LED LIGHT

Future Trend in the lighting market

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Environmental Economics

Agenda

- LED light
- History Timelines of Lighting & Led light
- Cost & profit of LED v.s.others
- LED in Market
- Green Product Upgrade Persuade

LED Light

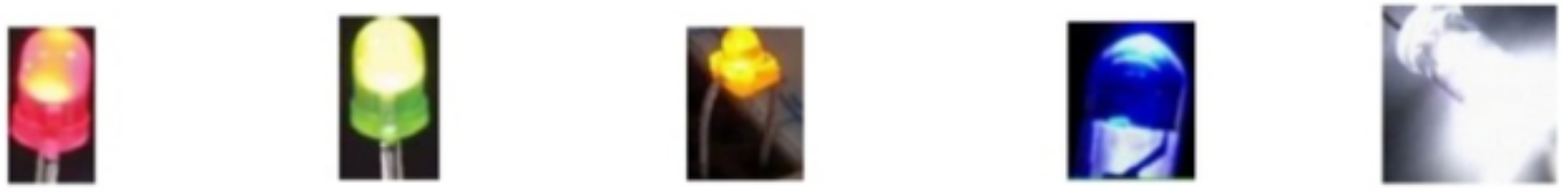
Light-emitting diode is an electric component that emits light when connected to direct current. It works on electroluminescent principle and can emit light in visible specter as well as in infrared and ultraviolet. They have characteristically low energy consumption, small size, longer lifetime and faster switching than incandescence lamps and because of that, they have a wide palette of applicability.

Benefits of LEDs

- High Efficiency
- Longer Lifetime
- Environmentally Friendly
- Safer Materals
- Smaller Light Spectrum

History Timelines of Lighting

LED History timelines



1962	1970's	1980's	1990's	2000's
First red luminescence diode, type GaAsP, is launched	Pale green light LEDs produced	First generation of superbright LEds- First red, then yellow and finally green	First significant high brightness blue LEDs appeared	White LEDs were developed

environment friendly solutions

Cost & Profit of LED v.s.others

- To begin, take a look at the following chart which breaks down the real costs associated with the three most common types of light bulbs over a seven year period (LEDs, CFLs and Incandescents). Note that this chart was compiled by Scott Cooney, an Adjunct Professor in the MBA program at the University of Hawaii and founder of the home efficiency service Pono Home, based on Hawaii's rates of 34.5c per kWh, and the assumption of 3 hours per day the bulbs are on (average American use stat from EnergyStar.gov).

Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
LED 7 watt (60 watt eq)										
Bulb purchase	$4.99									
Utility rate ($/kWh)	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345
Hours on	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095
Energy used (kWh/year)	7.67	7.67	7.67	7.67	7.67	7.67	7.67	7.67	7.67	7.67
Energy costs	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64
Annual cost (bulbs + energy)	$7.63	$2.64	$2.64	$2.64	$2.64	$2.64	$2.64	$2.64	$2.64	$2.64
Total life cumulative cost	$7.63	$10.28	$12.92	$15.57	$18.21	$20.86	$23.50	$26.15	$28.79	$31.43
Hours left in life of bulb	48905	47810	46715	45620	44525	43430	42335	41240	40145	39050
CFL 13 watt (60 watt eq)										
Bulb purchase	$1.60							$1.60		
Utility rate ($/kWh)	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345
Hours on	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095
Energy used (kWh/year)	14.24	14.24	14.24	14.24	14.24	14.24	14.24	14.24	14.24	14.24
Energy costs	4.91	4.91	4.91	4.91	4.91	4.91	4.91	4.91	4.91	4.91
Annual cost (bulbs + energy)	$6.51	$4.91	$4.91	$4.91	$4.91	$4.91	$4.91	$6.51	$4.91	$4.91
Total life cumulative cost	$6.51	$11.42	$16.33	$21.24	$26.16	$31.07	$35.98	$42.49	$47.40	$52.31
Hours left in life of bulb	6905	5810	4715	3620	2525	1430	335	7240	6145	5050
Incandescent 60 watt										
Bulb purchase	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94
Utility rate ($/kWh)	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345	0.345
Hours on	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095
Energy used (kWh/year)	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7
Energy costs	$22.67	$22.67	$22.67	$22.67	$22.67	$22.67	$22.67	$22.67	$22.67	$22.67
Annual cost (bulbs + energy)	$23.61	$23.61	$23.61	$23.61	$23.61	$23.61	$23.61	$23.61	$23.61	$23.61
Total life cumulative cost	$23.61	$47.21	$70.82	$94.43	$118.03	$141.64	$165.25	$188.85	$212.46	$236.07
Hours left in life of bulb	105	210	315	420	525	630	735	840	945	1050

Assumptions: 3 hours per day (Energy Star.gov)
50K hours life of LED
8K hours life of CFL
1200 hours life of incandescent

Sylvania 11373 - 60 Watt - A1...
$0.94
1000bulbs.com

13 Watt - T2 CFL - 60W Eq...
$1.60
1000bulbs.com

60 Watt Equal 2700K LED Li...
$4.99
1000bulbs.com

Cost & Profit of LED v.s.others

- The breakeven point (the point at which the total long term cost of the more efficient bulb becomes less than that of the less efficient bulb) happens in year one for both CFLs and LEDs as opposed to incandescents. In year 2, the LED surpasses the CFL in long term savings. So if you have a 2 year or longer time horizon, the LED is not only the more eco-friendly option, it's the most cost-effective, despite the higher upfront cost. LED bulbs have the added benefit of NOT containing mercury, which CFLs do.

Cost & Profit of LED v.s.others

- If don’t live in Hawaii where electricity comes from diesel fuel, and therefore, utility rates are a lot lower

Costs	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
LED 7 watt (60 watt eq)										
Bulb purchase	$4.99									
Utility rate ($/kWh)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Hours on	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095
Energy used (kWh/year)	7.67	7.67	7.67	7.67	7.67	7.67	7.67	7.67	7.67	7.67
Energy costs	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Annual cost (bulbs + energy)	$5.91	$0.92	$0.92	$0.92	$0.92	$0.92	$0.92	$0.92	$0.92	$0.92
Total life cumulative cost	$5.91	$6.83	$7.75	$8.67	$9.59	$10.51	$11.43	$12.35	$13.27	$14.19
Hours left in life of bulb	48905	47810	46715	45620	44525	43430	42335	41240	40145	39050
CFL 13 watt (60 watt eq)										
Bulb purchase	$1.60							$1.60		
Utility rate ($/kWh)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Hours on	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095
Energy used (kWh/year)	14.24	14.24	14.24	14.24	14.24	14.24	14.24	14.24	14.24	14.24
Energy costs	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71
Annual cost (bulbs + energy)	$3.31	$1.71	$1.71	$1.71	$1.71	$1.71	$1.71	$3.31	$1.71	$1.71
Total life cumulative cost	$3.31	$5.02	$6.72	$8.43	$10.14	$11.85	$13.56	$16.87	$18.57	$20.28
Hours left in life of bulb	6905	5810	4715	3620	2525	1430	335	7240	6145	5050
Incandescent 60 watt										
Bulb purchase	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94	$0.94
Utility rate ($/kWh)	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Hours on	1095	1095	1095	1095	1095	1095	1095	1095	1095	1095
Energy used (kWh/year)	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7	65.7
Energy costs	$7.88	$7.88	$7.88	$7.88	$7.88	$7.88	$7.88	$7.88	$7.88	$7.88
Annual cost (bulbs + energy)	$8.82	$8.82	$8.82	$8.82	$8.82	$8.82	$8.82	$8.82	$8.82	$8.82
Total life cumulative cost	$8.82	$17.65	$26.47	$35.30	$44.12	$52.94	$61.77	$70.59	$79.42	$88.24
Hours left in life of bulb	105	210	315	420	525	630	735	840	945	1050

Assumptions: 3 hours per day (Energy Star.gov)
50K hours life of LED
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Cost & Profit of LED v.s.others

- The LED still beats the incandescent even in the first year, and while it takes a little longer to beat the CFL (year 5), over a ten year period, it beats all competition handily (and still has 40,000 hours of life left).

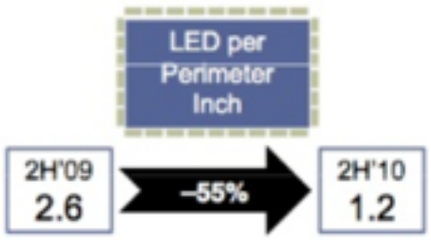
- LEDs (in the long run) are the cheapest and most energy efficient means by which you can illuminate your home.

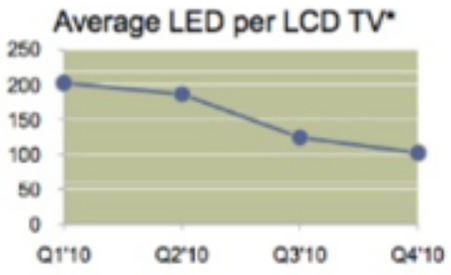
LED in Market

LED industry has grown in automotive and display markets, but with display demand falling, excess supply will spill over to general lighting

- Display backlighting demand has driven LED so far, but this is changing
- LED usage per TV is now decreasing and display panel makers have established their own sources/alliances
  - AUO — Lextar
  - CMI — CMLT/ GIO
  - LGD — LG Innotek
  - Samsung — Samsung LED
- As a result, companies have put in place excess capacity and this will provide stimulus to the general lighting market
- Chinese firms are beginning to pile in at all parts of the value chain, in what may be a replication of the dynamics of the photo-voltaic industry

LED-lit Costs Will Be Lower





Rewind and Reshape the Value Chain

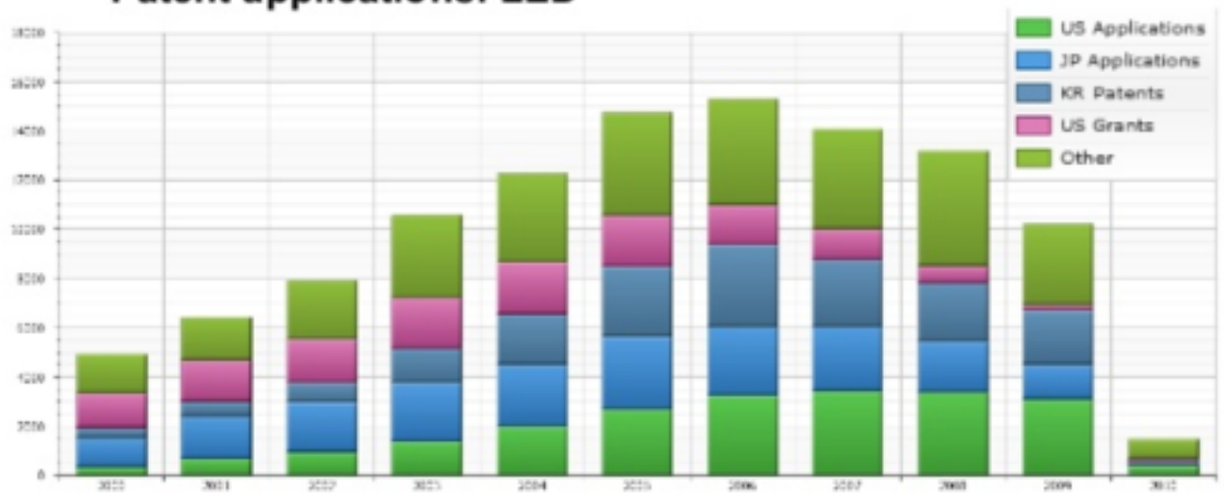
TV Brand	Panel Maker	LED Supplier	Related JV
Samsung	Samsung LCD	Samsung LED	Samsung Micro.
LG	LG Display	LG Innotek	Wooree
TPV (OEM) AOC	AU Optronics	Lextar	Everlight, Epistar
Hon Hai (OEM)	Chimei Innolux	Formosa Epitaxy	AOT, Chi Lin

Source: Our consulting partner BizWitz LLC presentation to Strategies In Light, 2011

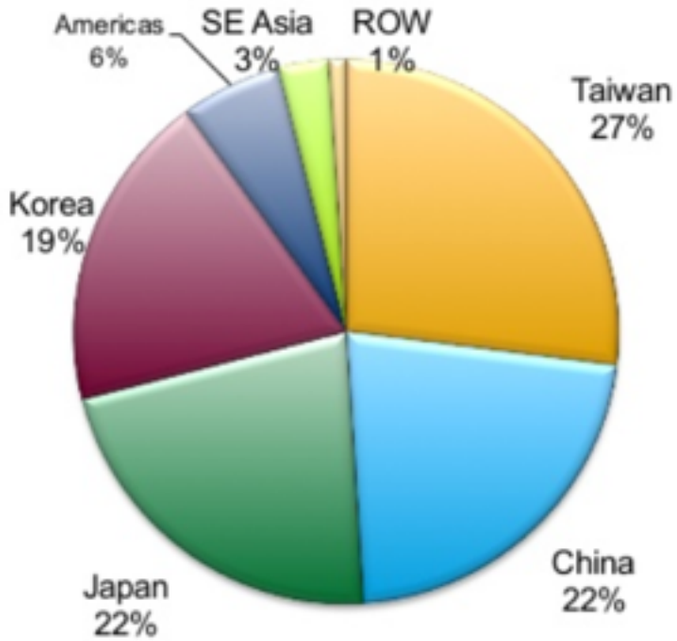
LED in Market

Patent filings also suggest that the LED technology development phase is over and now truly into “scaling up”

Patent applications: LED



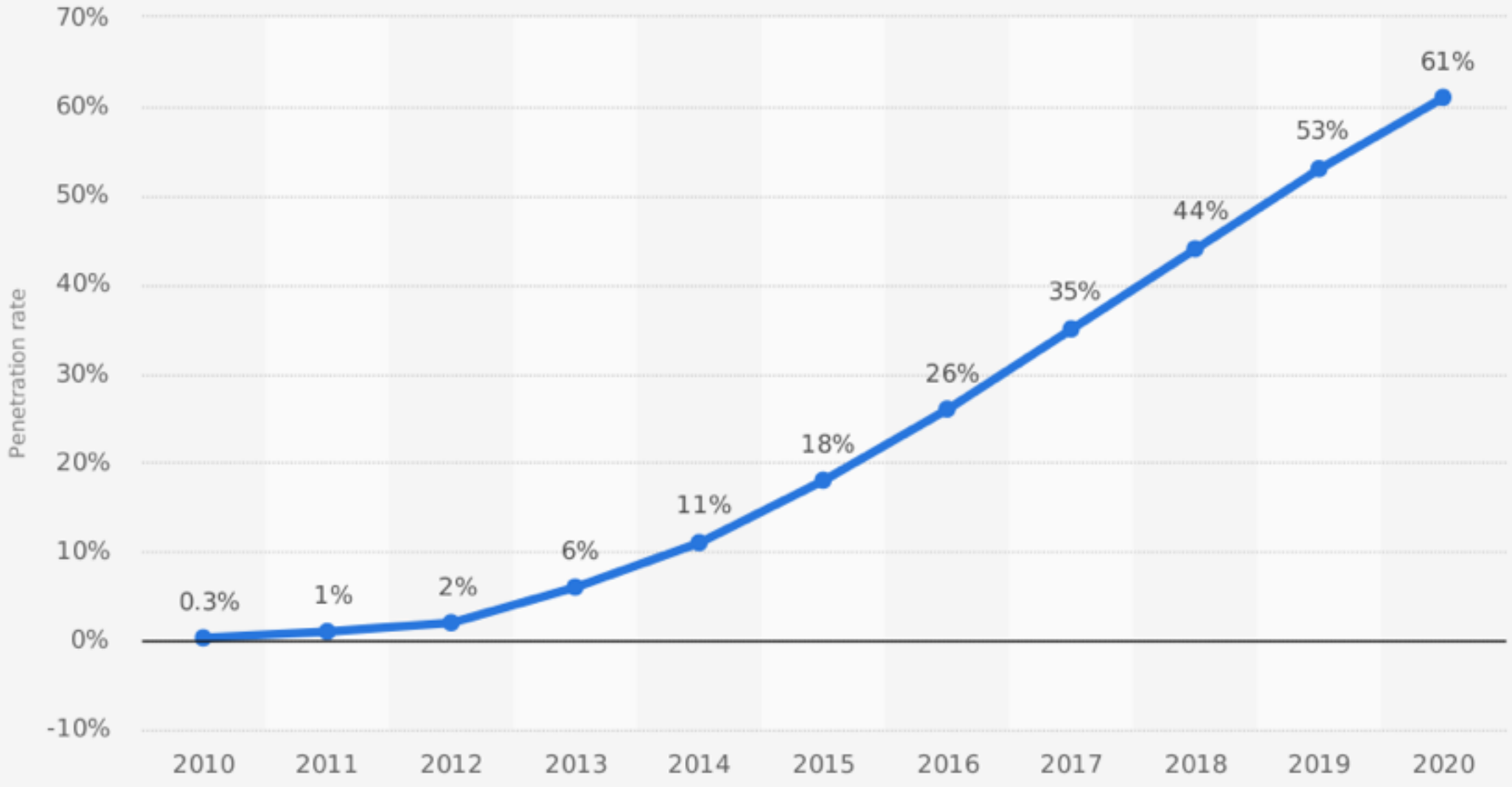
LED wafer capacity (2” equivalents)



- Patent searches show that the peak of IP registrations was already back in 2006
- New patent registration now is around colour management, thermal management and lighting fixture control
- SEMI counts 77 LED fab projects underway in 2011 and it expects 72 new projects will get underway in 2012
- Current investments supported heavily by government policies (especially rebates for investments in wafer capacity in China)
- LED wafer capacity is already 93% in Asia with China becoming more and more important

Source: Innography, SEMI

Estimated LED penetration of the global lighting market from 2010 to 2020



Source
Goldman Sachs

Additional Information:
Worldwide; Goldman Sachs; Beijing Gaohua Securities; 2010 and 2011

LED in Market

Assuming the following givens in 10 year outlook on solid state lighting:

- LED SSL has reached sufficient scale and trajectory to make us comfortable saying that it willing become the leading source of light

- additional capacity that was targeted for the display backlighting arena will spill over into lighting applications,esecially since the unit usage in backlighting is declining and TV demand is maturing

From HENDYCONSULTING

Green Product Upgrade Persuade

- Consumer Challenge

One major issue is LED Light's very high upfront cost compared to customer's existing lighting. Around ten times more expensive, it will be difficult to convince price sensitive customers to convert to our product even if the product does pay for itself over time.

Green Product Upgrade Persuade

- Strategies

1. Discuss additional benefit with potential clients

Electricity makes up on average 85% of the cost of a lighting system. The cheaper it is to operate, the cheaper the lighting system is to own. Contrary to popular belief, energy-efficient luminaires and lamps can provide improved light quality, uniformity, light output, color, and appearance.current technologies allow facilities to maintain, increase, or focus light levels, depending on the application.

2. Recommend the use of tested technologies

Clients may want to try out the latest trends in technology, but advising them to stick with products covered by manufacturers' warranties and those that already have been field tested is the safest bet

3. inform client of any rebates, tax credits, and grants

There are many programs at the local, state, and national levels that can help companies willing to upgrade. Electric utilities also offer rebates or energy-saving incentives.

4. Offer certification of your plan

In order to qualify for the federal tax deduction, lighting systems must be certified by authorized individuals, such as qualified electrical contractors and engineers and lighting-system designers.

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