative table shows the market research methodology applied in making this report on “VLC/Li-Fi and FSO market”.

Table of Contents

1. Introduction	21
1.1 Key Take-aways	21
1.2 Report Description	22
1.3 Markets Covered	22
1.4 Stakeholders	24
1.5 Research Methodology	25
1.5.1 Market size	26
1.5.2 Key data points from secondary sources	28
1.5.3 Key data points from primary sources	28
1.5.4 Assumptions made for this report	28
1.5.5 List of companies covered during the report	30
2. Executive Summary	31
3. Market Overview	34
3.1 Market Definition	35
3.2 Visible Light Communication (VLC) Concept	36
3.2.1 Roadmap to VLC	42
3.3 Market Dynamics	45
3.3.1 Drivers	45
3.3.1.1 Last mile connectivity	46
3.3.1.2 Power-efficient	47
3.3.1.3 Increasing government funding	49
3.3.1.4 Ultra-fast data transfer	50
3.3.2 Restraints	51
3.3.2.1 High installation cost	51
3.3.2.2 Lack of technology awareness	52
3.3.2.3 Competing technologies	52
3.3.3 Opportunities	53
3.3.3.1 Growing led industry	53
3.3.3.2 Penetration of VLC in advanced applications	54
3.3.3.2.1 Internet of things (IOT) and machine-to-machine communication (M2M)	56
3.3.3.2.2 Smart city	57
3.3.3.2.3 Wireless sensor network (WSN)	60
3.4 Burning Issue	62
3.4.1 Network Coverage and Dependency	62
3.5 Winning Imperative	62
3.5.1 Large Scale Implementation of VLC	62
3.6 Value Chain Analysis	63
3.7 Cash Cow for VLC Technology	64
3.8 Technology Life Cycle	67
3.9 Porter's Five Force Model	68

Table of Contents

3.9.1	Degree of competition	69
3.9.2	Buyers' power	69
3.9.3	Suppliers' power	69
3.9.4	Threat from substitutes	69
3.9.5	Threat from new entrants	69
3.10	Recent Activities in VLC Market	70
3.10.1	Lifi consortium	70
3.10.1.1	<i>Li-Fi objectives</i>	70
3.10.2	Ronja	71
3.10.2.1	<i>Ronja device</i>	72
3.10.3	D-light (data light) project	73
3.10.3.1	<i>Technology background</i>	73
3.10.3.2	<i>Environmental benefits</i>	74
3.10.3.3	<i>Commercial and technical features</i>	74
3.10.3.4	<i>Applications</i>	75
3.10.4	Omega Event	75

4. Optical Wireless Communication Technology 77

4.1	Introduction	78
4.2	Li-fi Technology	78
4.2.1	Visible light communication (VLC)	79
4.2.1.1	<i>Some of the VLC projects</i>	80
4.2.2	Working principle of VLC technology	81
4.3	Free Space Optics (FSO) Concept	84
4.3.1	History and evolution	85
4.3.1.1	<i>IrDA</i>	85
4.3.1.2	<i>Ronja</i>	86
4.3.2	Working principle	87
4.3.3	Advantages and limitations of FSO	89
4.4	Free Space Optics Market Forecast	90
4.4.1	Free space optics market forecast, by applications	91
4.4.1.1	<i>Enterprise application</i>	92
4.4.1.1.1	<i>Enterprise connectivity</i>	94
4.4.1.1.2	<i>Health care</i>	95
4.4.1.1.3	<i>Engineering and design services</i>	97
4.4.1.1.4	<i>Security</i>	98
4.4.1.2	<i>Mobile carrier backhaul</i>	101
4.4.1.3	<i>Military applications</i>	103
4.4.1.3.1	<i>Detection</i>	103
4.4.1.3.2	<i>Interception</i>	104
4.4.1.4	<i>Other Applications</i>	105

Table of Contents

4.4.1.4.1	Redundant link and disaster recovery	105
4.4.1.4.2	Storage area network	106
4.4.1.4.3	Last mile access	106
4.4.1.4.4	Metropolitan Area Network (MAN)	106
4.4.2	Free space optics market forecast, by geography	106
4.4.2.1	North America	106
4.4.2.2	Europe	107
4.4.2.3	APAC	109
4.4.2.4	ROW	110

5. Visible Light Communication Market, by Component 111

5.1	Introduction	112
5.2	LED	113
5.2.1	History	114
5.2.2	Working	115
5.2.3	LED lamps	117
5.2.3.1	White LEDs	119
5.2.3.2	RGB LEDs	119
5.3	Infrared Emitters	120
5.3.1	ALGAAS IR LED	120
5.3.2	GAAS LED	121
5.4	Opto-Couplers	122
5.5	Image Sensor	124
5.5.1	Different modes in photo-diodes	125
5.5.2	Features of image sensor VLC	126

6. Visible Light Communication Market, by Application 128

6.1	Introduction	129
6.2	Intelligent Traffic Management Systems (ITS)	131
6.2.1	Advanced traffic management system	132
6.2.2	Advanced traveler information system	134
6.2.2.1	Vehicle-to-infrastructure communications	136
6.2.2.2	Vehicle-to-vehicle (V2V) communications	136
6.2.3	Advanced public transportation system (APTS)	137
6.3	Indoor Networking	140
6.3.1	Comparison with existing technology	140
6.4	In-flight Entertainment & Communication	143
6.4.1	Growing IFE hardware expenses	144
6.4.2	Recent activity	145

Table of Contents

6.5 Underwater Communication	147
6.5.1 Flow of information	148
6.6 Location Based Service	151
6.6.1 Location based advertisement (LBA)	153
6.6.2 Location based shopping	154
6.6.3 Location based social networking	156
6.6.4 Location based search	157
6.6.5 Navigation	160

7. Visible Light Communication Market, by Geography 162

7.1 Introduction	163
7.2 North America	164
7.3 Europe	166
7.4 APAC	168
7.5 ROW	170

8. Competitive Landscape 173

8.1 Market Share Analysis	174
8.2 Key Growth Strategies	176
8.2.1 Mergers & acquisitions	176
8.2.2 New product launch	177
8.2.3 Collaboration and partnership	179

9. Company Profiles 181

(Overview, Financial Review, Strategy Focus & Future Approach)*

9.1 Aoptix Technologies, Inc.	181
9.2 Avago Technologies	183
9.3 Bytelight	186
9.4 Casio Computer Co., Ltd.	188
9.5 Fraunhofer-gesellschaft	192
9.6 Fsona Networks Corp	194
9.7 Lifi Consortium	196
9.8 Lightpointe Communications, Inc.	197
9.9 LSA, Inc.	199
9.10 LVX System	201
9.11 Mostcom	203
9.12 Nakagawa Laboratories, Inc.	205
9.13 Northern Hi-tec Ltd.	207
9.14 Oledcomm - France Lifi	209

Table of Contents

9.15 Omega Project Consortium	211
9.16 Outstanding Technology Corporation	212
9.17 Panasonic Corporation	214
9.18 Penguin Automated Systems Inc.	219
9.19 Plaintree Systems Inc	221
9.20 Purevlc Ltd	224
9.21 Society for Optical Communications Systems Ltd.	226
9.22 Tamura Corporation	228
9.23 Ubiquiti Networks, Inc.	232
9.24 Wireless Excellence Limited	235

*Details on overview, Financial Review, Strategy Focus & Future Approach might not be captured in case of unlisted companies.

List of Tables

1	VLC/Li-Fi and FSO Market Research Methodology	25
2	General Assumptions.	28
3	Market Assumptions	29
4	Companies Covered in this Report	30
5	Global VLC Market Revenue, by Geography, 2012 - 2018 (Million)	32
6	Global FSO Market Revenue, by Geography, 2012 - 2018 (Million)	33
7	VLC Vs RF Technology	40
8	Facts Related to Energy Saving	48
9	Government Initiatives to Replace the Incandescent Lamps.	49
10	VLC Vs Wi-Fi Technology	53
11	Systems to go Smarter	58
12	Average Traffic per Device Growth	66
13	Facts Related to Mobile Data Traffic	66
14	Ronja Models.	71
15	VLC Benefits	74
16	D-light Project Applications	75
17	VLC Projects	81
18	IRDA Standards.	85
19	Fiber Optics Vs Fso.	88
20	Advantages and Limitations.	89
21	Free Space Optics Market, by Applications, 2012 - 2018 (\$Million)	91
22	Free Space Optics Market in Enterprise Applications, 2012 - 2018 (\$Million).	92
23	Free Space Optics Enterprise Application Market, by Geography, 2012 - 2018 (\$Million)	93
24	Free Space Optics Market in Enterprise Connectivity, by Geography, 2012 - 2018 (\$Million)	95
25	Free Space Optics Market in Healthcare, by Geography, 2012 - 2018 (\$Million)	97
26	Free Space Optics Market in Engineering and Design Services, by Geography, 2012 - 2018 (\$Million)	98
27	Free Space Optics Market in Security Services, by Geography, 2012 - 2018 (\$Million)	100
28	FSO Advantages	101
29	Free Space Optics Market in Mobile Carrier Backhaul, by Geography, 2012 - 2018 (\$Million).	102
30	Free Space Optics Market in Military Applications, by Geography, 2012 - 2018 (\$Million)	105
31	North America Free Space Optics Market, by Application, 2012 - 2018 (\$Million)	107
32	Europe Free Space Optics Market, by Application, 2012 - 2018 (\$Million)	108
33	APAC Free Space Optics Market, by Application, 2012 - 2018 (\$Million)	109
34	Row Free Space Optics Market, by Application, 2012 - 2018 (\$Million)	110
35	Global VLC Market, by Components, 2012 - 2018 (\$Million).	112
36	Comparison of Leds, Incandescent and Fluorescent Lamps.	117

List of Tables

37	Semiconductor Material for Different Leds	118
38	Global VLC LED Component Market, by Geography, 2012 - 2018 (\$Million)	120
39	Global VLC LR Emitter Market, by Geography, 2012 - 2018 (\$Million)	121
40	Different Opto-couplers	123
41	Global VLC Opto-coupler Market, by Geography, 2012 - 2018 (\$Million)	124
42	Modes in Photo-diodes	125
43	Global VLC Image Sensor Market, by Geography, 2012 - 2018 (\$Million)	126
44	Global VLC Market Revenue, by Applications, 2012 - 2018 (\$Million)	130
45	Global VLC Market Revenue from LTS Application, by Category, 2012 - 2018 (\$Million)	131
46	Global VLC Market Revenue from LTS Application, by Geography, 2012 - 2018 (\$Million)	132
47	VLC Market in Advanced Traffic Management, by Geography, 2012 - 2018 (\$Million)	134
48	VLC Market in Advanced Traveller Information, by Geography, 2012 - 2018 (\$Million)	137
49	VLC Market in Advanced Public Transportation, by Geography, 2012 - 2018 (\$Million)	139
50	VLC Vs Wi-Fi	141
51	VLC Market Revenue from Indoor Networking System, by Geography, 2012 - 2018 (\$Million)	142
52	Comparison with Alternative Technologies	145
53	VLC Market Revenue from In-flight Entertainment and Communication, by Geography, 2012 - 2018 (\$Million)	146
54	VLC Market in Underwater Communication, by Geography, 2012 - 2018 (\$Million)	150
55	Global VLC Market Revenue from Location Based Services, by Applications, 2012 - 2018 (\$Million)	151
56	VLC Market Revenue from Location Based Services, by Geography, 2012 - 2018 (\$Million)	152
57	VLC Market Revenue from Location Based Mobile Advertisement, by Geography, 2012 - 2018 (\$Million)	154
58	VLC Market in Location Based Shopping, by Geography, 2012 - 2018 (\$Million)	155
59	VLC Market in Location Based Social Networking, by Geography, 2012 - 2018 (\$Million)	156
60	Comparison of Position Detection with Various Technologies	157
61	VLC Market in Location Based Search, by Geography, 2012 - 2018 (\$Million)	159
62	VLC Market in Navigation, by Geography, 2012 - 2018 (\$Million)	161
63	North America: VLC Market, by Applications, 2012 - 2018 (\$Million)	165
64	North America: VLC Market Revenue, by Components, 2012 - 2018 (\$Million)	166
65	Europe: VLC Market, by Applications, 2012 - 2018 (\$Million)	167
66	Europe: VLC Market Revenue, by Components, 2012 - 2018 (\$Million)	168
67	APAC: VLC Market Revenue, by Applications, 2012 - 2018 (\$Million)	169
68	APAC: VLC Market Revenue, by Components, 2012 - 2018 (\$Million)	170
69	Row: VLC Market Revenue, by Application, 2012 - 2018 (\$Million)	171
70	Row: VLC Market Revenue, by Components, 2012 - 2018 (\$Million)	172
71	Top Players in VLC Market	174

List of Tables

72	Top Players in FSO Market	175
73	Mergers & Acquisitions, 2010 - 2012	176
74	New Product Launch/development, 2010 - 2012	177
75	Partnerships/agreements/strategic Alliance/ Collaboration, 2010 - 2012	179
76	Avago Technologies: Overall Revenue, 2010 - 2011 (\$Million)	184
77	Casio Computer Co., Ltd.: Market Revenue, 2011 - 2012 (\$Billion)	189
78	Casio Computer Co., Ltd.: Market Revenue, by Product Segments, 2011 - 2012 (\$Billion)	189
79	Casio Computer Co., Ltd.: Market Revenue, by Geography, 2011 - 2012 (\$Billion)	190
80	Panasonic Corp: Market Revenue, 2011 - 2012 (\$Billion)	216
81	Panasonic Corporation: Market Revenue by Business Segments, 2011 - 2012 (\$Billion)	216
82	Panasonic Corp: Revenue by Geography, 2011 - 2012 (\$Billion)	217
83	Plaintree Systems Inc.: Market Revenue, 2011 - 2012 (\$Million)	222
84	Plaintree Systems Inc.: Market Revenue, by Business Segments, 2011 - 2012 (\$Million)	222
85	Plaintree Systems Inc.: Market Revenue, by Geography, 2011 - 2012 (\$Million)	223
86	Tamura Corp: Overall Revenue, 2011 - 2012 (\$Million)	229
87	Tamura Corp: Market Revenue, by Product Segments, 2011 - 2012 (\$Million)	229
88	Tamura Corp: Market Revenue, by Geography, 2011 - 2012 (\$Million)	230
89	Ubiquiti Networks, Inc.: Market Revenue, 2010 - 2011 (\$Million)	233
90	Ubiquiti Networks, Inc.: Market Revenue, by Geography, 2010 - 2011 (\$Million)	233

List of Figures

1	Market Size Estimation	27
2	Market Segmentation of VLC & FSO Technology	36
3	Market Segmentation of VLC Transmitter	37
4	VLC Characteristics	41
5	Optical Wireless Communication Evolution	42
6	Impact Analysis of Drivers	45
7	Technical Evaluation of Led	47
8	Impact Analysis of Restraints	51
9	Global LED Revenue, 2010 - 2018 (\$Billion)	54
10	Applications Mapping of VLC Technology	55
11	IOT Environment	57
12	Block Diagram of WSN	61
13	VLC Penetration in Future	64
14	Increasing Mobile Data Traffic	65
15	VLC Applications Life Cycle	67
16	Porter's Five Force Model	68
17	Ronja Device Outlook	72
18	Frequency Spectrum of VLC and Li-Fi	79
19	Working of VLC/Li-Fi Technology	82
20	Data Flow Process	83
21	FSO Communication Network	87
22	FSO Market Segmentation	90
23	FSO Enterprise Connectivity	94
24	FSO: Network for Healthcare	96
25	Evolution of LED	114
26	Diode Working Principle	115
27	Indoor LED Application in VLC	116
28	Opto-coupler Working Principle	122
29	Percentage Share of VLC Applications, 2013 - 2018	129
30	Architecture of Advanced Traffic Management System	133
31	Flow of Information in Advanced Traveller Information System	135
32	Flow of Information in Advanced Public Transportation System	138
33	Global IFE Hardware Expenses, 2012 - 2018 (\$Billion)	144
34	Information Flow in Underwater Communication	148
35	LBA Ecosystem	153
36	Percentage Share of VLC Market, by Geography, 2013 & 2018	163
37	Panasonic Corp: Business Segments	215

Sample Tables

Global VLC market Revenue, by Geography, 2012 - 2018 (Million)								
Region	2012	2013	2014	2015	2016	2017	2018	CAGR % (2013-2018)
North America								
Europe								
APAC								
ROW								
Total								

Free Space Optics Market, by Applications, 2012 - 2018 (\$Million)								
Applications	2012	2013	2014	2015	2016	2017	2018	CAGR % (2013-2018)
Enterprise Applications								
Military								
Mobile Carrier Backhaul								
Total								

Global VLC Market, by Components, 2012 - 2018 (\$Million)								
Components	2012	2013	2014	2015	2016	2017	2018	CAGR % (2013-2018)
LED								
IR emitters								
Opto-Couplers								
Image sensors								
Others								
Total								

Disclaimer

MarketsandMarkets strategic analysis services are limited publications containing valuable market information provided to a select group of customers in response to orders. Our customers acknowledge when ordering that MarketsandMarkets strategic analysis services are for our customers' internal use and not for general publication or disclosure to third parties.

Quantitative market information is based primarily on interviews and therefore, is subject to fluctuation.

MarketsandMarkets takes no responsibility for any incorrect information supplied to us by manufacturers or users.

No part of this strategic analysis service may be given, lent, resold or disclosed to non-customers without written permission.

Furthermore, no part may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the permission of the publisher.

For information regarding permission, contact:

Tel: 1-888-600-6441

Email: sales@marketsandmarkets.com

Copyright © 2013 MarketsandMarkets

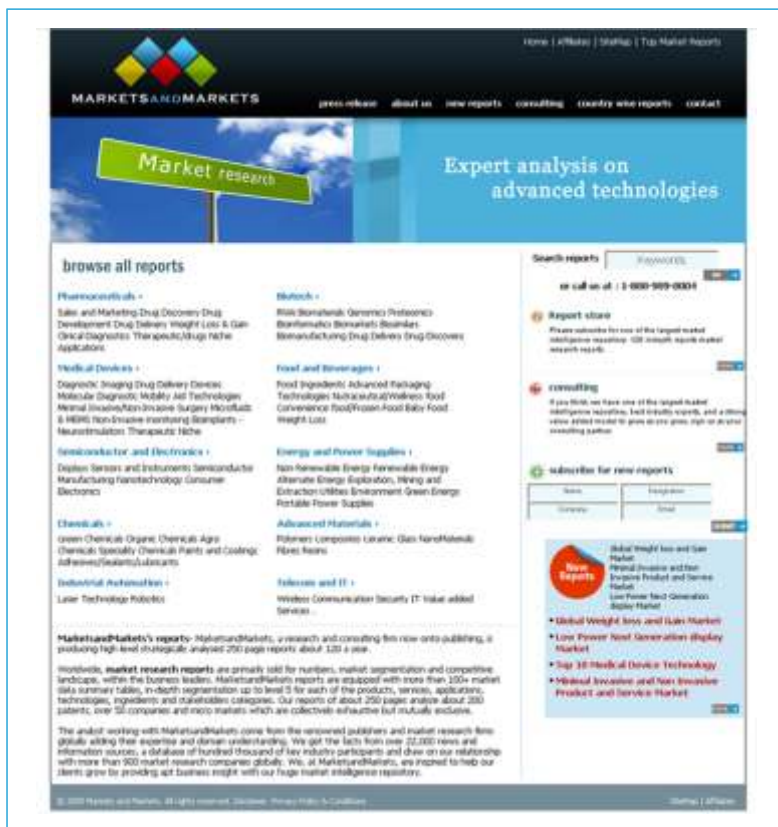
All Rights Reserved. This document contains highly confidential information and is the sole property of MarketsandMarkets. No part of it may be circulated, copied, quoted, or otherwise reproduced without the approval of MarketsandMarkets.

About MarketsandMarkets

We publish about 120 reports a year across 10 main industries. The reports are exhaustive, detailing about 50 micro markets and product segments, and featuring about 80 to 100 market data summary tables, 50 short company profiles, a five-level market breakdown, overviews of more than 300 patents, as well as analyses of the strategic and competitive landscape.

Our clients value our reports especially for the market insight we provide along with the market numbers. Our teams of specialized market analysts and domain experts work within a structured research process to deliver well-analyzed market reports to Fortune 1000 companies globally.

[Click here to learn more about us](#)



[Click here to visit our website](#)

Related Reports

Crystal Oscillator Market – Global Forecast & Analysis – Segmentation by General Circuitry (SPXO, TCXO, VCXO, FCXO, OCXO, MCXO, EMXO), Applications, Crystal Cuts (SC & AT) and Geography (2013-2018)

Crystal oscillators are one of the core components of any electronic device. They use the property of piezoelectricity which is exhibited by certain crystals, most notably quartz, to create waveforms with very accurate frequency based on the mechanical vibration of the precision machined crystal.

Report code: SE 1400

Microgrid Market, Global Forecast & Analysis (2012-2022) – Focus On Renewable Power Generation, Solar Photo-Voltaics, Wind Micro-Turbines, Battery, Energy Storage And Control Systems, By Types, Components And Technologies

A "MicroGrid", as the name suggests is a miniature version of the traditional "power grids" with certain distinguishing features. It could be a complementary source to the utility power grids or an independent source in itself. The key components of a "Micro-Grid" constitute a mesh of generation, control, distribution, storage, and load, linked together in a network.

Report code: SE 1375