

I. List of Content

1.	Introduction	20
1.1.	OLED Lighting – ready for takeoff	21
1.2.	The solid-state lighting century	21
1.3.	Scope of report	22
2.	OLED application & design aspects	24
2.1.	What makes OLED lighting so unique?	25
2.2.	Main application areas for OLED technology	27
2.2.1.	Lighting	27
2.2.2.	Signage	29
2.2.3.	Displays	31
2.3.	OLED contacting and driving	33
2.4.	OLED on glass	34
2.5.	Transparent OLED	35
2.6.	OLED on metal	36
2.7.	Flexible OLED	37
2.8.	Off-state appearance	38
3.	OLED technology – the basics	40
3.1.	Introduction	41
3.2.	How does an OLED work?	42
3.2.1.	OLED components	43
3.2.2.	Outcoupling	50
3.3.	OLED architecture	53
3.4.	Key technology parameters	54
3.4.1.	Lifetime	54
3.4.2.	Efficiency	55
3.4.3.	Brightness	56
3.4.4.	Color	56
3.5.	Key technology challenges	57
3.5.1.	Durability	57
3.5.2.	Cost and manufacturing	57
3.6.	OLED manufacturing	59

3.6.1. Vacuum evaporation vs solution processing	59
3.6.2. Evaporation source concepts	60
3.6.3. Small molecule OLED manufacturing	62
3.6.4. Binning	64
3.6.5. Next steps in manufacturing	65

4. OLED lighting roadmap 66

4.1. Lamp technology	67
4.2. Lighting technology	69
4.2.1. Development of efficiency and lifetime	70
4.2.2. Where are we right now?	72
4.3. International initiatives	74
4.3.1. Lighting policies	74
4.3.2. Funding programs for OLED lighting	75
4.4. Manufacturing development roadmap	79
4.4.1. Manufacturing processes	80
4.4.2. Front end	81
4.4.3. Back end	83
4.5. When will a major OLED lighting industry emerge?	84
4.5.1. Historical perspective	84
4.5.2. OLED in general lighting	85
4.5.3. Industry development issues	86
4.5.4. Investment in OLED	87
4.6. OLED roadmap	88
4.6.1. Positioning of OLED lighting	88
4.6.2. OLED lighting roadmap	89

5. OLED lighting market 92

5.1. Market drivers	93
5.1.1. Energy efficiency and sustainability	94
5.1.2. From smart grid to off-grid	97
5.1.3. Well-being: health and wellness	98
5.1.4. Aesthetic: freedom of design	100
5.2. OLED lighting adoption	102
5.2.1. Patterns of technology adoption	105
5.2.2. Adoption patterns for lighting	106
5.2.3. Implications for OLED lighting	107
5.3. The competitive landscape: Five forces analysis	110

5.3.1. Competitive rivalry	110
5.3.2. Threat of new entrants	111
5.3.3. Threat of substitutes	112
5.3.4. Bargaining power of customers	112
5.3.5. Bargaining power of suppliers	113
5.3.6. Strategy & positioning	113
5.4. OLED lighting market	116
5.4.1. Evolution of OLED added value	116
5.4.2. OLED lighting market assessment	118
5.5. Lighting market structure	132
5.5.1. Market structure luminaires	134
5.5.2. Lighting industry value chain	136
5.5.3. Reordering the lighting value chain with OLED	138
6. How OLED will change lighting	116
6.1. The OLED lighting revolution	141
6.2. Nature of OLED lighting products	145
6.3. Lighting requirements	150
6.4. Application areas for OLED Lighting	155
6.4.1. Lighting	158
6.4.2. Applications	161
6.4.3. Integrated	163
7. Novalled OLED luminaires – concept studies, designs & prototypes	168
7.1. Design concepts	169
7.1.1. OLED-on-glass	170
7.1.2. OLED-on-steel	171
7.2. Design prototypes	172
7.2.1. Desklamp “Victory”	174
7.2.2. Standard lamp “Fan”	176
7.2.3. Light sculpture “Palm Frond”	178
7.2.4. Suspension luminaire “Wave”	180
7.2.5. Pendant lamp “Tulip”	182
7.2.6. Suspension luminaire “Zigzag”	184
IV. Appendix	186